The role of L2 immersion in the use of pitch among Russian native speakers of British English

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Abstract

Proficient bilingual speakers often experience hampered access to their native language after moving to another country. Indeed, attrition research has found evidence of language loss across various speaker groups in different language domains. Although the research has established particular patterns of phonological attrition in early bilingual immigrants, less is known about late bilingual speakers who immigrated in adulthood. The present study investigates the use of pitch among late bilingual speakers in an immigrant setting. It aims to find out if late language learners experience phonological attrition/interference in the use of pitch. Three groups of 9-10 speakers were examined: (1) Russian-English bilinguals, (2) Russian monolinguals, and (3) English monolinguals. The speakers underwent a monologue-like spontaneous speech task, and the collected voice data was analyzed for five pitch parameters: (1) mean pitch, (2) pitch variability, (3) pitch range, (4) pitch maximum, and (5) pitch minimum. The bilingual speakers completed two versions of the task in Russian and English, whereas monolingual speakers performed it in their native language. Besides, the Russian speech of the bilinguals was rated by 13 monolingual Russian speakers for perceived foreign accent. According to the analysis of the listeners' ratings, there was no relationship between perceived foreign accent and the use of pitch by Russian-English bilingual speakers. The comparisons of the pitch values between the three groups showed that Russian monolinguals used a higher pitch maximum and a wider pitch range than English monolinguals. The results also demonstrated that the bilingual speakers used higher pitch variability, a higher pitch maximum, and a wider pitch range when speaking Russian compared to English. The comparison of the English speech between the bilingual and monolingual English speakers yielded no statistical difference. The bilingual speakers were shown to use lower pitch minimum in their Russian compared to the monolingual Russian group. Lowered pitch minimum in the Russian speech of bilinguals is supposedly caused by interference and transfer from bilinguals' second language.

Key Words: language loss, first language attrition, linguistic interference, mean pitch, pitch variability, pitch range, pitch maximum, pitch minimum.

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1. Introduction

More and more people choose to move to another country permanently. According to the statistics, 280 million people held the status of international immigrants in 2020 (UN DESA, 2020). In order to assimilate with the local population, immigrants often need to learn and speak a new language. Being exposed to a different culture and language often makes it challenging to maintain strong ties with the native language. Many bilingual speakers who moved to another country noticed that their native language became less accessible over time. This phenomenon is commonly referred to as first language attrition.

Research in first language attrition focuses on the deterioration and loss of one's native language (L1) under the influence of a more dominant second language (L2) (Seliger & Vago, 1991). The field of first language attrition remains underresearched because, for a long time, one's native language was believed to be unchangeable (Schmidt, 2013). However, with time, losing one's native language has been proved to be a fairly common phenomenon among language learners (Cook, 2003). Studies into language attrition explore what language domains undergo atrophy and if there is a hierarchy of loss. Apart from that, research in attrition investigates extralinguistic factors that contribute to the degree of language deterioration (e.g., amount of L1 and L2 contact, L2 proficiency, age of L2 acquisition) (Schmid & Dusseldorp, 2010).

The majority of research presents data in regard to language loss in the properties of grammar, syntax, and lexicon since these language domains are the first to undergo attrition (Köpke et al., 2007). However, less is known about attrition processes in phonology and phonetics because this language domain is considered more robust and less vulnerable to attrition (Schmid, 2007). Schmid (2011) states that post-pubescent L2 learners are not likely to experience attrition because L1 phonological representations are stabilized after puberty. Indeed, instances of phonological attrition among late bilinguals are limited. However, several studies have found effects of so-called linguistic interference in pronunciation of late L2 learners (de Leeuw et al., 2018; de Leeuw et al., 2012; Major, 1992; Mennen, 2004; Queen, 2001). Linguistic interference, or cross-linguistic influence, does not necessarily pertain to language loss per se but rather to the transfer of language characteristics of a specific domain caused by cross-linguistic differences (Mennen, 2004). The research dedicated to phonological interference is sparse, and language interference's working principles remain unknown (de Leeuw et al., 2012). In order to contribute to the previous research in phonological attrition and interference, the present study investigates pitch production by late bilingual speakers in their L1 and L2.

Pitch is considered one of the most prominent cues of accent location along with length, loudness, and sound quality (Hasegawa & Hata, 1992). Nevertheless, most research on pitch is almost solely dedicated to how L2 learners acquire the patterns of pitch use. At present, there is very limited research about the use of pitch among late bilinguals in the context of L1 attrition. In order to bridge the gap in the available literature on phonological attrition and interference, the present study investigates the use of pitch among late Russian-English bilinguals in an immigrant setting. Given the sparsity of attrition research in the use of pitch among late bilinguals, the present study seeks to find answers to the following questions:

1. Can late bilingual speakers experience L1 attrition in the use of pitch?
2. What aspects of pitch undergo attrition?
3. Is there a relationship between the use of pitch and accentedness ratings of bilinguals' L1?

The present study attempts to answer these questions by investigating the use of pitch in ten sequential Russian-English bilinguals who immigrated to the UK. The bilinguals' voice data was compared with the speech of ten Russian and nine English monolingual speakers. The speakers underwent a spontaneous monologue-like speech task for voice data collection. The bilingual speakers completed two versions of the speech task in English and Russian, whereas monolinguals did it in their native language. The recorded voice data was analyzed for five pitch parameters: (1) mean pitch, (2) pitch variability, (3) pitch range, (4) pitch maximum, and (5) pitch minimum. In addition, an impressionistic analysis of bilinguals' speech in their L1 was performed to investigate a possible relationship between the patterns of pitch use and accentedness ratings.

Chapter 2 presents a literature review regarding the previous research on phonological attrition leading to the four hypotheses of the present study. The methodology and design of the present research are described in Chapter 3. In Chapter 4, the impressionistic analysis is presented, followed by the acoustic and statistical analyses. The discussion of the obtained results and stated implications are offered in Chapter 5, along with acknowledged limitations. Finally, the main findings are summarized in Chapter 6.

2. Literature review

Language studies into bilingualism have proved that speakers who learned a foreign language and consistently used it may experience signs of first language attrition given time (Schmid & Köpke, 2017). This chapter discusses language attrition and provides an account of the previous literature regarding phonological attrition among late bilinguals. As the present research focuses on the use of pitch among bilingual speakers, the key studies that helped formulate the hypotheses and the research question are given credit further.

2.1 First language attrition

First language attrition is commonly defined as the process during which previously acquired linguistic knowledge is negatively affected by learning another language according to Schmid and Köpke (2017). The authors point out that one's native language can become less accessible and lose its "nativeness" on different levels (e.g., syntactic, phonological, semantic) under the influence of a more dominant L2. Although the first language attrition research offers various insights into the working principles of human memory and second language acquisition, it is a relatively new field in linguistics. For many years, research in bilingualism had been referring to attrition as simply "forgetting" and solely investigated the processes of second language acquisition (SLA) (Schmid, 2013, p. 95). Research on attrition emerged in the 1980s and was immediately defined as an extension field of second language acquisition (SLA) since both language learning and language loss are closely related in the context of bilingualism (Weltens et al., 1986). Over time, first language attrition has evolved into an independent research topic that has yielded new perspectives regarding human memory, pathological and non-pathological language loss, second language teaching, psycholinguistics, and sociolinguistics. First language acquisition has become a complex field with various research foci: L1 child attrition, L1 adult attrition, attrition in an immigrant setting, L2 attrition in returnees, L1 attrition in adoptees, and others.

Various hypotheses have been proposed to explain the mechanism of attrition. Even though some of them were successfully tested by particular studies, the applied research on the suggested frameworks lacks consistency and structure (Köpke & Schmid, 2004). Nevertheless, the hypotheses that are frequently discussed in the research (for overviews of the hypotheses, see Bardovi-Harlig & Stringer, 2010; Köpke & Schmid, 2004; Schmid, 2002) are as follows:

a) Regression hypothesis
b) Threshold hypothesis
c) Interlanguage hypothesis

The earliest hypothesis that tried to interpret the mechanism of language attrition is the *regression hypothesis*. The hypothesis was first formulated by Jacobson (1941), who tested it in relation to pathological language loss. According to the rationale of the regression hypothesis, the order of language attrition is the reversed order of language acquisition, which means that the information learned last is first to attrit. This phenomenon can be explained by how human memory works. Based on the suggested principles of human memory functioning, information is stored in layers. The top layers are the most vulnerable and more prone to be lost as they represent the most recently learned information (Keijzer, 2010). The framework of the regression hypothesis within the domain of pathological language loss was extensively researched; however, the theoretical implications regarding non-pathological language loss remain somewhat tentative (Keijzer, 2004). The studies on the regression hypothesis testing exist (Anderson, 2001; Håkansson, 1995; Hansen and Chen, 2001; Hayashi, 1999; Olshtain,

1989), but they are restricted to a particular language domain and eventually do not confirm the universality of the regression hypothesis, especially among late language learners (Ecke, 2004).

Keijzer (2010) contributed significantly to the regression hypothesis research by conducting an empirical study on morphology and syntax attrition among Dutch immigrants in Anglophone Canada. The study compared three groups of speakers: (1) 45 Dutch immigrants in Anglophone Canada (attriters), (2) the matched control group of monolingual Dutch speakers, and (3) 35 monolingual Dutch school graders of 13-14 years of age (acquirers). The subjects underwent controlled language tasks and retold a video clip from the *Modern Times* movie by Charlie Chaplin for free-speech elicitation. The research analyzed the voice material for various morphological and syntactic aspects of the language. However, the most attention was paid to how attriters and acquirers form plurals and diminutives in Dutch. The research hypothesized that the ability to form plurals and diminutives would be attrited first according to the developmental sequences in Dutch. According to the results, performance on plural and diminutive forms was similar between attriters and acquirers, which means that the regression hypothesis was positively tested in the domain of morphology. However, the comparisons in the syntax domain did not yield any mirror symmetries between the immigrant and adolescent groups, and syntactic attrition was mainly related to interference from English. Keijzer suggests that the regression hypothesis is more subtle than assumed before and can be applied only in specific language domains.

Paradis (1993; 2007) proposed the *threshold hypothesis* to explain the nature of language loss from the perspective of psycholinguistics. The main idea of the threshold hypothesis is that all linguistic items adhere to a threshold that needs to be reached in order for the item to be used. When a language is used, the activation threshold is low, and access is fast and easy. However, when the language is not frequently used, the activation threshold increases, and the item becomes less accessible. Thus, Paradis's threshold hypothesis constitutes two factors that contribute to access threshold: (1) frequency of item activation and (2) recency of activation (Paradis, 2007). Accordingly, language items that are not activated frequently tend to be vulnerable to attrition. For instance, supposing a language item A has a lower activation threshold, and a language item B has a higher activation threshold. When the competition arises between the items, the speaker will use item A because of the lower activation threshold. As item B has a higher activation threshold, it remains unused, and next time the competition arises, item B is even more likely to lose the competition. Therefore, items of L1 may gradually become less accessible if they are not frequently accessed. Although the Threshold Hypothesis provides a reasonable rationale for how L1 attrition functions, Paradis himself admits that the hypothesis is not flawless. According to his explanation, lexicon appears to be the most vulnerable under the frequency effect compared to morphology, syntax, and phonology.

The *interlanguage hypothesis*, also known as the cross-linguistic influence or interference hypothesis, advocates that L1 attrition is caused by the process of interference from a more dominant L2. The hypothesis was proposed by Sharwood Smith (1983) and was later adopted by several researchers in the field (Altenberg, 1991; Köpke, 1999; Major 1992; Pavlenko, 2004; Seliger & Vago, 1991, and others). The interlanguage hypothesis stems from the Interference theory described by Underwood (1957), which refers to a well-known phenomenon of linguistic transfer from L1 to L2. The interlanguage hypothesis suggests that a reverse process occurs when a bilingual speaker becomes highly proficient in their L2. Previous works made attempts to interpret the mechanism of interference. For instance, Seliger and Vago (1991) suggested that more complex rules of one's native language are likely to be replaced by more straightforward rules of L2. Another interpretation described by Altenberg (1991) and Andersen (1982) stated that similarity between the two languages is necessary for interference. However, the proposed interpretations were found to be somewhat inconsistent across language

domains (Köpke & Schmid, 2004). Later, Pavlenko (2004) advocated that linguistic interference does not necessarily indicate attrition but rather weakening of the less dominant language. She proposed that interference and transfer work within the *multicompetence* framework introduced by Cook (1992). Based on Cook's idea of multicompetence, the competence of the two languages can be placed on a so-called integration continuum with two opposite ends: (1) separation and (2) integration. However, the language organization in the mind of a bilingual lies somewhere between the two endpoints and forms interconnection. "Total separation is impossible since both languages are in the same mind; total integration is impossible since L2 users can keep the languages apart" (Cook, 2003, p. 7). Therefore, the multicompetence framework suggests a super-system comprising multiple language systems that integrate rather than be stored in isolation (Cook, 2003). However, multicompetence does not imply being equally proficient in both languages. In fact, native-like proficiency in both languages is a rare phenomenon due to the dynamic nature of human language (Köpke, 2004). Accordingly, the two languages are in constant flux as they continually compete for dominance and memory space in the mind of a bilingual (Marian & Spivey, 2003). As a result of the competition, linguistic items of one language can obtain a more dominant position at the cost of those of the less dominant language (Seliger & Vago, 1991).

Taken together, the three attrition hypotheses described above attempt to explain the attrition mechanism. Although the hypotheses found support when tested on certain language levels, none of the frameworks equally sustain across all language domains. However, not all domains have been analyzed to the same degree. For instance, the lexical-semantic domain has been more frequently researched than morphology and phonology (Köpke & Schmid, 2004). The more significant number of attrition studies in lexicon and semantics may result from the hierarchy of language loss, meaning certain language domains are more vulnerable to language loss than others. Therefore, the more easily attrited language properties may offer more room for research.

2.1.1 Attrition in phonology

Previous research was mainly focused on inspecting L1 attrition in lexicon, morphology, and syntax since these language domains are more vulnerable to atrophy than phonology, especially among late bilinguals (Köpke et al., 2007). One of the proposed explanations for the attrition hierarchy may be related to how closely the elements of each language level are tied with each other. Schmid (2007) suggested that segments of lexicon are less connected than those of phonology. Therefore, phonological segments are less easy to attrit. However, according to Schmid (2010), although the working principles of phonology are more robust, phonetic elements of one's L1 are still affected by attrition. The previous research has established specific patterns of phonological attrition, the area remains severely understudied, nonetheless. The majority of the research into phonological attrition focuses on early bilinguals in immigrant settings (Queen, 2001; Ventureyra et al., 2004; Yeni-Komshian et al., 2000, among others), and significantly less in known about late language learners who immigrate in adulthood. The age factor of language learners may have contributed to the scarcity of research in phonological attrition among late bilinguals.

The degree of phonological attrition is reported to be predominantly determined by the age of L2 acquisition (Schmid, 2013). Early bilinguals who immigrated to an L2 environment are significantly more prone to become attriters than those who immigrated after puberty (approximately 12 years old) (Yeni-Komshian et al., 2000). Hopp and Schmid (2013) suggested that the age of L2 acquisition may be directly related to the critical period hypothesis in the acquisition of L2 phonology, according to which late L2 learners rarely master native-like pronunciation in their target language. Nevertheless, instances of language atrophy in

phonology and phonetics among late bilinguals were reported by several studies (Flege, 1987; de Leeuw et al., 2012; Major, 1992; Mennen, 2004; Queen, 2001). These studies in reported "merging" of L1 and L2 phonological properties rather than attrition or loss. Indeed, the "merging" effect can hardly manifest attrition in its strictest sense but rather of what is called linguistic interference, based on the interlanguage hypothesis of attrition.

Linguistic interference, also known as language transfer, cross-linguistic influence, or bi-directional interference (Köpke & Schmid, 2004), refers to a phenomenon that arises from constant competition between L1 and L2. Jarvis and Pavlenko (2008) determine linguistic interference as "the influence of a person's knowledge of one language on that person's knowledge or use of another language" (p. 1). As mentioned earlier, the notion of language transfer and interference stems from Cook's theory of multicompetence, meaning that two (or more) languages are in constant interaction (Cook, 1992). Accordingly, one's native language can influence one's second language and vice versa. Therefore, language interference is a bidirectional phenomenon that concerns interactional effects between L1 and L2 (Grosjean, 2001; Kramsch, 1993). Hopp and Schmid (2013) concluded that linguistic interference hampers L2 acquisition at low L2 proficiency levels and causes transfers from the more dominant native language to L2. However, with consistent L2 input and growing L2 proficiency, the native language starts being affected by interference from L2. Hence, linguistic interference can similarly impact L1 and L2 among late bilinguals (Hopp & Schmid, 2013). Schmid and Köpke (2007) view linguistic interference as an unavoidable process for any bilingual speaker. According to the authors, linguistic interference is a starting point of language loss that can later develop into language attrition under the influence of extralinguistic variables. Thus, in the context of L1 loss, linguistic interference can be viewed as an early stage of L1 attrition that can develop when L2 obtains a more dominant position.

Linguistic interference is traditionally associated with the so-called "merge" of the two languages, and it has been the case in several studies on first language loss (Flege, 1987; Flege & Hillenbrand, 1984; Mennen, 2004; de Leeuw et al., 2012). For instance, Mennen (2004) examined the ability of five Dutch L2 speakers of Greek to produce the correct alignment (exact timing) of the rise peak in declarative sentences in Greek and Dutch. Realization of the rise peak is similar in Dutch and Greek, but yet there are differences. In Greek, the rise peak does not occur in the stressed syllable but rather in the postaccentual vowel. By contrast, the peak occurs within the accented syllable in Dutch. The speakers were asked to naturally read the two sets of test sentences in Dutch and Greek. Each sentence contained a word with one of the vowels /i/, /e/, /a/, /o/, or /u/ in the accented syllable. The results demonstrated that four out of five speakers failed to produce either Greek or Dutch native-like alignment of the rise peak, which was caused by bi-directional interference, according to the author. De Leeuw et al. (2012) reported similar results in a later study that inspected late German-English bilinguals. Similar to the study by Mennen et al. (2007), German-English bilingual speakers were to produce a rise peak alignment in English and German. In English, the rise reaches its peak earlier than in German. The participants were asked to read aloud sentences that contained prenuclear rising accents. To make sure that a rise peak falls on a test syllable, the test word was either an adjective followed by a noun, or a noun proceeded by a genitive construction. According to the results, bilingual speakers exhibited partial interference with the "merging" effect at the start of the rise but not the end. As suggested by de Leeuw et al., "L1 attrition may result in phenomena within the L1 which resemble neither the L1 nor the L2" (p. 113).

Previous research has yielded evidence of L1 attrition and linguistic interference in phonology among late bilinguals (Cantor-Cutiva et al., 2019; Cantor-Cutiva et al., 2021; de Leeuw et al., 2012; de Leeuw et al., 2018; Major, 1992; Mayr et al., 2012; Mennen, 2004); however, not extensively. The statement is supported by Giesbers (1997), who examined a

native Dutch speaker living in Indonesia for 30 years. The author recorded one hour of spontaneous speech with the subject. The speech was tape-recorded and analyzed on all language levels. During the one-hour conversation with the speaker, only 48 instances of deviant pronunciation were observed. Incorrect word stress and incorrect sentence intonation patterns were the most common deviations. However, it should be acknowledged that the voice analysis was based on one person's data and is unlikely to be descriptive of all speakers of a similar profile. To provide another example, de Leeuw et al. (2018) examined phonological attrition among 10 late Albanian-English bilinguals in an immigrant setting. The experiment examined pronunciation of dark /ɬ/ and light /l/ consonant sounds in onset (at the beginning of a word) and coda (at the end of a word) positions. Commonly, light /l/ appears in onset positions, and dark /ɬ/ occurs in coda positions in English, whereas neither of the sounds appears to be position-sensitive in Albanian. The study hypothesized that the speakers would produce the Albanian dark /ɬ/ and light /l/ according to their position in the word, like in English. The study revealed signs of attrition among several speakers. Seven out of ten participants exhibited a certain degree of phonological attrition. The authors concluded that attrition of phonology in late sequential bilinguals is possible but is not always the case. Apart from that, the study reported various degrees of phonological attrition, which may have been predisposed by extralinguistic variables such as length of residence, amount of L1 and L2 contact, or level of education. Other studies in phonological interference and attrition also revealed between-subject differences within a speaker group of a seemingly homogenous speaker profile (Major, 1992; Mennen, 2004; Queen, 2001). Therefore, in order to investigate the factors that contribute to first language attrition and linguistic interference, the main predictor variables and their roles are reviewed below.

2.1.2 Predictor variables

2.1.2.1 Language contact

Language contact is also known as the amount of input or frequency of contact. The importance of the language contact variable is reinforced by the threshold hypothesis described earlier (section 2.1). Based on Paradis's threshold hypothesis, the frequency of item activation plays a significant role in establishing language dominance. The frequency of activation positively correlates with the amount of input in a particular language. The more time a person spends speaking a language, the more frequently the corresponding linguistic items are accessed, decreasing their activation threshold. Indeed, numerous studies agree that the frequency of L1 and L2 contact plays an essential role in attrition and linguistic interference (Ammerlaan, 1996; Bullock & Gerfen, 2004; Hulsen, 2000; Newman & German, 2002; Paradis, 2007; Schmid, 2013; Ulbrich & Ordin, 2014). Therefore, L2 interference and L1 attrition are mainly researched in immigrant speakers consistently exposed to the second language environment (Schmid, 2010). If L1 use decreases after relocating, the use of L2 increases, propagating L2 dominance. Indeed, most bilingual immigrants start using their L2 more frequently after relocation; however, most of the late bilinguals who emigrated to another country do not "abandon" their native language. Thus, it is crucial to analyze the L1 and L2 contact ratio of the speakers in attrition research.

The L1 and L2 use ratio that launches attrition processes is still undefined and can be influenced by other variables such as L2 proficiency or language attitude (Seliger & Vago, 1991). Speakers who are highly proficient in the second language do not experience struggles expressing various ideas in their second language, including very complex ones. Higher L2 proficiency makes a speaker more perceptive and willing to engage in interactions in their L2, which increases the frequency of L2 contact. Language attitude and intrinsic motivation can dramatically contribute to language contact as well. For example, more motivated speakers

learn faster and tend to have an expanded native speaker network. However, the factors that seemingly contribute to L1 or L2 frequency of use are not always what they seem to be. Jaespert and Kroon (1989), who investigated attrition in Italian couples in the Netherlands, showed that Italians whose spouse was also Italian exhibited more attrition than those married to a native speaker of Dutch (the study is discussed in more detail in section 2.1.2.3). A possible explanation for this unexpected result was provided by Cook (2003), who suggested that the speakers who are part of the immigrant minority (in this case, couples) may be willing to socialize with the native speakers more.

According to the previous research, early bilinguals who emigrated to an L2 environment relatively young are more likely to experience L1 attrition and interference than those who learned their L2 later and immigrated in adulthood (de Leeuw et al., 2012). However, even late bilinguals are not spared the opportunity to experience attrition and interference as the variable of language contact can largely influence the degree of language loss. De Leeuw et al. (2010) examined German immigrants living in Anglophone Canada and the Netherlands. The speakers were asked to retell the film *Modern Times* by Charlie Chaplin in German, and long enough speech samples (average 15.2 seconds) were extracted from each recording. German listeners assessed the extracts for foreign accentedness. Bilingual speakers were divided into two groups according to the type of L1 input: (a) speakers with frequent code-switching of L1 and L2 in informal settings, e.g., with family, friends, and (b) speakers with code-switching that occurs in formal settings such as at work or with individuals who reside in Germany. The study revealed that the amount of L1 input was a significant predictor of the foreign accent in the native speech of German bilinguals. In fact, the correlation between the amount of L2 exposure and foreign accentedness was even stronger among those who immigrated after the age of 22.

2.1.2.2 L2 proficiency

The level of L2 proficiency is one of the crucial variables to consider in attrition research (Seliger & Vago, 1991; Major, 1992). As described in section 2.1.2.1 on *Language Contact*, high L2 proficiency may significantly increase the frequency of L2 contact and vice versa. According to the observation made by Schmid (2013), the level of L2 proficiency can be even more important than the age of L2 acquisition. The author noticed that highly proficient L2 speakers with varying ages of acquisition process the language similar to the native speakers. Although not much research was conducted to investigate the role of L1 and L2 proficiency among late bilinguals, the most prominent study results are discussed further.

Major (1992) illustrated the significance of L2 proficiency in attrition in his research on VOT of voiceless stops in American immigrants in Brazil. The study analyzed the amount of aspiration in voiceless stops /p, t, k/ in five late female English-Portuguese bilinguals. English uses a more significant amount of aspiration in voiceless stops, whereas aspiration does not characterize Portuguese to the same extent. For the experimental part of the study, the participants were presented with two lists of words in English and Portuguese. The speakers were asked to read each word and produce an original sentence that contained the word. An informal conversation followed the task in the corresponding language. The results showed varying levels of language loss among the speakers and established a significant relationship between the degree of language loss and proficiency of their L2. However, although there was a correlation between attrition and L2 proficiency, the decreased use of L1 was not significantly relevant for the degree of attrition.

Later, Yeni-Komshian et al. (2000) investigated the relationship between accentedness in the native speech and age of arrival in Korean-English bilinguals in the USA. The study examined 240 bilingual immigrants with their age of arrival ranging from 1 to 27. The speakers had to perform a speech-eliciting task in English and Korean. Their speech was later rated by

10 monolingual native speakers of English and Korean for foreign accentedness. In contrast to Major's findings, Yeni-Komshian et al. proved that increased L2 proficiency and decreased L1 use correlated with attrition. Possibly, Major did not reveal the importance of the language contact variable because of the low participant number (5 speakers).

Although the discussed studies by Major and Yeni-Komshian et al. confirmed the importance of the L2 proficiency variable in language loss, the opposite was found by Zimmerer et al. (2014), who examined the use of pitch range in seven German-French and seven French-German bilinguals in their L1 and L2. The participants were to do a reading task to record the voice data for the pitch range analysis. The speakers were divided into two groups based on their proficiency level (Beginner/Advanced). According to the authors' prediction, more proficient speakers were expected to produce a more native-like pitch in their L2. However, the results yielded no significant role of the proficiency factor. However, it should be mentioned that Major and Yeni-Komshian et al. established the link between L2 proficiency and the listeners' ratings. In contrast, Zimmerer et al. tried to find a correlation between L2 proficiency and the results of the acoustic analysis of the pitch range production.

2.1.2.3 Level of education

The level of education does was not widely reported to play a role in attrition processes but is often a significant factor in particular formal tasks (Schmid & Dusseldorp, 2010). According to Schmid and Köpke (2009) found the variables of education level to be a significant predictor in the cloze test task, when participants need to fill in the missing language items in a text. Nevertheless, possible relationships between L1 and L2 proficiency and the degree of attrition reported by the previous research are illustrated further.

A higher level of education is commonly attributed to the maintenance of L1 proficiency. This correlation can be demonstrated by Jaespert and Kroon (1989), whose study was briefly discussed in section 2.1.2.1 on *Language Contact*. Jaespert and Kroon launched longitudinal research that examined 800 Italian speakers of the first, second, and third generation who lived in the Netherlands. The study opted for a proficiency estimation test that included comprising correction, editing, lexical, and comprehension tasks. As a result, language retention was significantly correlated with the level of education. More educated immigrants showed lesser degrees of language loss. One possible explanation for this is that education may entail another important variable – income – which is associated with mobility and travel opportunities. With higher income, immigrants can travel to their home country more frequently, which allows bilinguals to maintain a decent level of L1 proficiency due to supposedly monolingual L1 exposure.

Another study by Yagmur (1997) investigated socioeconomic factors in L2 attrition and revealed a more in-depth perspective on education level. The research project analyzed attrition in the spontaneous speech of 40 Turkish-English bilinguals who immigrated to Australia. Similar to the results reported by Jaespert and Kroon, higher education levels were significantly correlated with L1 proficiency but only when the education was received in their L1. Thus, the results propagate the idea that the language in which the education was obtained may influence proficiency in the corresponding language.

2.1.2.4 Age

Age in bilingual studies is traditionally discussed in relation to the age of arrival and the age of L2 acquisition. The two concepts are often considered synonymous as the ability to use the second language truly develops in an L2 environment (de Leeuw, 2008). Several studies have proved that early bilingual immigrants are more prone to become attriters than those who

immigrated after puberty (de Leeuw et al., 2012; Schmid, 2019). Accordingly, Köpke and Schmid (2004) suggested differentiating between L1 attrition and incomplete acquisition. The former refers to late bilinguals who have ultimately acquired their L1 and relocated after the age of 10-12. In contrast, the incomplete acquisition is a language phenomenon experienced by early bilinguals who emigrated before puberty. The incompletely acquired L1 poses less interference in L2 and allows the young bilingual immigrants to acquire L2 in a native-like way (Schmid et al., 2004).

The already mentioned research by Yeni-Komshian et al. (2000) is the most ambitious project in regard to the role of age of acquisition in bilingual immigrants. The study analyzed perceived foreign accent in 240 Korean-English bilinguals with varying ages of acquisition. The subjects underwent a speech elicitation session that included a free-speech interview with an interviewer, followed by speech production tests. Korean bilinguals completed two sessions in English and Korean. The ratings of bilinguals' English speech revealed that those with ages of arrival of 1-5 were rated close to monolinguals, and those with ages of arrival of 6-23 showed more prominent foreign accents in their L2. As for the assessment of bilinguals' Korean, those who immigrated between 1-7 years were rated to have a distinct foreign accent, whereas the speakers who left their country after 12 were rated within the range of native speakers.

Indeed, previous research (Bylund & Jarvis, 2011; de Leeuw et al., 2012; Yeni-Komshian et al., 2000) suggested a strong impact of age of acquisition on native-like L2 production and, consequently, L1 attrition. Nevertheless, the importance of age of L2 acquisition may sometimes be supplanted by other factors. For example, according to the observation made by Schmid (2013), the level of L2 proficiency may play a more critical role than the age of acquisition in attrition research. Some late bilinguals show very high L2 proficiency scores and even pass for natives, and not all early bilinguals reach native-like L2 proficiency (Abrahamsson & Hyltenstam, 2009). Therefore, age of acquisition is a crucial predictor of attrition but is not always a strict determinant regarding the degree of language loss.

2.1.2.5 Length of residence

Length of residence is considered a predictor of L1 attrition because, like any other skill, language skills of L1 deteriorate outside of the L1 environment given time. The more time one spends in an L2 environment, the more extensively they use their L2 and the more proficient they become in it (de Bot and Hulsen, 2002; Weltens et al., 1986). Length of residence is assumed to be positively correlated with L2 input and L2 proficiency, the crucial variables in L2 attrition and interference. However, the relationship between the length of residence and the degree of interference or attrition is not as straightforward.

A longitudinal research project by Mägiste (1979) inspected L1 attrition in an immigrant setting among 163 German-Swedish bilinguals with varying lengths of residence. A monolingual Swedish group of 20 speakers was recruited as a control group. The study used a picture naming task and a reading task for bilingual speakers in both German and Swedish to elicit the reaction times. The task was expected to indicate language dominance among bilingual speakers who were divided into eight groups according to their length of residence in Sweden. Analysis of the reaction times during the tasks suggested that the shift in language dominance occurs after approximately 3-7 years in an L2 environment. This conclusion was corroborated by Goral et al. (2008), who focused on patterns of lexical attrition in 84 Hebrew-English bilinguals in the USA. The study compared the performance of language processing between younger (19-38 years) and older (55-64) bilinguals to investigate whether attrition was caused by the age of the speakers or the reported length of residence. The participants were asked to complete a lexical-decision task in Hebrew and English, during which the reaction times were measured. The speakers had to indicate if they see a "word" or a "non-word" on the screen

during the task. The analysis of the reaction times showed that the older group was slower than the younger group for the task in their L1 (Hebrew). However, the accuracy of the task showed no significant difference between the younger and the older groups. The authors concluded that the signs of lexical attrition were detected after an average of four years of residence and did not significantly progress with time. Therefore, the previous research suggests that signs of interference and attrition occur during the first years after relocating and do not significantly progress with an extended length of residence.

All in all, it has been established that early bilinguals are more prone to attrit their native language compared to late bilingual speakers. However, attrition in late bilinguals who immigrated to an L2 environment after puberty is possible, although to a lesser degree. Such factors as the amount of L1 and L2 contact, L2 proficiency, education level, and length of residence in an L2 environment may notably contribute to the degree of L1 attrition and interference. Consequently, controlling for predictor variables in attrition research among later bilinguals is crucial to establish possible correlations between the degree of language loss and a speaker's background.

2.2 Pitch, pitch range, and pitch variability

To better understand prosodic implications of pitch variables that are discussed further, it is necessary to define pitch and its acoustic correlate, fundamental frequency (F0). Pitch is a perceptual property, whereas F0 is its acoustic quantifier that refers to the approximate frequency of the quasi-periodic structure of voiced speech signals (Bäckström, 2020). During speaking, vocal folds oscillate in the airflow when appropriate tension is applied. F0 is defined as the average number of those oscillations per second and is measured in Hertz. F0 is not periodic, and it changes within an utterance, indicating emphasis in a sentence (O'Shaughnessy, 1979). Hasegawa and Hata (1992) stated that F0 is the most prominent cue to accent perception in English. Therefore, given the prosodic representativeness of F0, its estimation is crucial when analyzing the acoustic properties of speech.

Although F0 is traditionally associated with pitch, there is a difference between the two definitions. The difference is explained by a non-linear relationship between pitch and F0. The higher the frequency is, the more difficult it is to notice the difference between the values. To illustrate, "it is possible to detect a difference between 100 Hz and 103 Hz, but not between 4000 Hz and 4003 Hz" (Hewlett & Beck, 2013, p. 213). Nevertheless, since F0 values of the human voice lie in the lower F0 range (approximately 100-500 Hz for male speakers and 130-800 Hz for female speakers), the relationship between pitch and F0 is assumed to have a linear relationship in human voice (Titze et al., 2016). Therefore, pitch and F0 are often used interchangeably in prosodic research (unless the distinction is crucial). The present study also uses the terms synonymously further on.

As previously mentioned, F0 is quantified in Hz, whereas pitch can be measured using various pitch scales such as mels, Bark, semitones, ERB, or sometimes even Hz, which is somewhat controversial (Nolan, 2003). The choice of pitch scale can become crucial in relation to the results. Many pitch-related values are traditionally extracted and analyzed using a linear Hertz scale or a logarithmic semitone scale. However, according to several research projects (Daly & Warren, 2001; Hermes & van Gestel, 1991), ERB (Equivalent Rectangular Bandwidth) scale is more appropriate compared to either Hertz or semitones. ERB is a near logarithmic frequency scale that allows for data normalization (Barry, 2007). Apart from that, ERB models intonational equivalence the most successfully, similar to the semitone scale (Nolan, 2003).

The variable of mean pitch is an indicator of pitch level, which refers to how high or low one's voice is (Patterson, 2000). When measuring and analyzing pitch, research usually

reports the values of pitch maximum and pitch minimum along with the mean pitch, which allows obtaining a complete picture of pitch behavior within a given speech sample. Mean pitch, pitch maximum, and pitch minimum represent a speaker's average, highest, and lowest points of pitch within an utterance, respectively, with the higher values sounding "squeaky" and lower values sounding "deeper" (Pisanski et al., 2018, p. 3). The difference between the highest and the lowest pitch points within a given utterance is commonly referred to as pitch range, a vital pitch variable discussed further.

Pitch range is a variable that is almost always analyzed regarding prosody and intonation. The calculation method of pitch range has been a reason for heated discussions in recent studies (more details are provided in section 3.4.3.1 in *Method*); however, pitch range is traditionally associated with the difference between the pitch maximum and pitch minimum (Clark, 2003). Smaller values correspond to a narrower pitch range, and higher values relate to a wider pitch range.

Differences in pitch range can be associated with specific perceived characteristics of the speech. For example, Mennen et al. (2007) and Traunmüller and Eriksson (1995) proposed that a wider pitch range may correlate with "lively" speech, whereas a narrower pitch range is perceived as more monotonous. Since all languages sound different from each other, the reason for that may be explained by distinct pitch settings of every language (Mennen et al., 2010). For example, Grønnum (1992) claimed that Danish does not sound very expressive, which is commonly linked to its narrow pitch range. Indeed, previous research has found evidence of language-specific pitch ranges (Altenberg & Ferrand, 2005; Andreeva et al., 2014; Busà & Urbani, 2011; Fuchs, 2018; Mennen et al., 2014; Ordin & Mennen, 2017; Ullakonoja, 2007), which makes pitch range an important variable that contributes to the language-specific phonetic profile.

Even though all languages adhere to specific pitch range settings, stating that language A has a wider pitch than language B would be an oversimplification since inter-speaker variables such as sex, weight, height, age, and even smoking habits can introduce variations in pitch range (Baird, 2019). For example, women generally exhibit a significantly wider pitch range and higher pitch dynamism than men (Daly & Warren, 2001). Apart from that, pitch range modulation can depend on socioeconomic status and cultural factors. For example, Shevchenko (2003) provided interesting findings in regard to how the sociocultural environment predisposes pitch, loudness, and tempo modulation. The study examined female speakers of Russian, British English, and American English in radio interviews. The speakers were divided into two groups of higher and lower socioeconomic status to inspect differences in speech modulation. The study discovered that Russian women of higher socioeconomic status have a higher-pitched voice. In contrast, women who belong to the upper class in British and American culture, tend to lower their pitch.

Pitch variability (also known as pitch dynamism, pitch variance, or pitch variation) is another pitch-related variable that has been given significantly less attention than pitch range (Daly & Warren, 2001). Pitch variability refers to the frequency of pitch excursions within a speech sample (Arvaniti, 2020), and similar to pitch range, pitch variability has been previously associated with speech liveliness (Hincks, 2005). Fuchs (2018) and Meer and Fuchs (2019) confirmed language-specific pitch variability in their studies that compare different varieties of English. Meer and Fuchs (2019) compared Trinidadian English, Indian English, and British English for differences in mean pitch, pitch range, and pitch dynamism (corresponds to pitch variability of the present study). Trinidadian English is commonly believed to have a "sing-song" intonation, and the study hypothesized that pitch characteristics of Trinidadian English would be different from other varieties of English. The study examined read and spontaneous speech of 54 male and female speakers. The results showed that Trinidadian English is

characterized by a low mean pitch, relatively high pitch dynamism, and a wide pitch range compared to Indian and British English. Apart from that, the authors pointed out that the values of pitch range and pitch dynamism are very similar across all three varieties of English. Based on the results reported by Meer and Fuchs (2019), pitch variability is language-specific, and it can potentially reveal more information about pitch behavior in bilinguals in the present study.

2.3 Bilingual variation in the use of pitch

As mentioned above, every language is characterized by particular pitch settings. However, less is known about how bilingual speakers manipulate their pitch in their L2 compared to their native language. Laver (1980) stated that pitch range production is determined anatomically, e.g., by body size and by the length of the vocal tract; however, pitch range can also be altered by the speaker. He proposed that the pitch range of one's second language may be adopted habitually. Speech Accommodation Theory (SAT) may offer an insight into how bilingual speakers adopt phonetic features of their L2. According to SAT, bilingual speakers tend to change their speech by applying certain vocal adjustments when interacting with individuals from other cultural backgrounds (Giles et al., 1987). They form these vocal adjustments based on the metalinguistic knowledge and linguistic experience they have at hand (Giles et al., 1987). With time, the habit of adjusting their articulation and pronunciation integrates the second language vocal patterns in the muscle memory, which allows bilingual speakers to code-switch between corresponding phonetic settings to fit the language spoken at the moment (Benoist-Lucy & Pillot-Loiseau, 2013).

Pitch use among bilinguals is significantly understudied simply because bilingual speakers do not represent a homogenous population. Bilingual speakers often report different information in regard to extralinguistic variables (Baird, 2019). Apart from that, inter-speaker variation may also play a significant role in bilingual pitch production. Ordin and Mennen (2017) demonstrated that male and female bilinguals differ in pitch range production in their L1 and L2. The study recruited 32 simultaneous English-Welsh bilingual speakers to discover a possible relationship between sex and spoken language. The speakers had to perform a reading task in both languages. The acoustic analysis showed that female speakers had a wider pitch range in Welsh than in English. In contrast, males did not show any difference in pitch range production between the languages. Although sex differences in speech production of bilingual speakers have been reported to be language-specific by several studies (Ordin & Mennen, 2017; Passoni et al., 2018; Pépiot & Arnold, 2021), these differences are not very frequent in regard to pitch production (Rose, 1991).

2.3.1 The use of pitch in bilinguals' L2

Acquisition of pitch range by L2 learners has been the topic of interest in a number of studies (Busà & Urbani, 2011; Ernst, 2019; Mennen, 1998; Mennen et al., 2014; Passoni et al., 2018; Scharff-Rethfeldt, 2008; Ulbrich, 2008; Ullakonoja, 2007; Zimmerer et al., 2014, among others), and the majority has shown that pitch range production by L2 learners is different from the native norm (Ernst, 2019; Mennen, 2014; Scharff-Rethfeldt, 2008; Sloos et al., 2016; Ullakonoja, 2007; Zimmerer et al., 2014). Failure to attain the native-like norm in pitch rage production can be predisposed by the influence from the native language of bilingual speakers (Ernst, 2019; Scharff-Rethfeldt, 2008). Mennen et al. (2010) also suggested universal patterns in pitch acquisition among L2 learners that take place across all intonation dimensions regardless of the native language.

Several studies (Gut, 2007; Juffs, 1990; Mennen, 1998; Sloos et al., 2016; Ullakonoja, 2007; Zimmerer et al., 2014) found that pitch range in L2 becomes compressed compared to

the native production. For example, Sloos et al. (2016) investigated the use of among 12 Danish learners of Chinese. The authors aimed to discover if Danish speakers who are famous for their narrow pitch range could produce a wider pitch range commonly attributed to Chinese. Apart from the differences in pitch production, the function of pitch is different in Danish and Chinese. Chinese is a tonal language that uses pitch to differentiate the word meaning, whereas Danish is an intonation language that uses pitch to place emphasis or indicate yes/no questions and phrase boundaries (Quam & Creel, 2017). The participant underwent a task that included reading simple sentences aloud. The acoustic analysis revealed that bilinguals increased their overall pitch and pitch range when they spoke Chinese, although it was significantly lower than native Chinese production. Zimmerer et al. (2014) suggested that the trend for the compressed pitch range in L2 production could be explained by insecurity or lack of confidence of bilingual speakers when they speak their L2. As the authors explained, speakers may be prone to concentrate more on correct pronunciation or stress and disregard paying enough attention to how pitch is used in their L2.

Even though most bilingual speaker fail to attain the monolingual pitch and pitch range production, level of L2 proficiency can play a significant role in the use of pitch among L2 learners. Case in point, Ullakonoja (2007) examined Finnish students studying Russian as their second language. The study compared the production of pitch range in speakers' L2 before and after their stay in Russia. The subjects were instructed to read a dialogue in pairs to elicit the voice data. Since Finnish has a narrower pitch range than Russian, the speakers were expected to produce a wider pitch in their L2 to match the Russian native norm. As a result, Finnish participants were able to attain a more native-like pitch range after their stay in Russia. More evidence is provided by Flege and Eefting (1987). The authors examined a gender-balanced group of 50 Dutch-English consecutive bilinguals for voice onset time (VOT) production in plosive /t/ in their Dutch speech. English uses longer VOT in plosive sounds compared to Dutch. The subjects were placed in three groups according to their proficiency level in English. Accordingly, the research expected less proficient speakers of English to produce shorter, Dutch-like VOT when they speak English. For data elicitation, the participants read language-balanced speech material from the list in Dutch and English that contained the focal sound /t/. According to the acoustic results, bilingual speakers of higher L2 proficiency levels managed to produce longer VOT in their L2 compared less proficient L2 speakers.

Although bilingual groups from the above-discussed studies managed to achieve more native-like pitch production in their L2, none of the speakers produced the perfectly native-like pitch and pitch range of the respective second language. A more detailed insight into pitch range acquisition by L2 learners was presented by Mennen et al. (2014). The author tried to see if the pitch range in L2 production is adjusted globally or according to a specific position in an utterance to match the native norm. The study examined 21 female German-English bilinguals of moderate to high L2 proficiency. The speakers were asked to read the *Dog and Duck* passage, which was considered a lively text that would elicit specific intonation patterns. The study analyzed three measures of pitch range that varied depending on their position in an intonation contour. Based on the acoustic analysis results, speakers managed to approximate the L2 pitch range, but not in all pitch range measures. Participants showed target L2 production of the pitch range at the beginning of an utterance but compressed their pitch by its end, which means that L2 pitch range production was shown to be position-sensitive. It is worth mentioning that the above-discussed studies (Sloos et al., 2016; Mennen et al., 2014; Ullakonoja, 2007) used a reading task to collect the voice data, which is not always representative of real-life speech production (Blaauw, 1994, Munro & Derwing, 1994; Nakamura et al., 2008).

2.3.2 The use of pitch in bilinguals' L1

Compared to the research in pitch acquisition among L2 learners, significantly fewer studies have focused on the use of pitch by bilingual speakers in their L1. This section discusses three studies that contributed to the topic (Cantor-Cutiva et al., 2019; Cantor-Cutiva et al., 2021; Scharff-Rethfeldt et al., 2008). The main findings of the three studies are acknowledged and discussed in regard to the research question and the hypotheses.

The earlier study by Cantor-Cutiva et al. (2019) compared acoustic parameters of English production between 13 English-Spanish bilinguals and 40 monolingual English speakers. The participants completed a questionnaire that asked about their language background and sociodemographic information (age, gender, ethnicity). For speech elicitation, the speakers were asked to read a short story in English, and each recording lasted approximately 30 seconds. The voice material was analyzed for five acoustic parameters, including F0 and the standard deviation of F0. The acoustic analysis revealed two main findings in regard to the use of pitch: (1) female monolingual speakers exhibited higher F0 and higher standard deviation compared to the female bilingual group, and (2) male monolingual speakers similarly showed higher F0 but lower standard deviation than male bilingual speakers. The authors attribute the difference in pitch production between bilinguals and monolinguals to the Spanish sound inclusions in the native speech of bilingual speakers. According to the authors, "the long-term muscular adjustments of the vocal apparatus" to match the monolingual norm of the second language may have influenced the native production of bilingual speakers (p. 201).

The later study by Cantor-Cutiva et al. (2021) is similar to their earlier research project; however, there are some differences. Whereas the first study by Cantor-Cutiva et al. (2019) inspected male and female English-Spanish bilingual speakers, their later research project (Cantor-Cutiva et al., 2021) analyzed female Spanish-English bilinguals. The study examined the L1 production of 11 Latin-American Spanish-English female bilinguals and 17 female monolingual Spanish speakers. Similar to the earlier study (Cantor-Cutiva et al.,2019), the participants were to complete a questionnaire and read aloud six sentences. In addition, they were also asked to produce a sustained vowel /a/. Pitch was investigated by reporting F0 only. The acoustic analysis of pitch showed that monolingual participants had higher F0 than the bilingual group during the reading task and sustained vowel production. The explanation of the result was similar to the one provided in the first study (Cantor-Cutiva et al., 2019). According to the explanation, the difference between bilingual and monolingual L1 production of F0 by speakers was caused by mixing up laryngeal settings of English and Spanish in bilinguals' speech. The authors did not refer to interference as an explanation in their studies; however, the failure of bilingual speakers to attain the L1 monolingual norm can allegedly be caused by interference and transfer from their L2.

The studies by Cantor-Cutiva et al. explained the difference between bilingual and monolingual L1 pitch production by the influence from L2 caused by long-term muscular adjustments. However, the results showed that the deviation in L1 pitch production in bilinguals from the monolingual norm did not depend on language-specific pitch characteristics. The first study (Cantor-Cutiva et al., 2019) investigated a bilingual group of speakers whose native language was English, whereas the second study (Cantor-Cutiva et al., 2021) analyzed bilinguals who natively spoke Spanish. According to Hanley et al. (1966), English and Latin American Spanish have distinct pitch profiles. Therefore, if the pitch production of bilinguals' L1 was affected by the respective second language, the results of the two studies by Cantor-Cutiva et al. should have shown different patterns of L1 pitch production in bilinguals. Nevertheless, the bilingual groups produced lower F0 compared to the monolingual groups in

both studies. Therefore, the study results imply that bilingual speakers abide by universal patterns in the L1 production that are not conditioned by language-specific characteristics of the respective L1 and L2.

Neither of the studies, however, are spared significant limitations. One possible limitation lies in the type of speech task, which is a short reading passage (approximately 30 seconds of reading). The results may not have been descriptive of spontaneous speech since acoustic characteristics of read speech are different from those of spontaneous speech (Nakamura et al., 2008). Furthermore, the reading task may have prompted the speakers to have a more formal attitude, compelling them to be more careful with their speech (Major, 1992). In addition, information about bilinguals' L2 proficiency was obtained via participants' self-reports, and no test was performed to give a more accurate estimate of bilinguals' proficiency level. Bilingual speakers were admitted to the study if they "reported having studied English as a second language at school or being exposed to it at home" (Cantor-Cutiva et al., 2021, p. 2). Besides, bilingual speakers in both studies were tested for their listening ability in their L2 by the interviewer who would start to speak English/Spanish with the participants. If a speaker asked for clarification in their native language, they were classified as "better listening ability"; if a speaker could maintain a conversation in their L2, they were classified as "good listening ability" (Cantor-Cutiva et al., 2021, p. 2). Based on the provided description of bilinguals and their L2 proficiency classification, the L2 proficiency requirements were not very high. Therefore, it could be assumed that not all bilingual speakers who participated in the study were highly proficient in their L2.

Scharff-Rethfeldt et al. (2008) examined F0 among 12 highly proficient female German-English bilinguals and two groups of monolingual speakers of German and English. Bilingual speakers reported being simultaneous or early consecutive L2 learners. The speakers performed two speaking tasks: (1) reading the story *The North Wind and the Sun* and (2) telling a joke in a manner of spontaneous speech. The acoustic analysis examined the variable of F0 in four comparison pairs:

1. German monolinguals vs. English monolinguals
2. English monolinguals vs. German-English bilinguals (in English)
3. German monolinguals vs. German-English bilinguals (in German)
4. German-English bilinguals (English vs. German)

The reported results suggested the following:

1. German monolinguals use lower F0 than English monolinguals.
2. Bilingual speakers use different F0 in German and English.
3. Bilingual F0 production in German and English lies between the monolingual standards corresponding to neither of the monolingual norms.

Similar to the explanation provided by Cantor-Cutiva et al., Scharff-Rethfeldt et al. suggested that production of German and English in bilinguals is propagated by code-switching between language-specific muscular settings of the vocal folds and larynx. Habitually, bilingual speakers tend to adjust their articulatory settings to match the target language, and it possibly leads to bi-directional interference that hampers L1 and L2 native production by bilingual speakers (Mennen, 2004). Hence, Scharff-Rethfeldt et al. showed that in their study, bilingual F0 production was predisposed by language-specific pitch settings of the respective L1 and L2. However, it should be borne in mind that the provided results revealed the patterns of pitch behavior in simultaneous and early bilingual speakers and may not be descriptive of how late bilinguals use their pitch.

All in all, the discussed studies yield two distinct patterns in the use of pitch by bilingual speakers in their native language. According to the results reported by Cantor-Cutiva et al., bilingual speakers produce a lower mean pitch compared to monolingual speakers regardless of L1 and L2. In contrast, Scharff-Rethfeldt et al. showed that the values of the mean pitch in bilinguals' L1 production lie between the monolingual standards of L1 and L2. The results provided by Cantor-Cutiva et al. contribute to the universal patterns of native pitch production that are not language-dependent, whereas Scharff-Rethfeldt et al. propose that pitch modulation in bilingual production is predisposed by language-specific pitch settings. The incongruency of the results reported by the Cantor-Cutiva et al. (2019; 2021) and Scharff-Rethfeldt et al. (2008) may be predisposed by different levels of L2 proficiency of the bilingual groups. As described earlier, bilingual speakers in two studies by Cantor-Cutiva et al. may not have been highly proficient in their second language, whereas the bilinguals involved in the study by Scharff-Rethfeldt et al. were very proficient simultaneous or early consecutive bilingual speakers. Perhaps, the patterns of pitch production in bilinguals adhere to more universal patterns at lower levels of L2 proficiency and become more language-dependent when higher levels of L2 mastery are achieved.

2.4 Pitch characteristics of Russian and English

Datta (2010) reported that the degree of attrition and interference from L2 to L1 highly depends on grammatical and phonological similarities between the two languages. Andersen (1982) claimed that bilingual speakers tend to retain phonological segments that are similar or the same in both languages. Case in point, Ammerlaan (1996) analyzed lexical retrieval processes in a picture-naming task among Dutch immigrants in Australia who no longer used their native language. The subjects were presented with pictures showing an object, and the participants had to name the object in their native language. If they struggled with naming an object, six written options of the object names were shown on the screen to help the speaker. The author hypothesized that words that share cross-linguistic similarities between Dutch and English would be accessed more easily than dissimilar ones. Indeed, the participants made fewer errors when retrieving Dutch words that were similar to English words morphologically, phonologically, and semantically. In contrast, Dutch words dissimilar to their English equivalents were retrieved slower, and speakers made more mistakes. It can be concluded that the degree of similarity of linguistic elements between L1 and L2 can influence the degree of language loss. Therefore, it is necessary to establish differences between Russian and English in regard to the inspected pitch variables.

Similarities across languages are commonly predisposed by language descent (Comrie, 2009). For example, since Italian and French belong to the group of Romance languages, they are considerably more similar than Italian and Dutch (Romance and Germanic languages, respectively). Andreeva et al. (2014) discovered that language-specific pitch characteristics are similar across genetically close languages. In their study, two groups of Slavic (Polish, Bulgarian) and Germanic (German, English) languages were compared for their pitch characteristics, including pitch range and pitch variability (pitch variability was defined as the standard deviation in their study). The authors analyzed read speech from multi-lingual speech databases performed by 22 speakers (11 males and 11 females) for each language. The findings showed that Slavic languages exhibited higher pitch values (a wider pitch range, a higher mean pitch and pitch variability) compared to Germanic languages. The study results implied that languages of the same language family share similarities in regard to their pitch profiles.

Based on Andreeva et al. (2014), Russian and English are expected to have different language-specific pitch settings since they belong to different language families (Slavic and Germanic). The findings obtained by Andreeva et al. may suggest that Russian, being a Slavic

language, also has higher pitch values compared to English. All in all, Andreeva et al. yield the following implications regarding Russian and English pitch profiles:

1. Russian has a higher mean pitch than English.
2. Russian has a wider pitch range than English.
3. Russian has a higher standard deviation of pitch than English.

2.5 Research question and hypotheses

In light of the above-discussed research on phonological attrition and interference among late bilingual speakers in an immigrant setting, the following research question can be formulated:

Research Question: Do Russian-English bilingual speakers who immigrated to the UK after puberty use pitch differently from monolingual Russian speakers because of linguistic interference?

Extensive exposure to English was expected to have influenced the speech patterns of Russian-English bilingual speakers and have caused a certain level of interference in their native language. Upon analyzing the previous research in relation to language-specific acoustic characteristics, attrition, and linguistic interference, specific hypotheses were formulated as follows:

Hypothesis 1: Russian monolinguals are predicted to show a higher mean pitch and a wider pitch range than English monolinguals based on Andreeva et al. (2014).

Hypothesis 2: Russian-English bilingual speakers are predicted to show a higher pitch variability and a wider pitch range in their Russian speech compared to their English speech based on the language-specific pitch characteristics described by Andreeva et al. (2014), and patterns of pitch range production by L2 learners revealed by Scharff-Rethfeldt et al. (2008), Ullakonoja (2007), and Zimmerer et al. (2014).

Hypothesis 3: Due to the high L2 proficiency of Russian-English bilinguals, bilingual speakers are expected to approximate the monolingual English norm in their pitch. However, the speakers are not expected to attain native-like English pitch production based on the findings reported by Mennen et al. (2014).

Hypothesis 4: Russian-English bilinguals are expected to display a lower mean pitch in their Russian speech compared to the speech of Russian monolinguals (Scharff-Rethfeldt et al., 2008).

Hypothesis 5: Although sex differences in the use of pitch are anticipated (Daly & Warren, 2001; van Bezooijen, 1995), they are not expected to interact with language spoken or background (monolingual; bilingual) (Henton, 1995; Rose, 1991).

3. Method

3.1 Participants

The study examined three groups of speakers with 9-10 participants per group. These groups were Russian monolinguals (three males, six females), British monolinguals (four males, five females), and consecutive Russian-English bilinguals (four males, six females). Russian monolinguals resided in Russia, British monolinguals and Russian-English bilinguals resided in the UK when the study was conducted. Their average age ranged from 20 to 39 years with the average mean of 27.1 years and standard deviation of 4.4 years (Russian monolinguals: 23-26 years, M = 24.6, SD = 0.97; English monolinguals: 20-35 years, M = 26.5, SD = 4.39; Russian-English bilinguals: 25-38 years, M = 30.1, SD = 4.99;). All participants were asked to complete the Language Proficiency and Experience Questionnaire (LEAP-Q; Marian, Blumenfeld, & Kaushanskaya, 2007) with the view to gathering self-reported data about L1 and L2 proficiency, language use, and language exposure in different contexts (see below for more details). All participants were highly educated with the minimum education level of a bachelor's degree. To recruit the participants, social media platforms such as Facebook, VKontakte, and Instagram were used. Speakers participated on a voluntary basis and received no payment.

3.1.1 Russian monolinguals

The group of Russian monolingual speakers consisted of four female and six male participants with their ages ranging from 23 to 26 years (M = 24.5, SD = 0.97). Russian monolinguals spoke the Southern Russian dialect, which is spoken in 11 regions of Russia: Belgorod, Bryansk, Kaluga, Kursk, Lipetsk, Oryol, Ryazan, Smolensk, Tambov, Tula, and Voronezh. The Southern Russian dialect is commonly characterized by (1) a voiced glottal fricative /ɦ/ consonant sound instead of standard /g/ and (2) vowel reduction in unstressed position usually termed as *akanye* and *yakanye* (Exlinguo Russian Language Centre, 2018).

1. Akanye (literally "*a*-ing") refers to the vowel reduction type when unstressed /o/ merges with /a/ and becomes a near-open central vowel /ɐ/.
2. Yakanye (literally "*ya*-ing") refers to the vowel reduction type when unstressed /o/, /e/, /a/ following palatalized consonants preceding a stressed syllable are pronounced as a near-front low unrounded /æ/ rather than /i/, like in Standard Russian dialect. For example, [nʲ æsˈlʲi] and not [nʲɪsˈlʲi] (Enguehard, 2018).

Although there are pronunciation differences between the Southern Russian dialect and the Standard (Moscow) Russian dialect, these differences are unlikely to affect the present results. According to Kasatkin (1999), dialectal varieties are degrading across Russia. Dialects are primarily spoken by older generations in rural areas. In contrast, the younger population from urban areas of the country adheres to the Standard (Moscow) Russian dialect. All Russian monolingual speakers have specific characteristics in common: they are (a) younger, (b) highly educated, and (c) they come from the regional capitals. Thus, the dialectal variety they spoke was expected to have less typical features of the Southern Russian dialect and be similar to the Standard Russian dialect. For example, none of the speakers used glottal fricative /ɦ/ consonant sound in their speech.

Current educational systems in Russia and the UK leave no chance for the monolinguals to be fully unexposed to learning a foreign language in school. Therefore, the study allowed for the monolingual speakers who could have learned another language. Nine speakers indicated experience learning another language – English – a compulsory subject in public schools in Russia. Three speakers also indicated having learned German and Ukrainian apart from English.

The study tolerated minimal exposure of 10% to a foreign language in Russian monolinguals due to the rapid integration of English language-based online service and education platforms and the gaming industry. It is important to note that proximity with the above-mentioned digital environments can increase foreign language skills regarding reading and vocabulary knowledge and, to a lesser degree, oral proficiency (Sundqvist, 2009). For the foreign language exposure in Russian monolinguals, see Table 1.

Table 1
Percentage of foreign language exposure in Russian monolinguals

Participant	MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9	MP10
Exposure	5%	10%	2%	0%	0%	10%	1%	10%	10%	10%

Note. MP stands for monolingual participant.

3.1.2 English monolinguals

The English monolingual group comprised five female and four male participants (ages 20-35, M = 26.5, SD = 4.39). All participants spoke Standard Southern British English (henceforth SSBE), a more descriptive term for Received Pronunciation. According to Hughes et al. (2013), SSBE accent conventionally serves as an indicator of an upper-class individual with a certain level of income, education, and usually scoring high on perceived intelligence. SSBE has always been associated with the Southeast regions of the country and the Home Counties (the counties bordering London). However, SSBE is not the accent of a particular area of the country, and one may hear SSBE from a person who comes, for example, from an area in the North of the British Isles. It is worth mentioning that SSBE is not a homogeneous variety of English, and it is often altered by regional spoken varieties, style, and level of formality (Hughes et al., 2013).

Six speakers indicated having experience learning another foreign language. Unlike Russian monolinguals, English speakers displayed more heterogeneous experiences with learning a foreign language. Whereas Russian monolinguals had experience learning English in most cases, English monolinguals indicated having learned French, Russian, Spanish, and German. Similar to the Russian monolinguals, the study tolerated a total of 10% of the foreign language exposure (see Table 2).

Table 2
Percentage of foreign language exposure in English monolinguals

Participant	MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9
Exposure	0%	5; 5%*	0%	0%	10%	0%	0%	1%	0.1; 0.1%*

Note. MP stands for monolingual participant; *MP2 and MP9 indicated exposure to two foreign languages.

3.1.3 Russian-English bilinguals

The Russian-English bilingual group consisted of four male and six female speakers with their ages ranging from 25 to 38 years (M=30.1, SD=4.99). The study recruited participants from Southern England, namely London and the counties of Berkshire, Essex, Kent, Somerset, and West Sussex. Whereas six bilingual speakers were born in Russia (the cities of Central Federal District and Krasnodar Krai), four other bilingual speakers were born in the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan. According to self-reported

data, these speakers were born into Russian-speaking families and went to Russian schools. Nevertheless, the language situation in each country or region mentioned above is discussed further to give a complete overview of the participants' linguistic background.

3.1.3.1 Language situation in the Republic of Kalmykia

The Republic of Kalmykia is officially a part of Russia, and Russian and Kalmyk are the two state languages. Although the two languages have the same status, the usage of the national language had been massively reduced during so-called Russification in the Soviet times, so nowadays, Kalmyk is labeled as "definitely endangered" by UNESCO. During the Soviet era, the position of Russian in Kalmykia was consolidated in institutions of education, healthcare, and government. In present times, the impact of the national language on Russian is strongly felt among the older generation, whereas the middle generation speaks grammatically correct Russian with lexical inclusions from Kalmyk (words, colloquialisms). The young people of the Republic of Kalmykia acquire the native language in a fragmented way. The speech of the younger generation may include Kalmyk lexical inclusions; however, phonetic, morphological, and syntactic interference is not present (Esenova, 2015). Table 3 represents language characteristics of the Russian language spoken in the Republic of Kalmykia that deviate from the language norms of standard Russian (Esenova, 2015, pp. 458-460).

The speaker that participated in the study was 25 years old and was considered a young person. She indicated zero familiarity with the Kalmyk language; only her grandmother spoke Kalmyk in her family, although not very fluently. According to the speaker, almost no one speaks Kalmyk in her hometown, Elista (the capital of Kalmykia). The native language is only used in villages and smaller towns as a means of communication.

3.1.3.2 Language situation in the Republic of Belarus

Similar to the language policy in the Republic of Kalmykia, the Republic of Belarus has two state languages: Russian and Belarusian. However, most of the population chooses Russian for everyday communication (Kittel et al., 2010). According to Koryakov (2002), the distinction between Russian and Belarusian speakers in Belarus is commonly attributed to how populous an area is. Belarusian is used significantly more often in the country, whereas people from more urban areas indicate more frequent use of Russian. Koryakov also mentions the rough division between Russian-speaking and Belarusian-speaking regions in the Republic of Belarus. To illustrate, Gomel, Brest, Minsk, and Grodno regions score higher on Belarusian, whereas people from Vitebsk and Mogilev regions speak Russian almost exclusively. Koryakov (2002) listed phonetic, morphological, and lexical deviations of "Russian with a Belarusian accent" from standard Russian in his study. The overview is presented in Table 4 (Koryakov, 2002, p. 52; Mechkovskaya, 1994, p. 312; Melnikova, 1999, pp. 52-65; Nikolaeva, 1999, pp. 73-83; Veshtort & Krysin, 1999, pp. 65-73).

The speaker from Belarus was originally from Vitebsk, which is one of the Russian-speaking cities according to Kayakov's study. The speaker also indicated homogenous usage of Russian at home and zero knowledge of Belarusian. Furthermore, the speaker's family was from Vladimir, a city in the Central Federal District of Russia. Hence, the characteristics of the "Russian with a Belarusian accent" provided in Table 4 can be ascribed to the speaker from Belarus minimally, if at all.

Table 3
Characteristics of the Russian language spoken in the Republic of Kalmykia grouped by language level and generation

	Older generation	Middle generation	Younger generation
Phonetic	Pronunciation is letter by letter; the vowels in weak positions are not reduced Soft consonants are pronounced as half-soft Reduction of end vowels in nouns Insertion of a vowel before the initial /r/ of a word		
Morphological & Syntactical	Using Kalmyk affixes instead of Russian morphemes Mistakes related to the category of number Using participial and verbal adverb constructions adjacently (as it is in Kalmyk) Kalmyk postpositions can be used instead of Russian prepositions	Contracting several sentences into one construction by omitting semantically unloaded components	
Lexical	Bookishness of speech No slang, colloquialisms, and reduced elements Kalmyk lexical inclusions	Bookish words and expressions are found side by side with slang and vernacular vocabulary The abundance of words and expressions from the official style Using emotional means of native language Using ready-made lexical units, no inventiveness	Kalmyk words and expressions come to the formulas of speech etiquette The interaction of bookish, colloquial, slangy, and rude words; abusive, swear words are frequently used

3.1.3.3 The language situation in the Republic of Kazakhstan

The language situation in Kazakhstan is slightly different. According to the language policy of Kazakhstan, the Kazakh language is the official language of the republic, and Russian can be used alongside; however, most Kazakhstani people speak both Kazakh and Russian. After Russification in the Soviet times, the Kazakh people developed bilingual culture, and nowadays, Russian holds a more dominant position in everyday interactions (Aksholakova & Ismailova, 2013). According to Sabitova (2014), differences between Russian spoken in Kazakhstan and Russia manifest themselves on the lexical level but not on the levels of phonetics or grammar. Kazakh lexical borrowings occur in Russian due to socio-cultural phenomena that exist in Kazakh but not in Russian. Even though Kazakh people use Kazakh lexical items when they speak Russian, they are phonetically and morphologically adapted to Russian (Suleimenova et al., 2021).

Table 4
Characteristics of the Russian language spoken in the Republic of Belarus grouped by language level

Phonetic	Morphological	Lexical
More frequent:	Gender disagreement	Belarusian lexical inclusions
Different intonation patterns in questions	Incorrect word form in relation to number	Stylistically incorrect vocabulary choice
Fricative / ɦ / instead of standard /g/	Incorrect word ending in relation to declension	Incorrect usage of Russian words caused by the interference of their Belarussian equivalents
No reduction of vowels in weak positions (yakanye)	Omitting /t/ or /t'/ in verb endings in 3rd person singular form	
Hard /dʑ / consonant sound instead of soft Russian alveolo-palatal sibilant fricative /ɕ:/	Contracting suffixes in imperfective verbs	
/Ts/ and /dz/ sounds instead of /t/ and /d/ sounds, respectively		
Incorrect word stress		
Less frequent:		
Doubling of soft consonants in nouns		
Hard /r/ consonant sound instead of softer / rʲ/		
Hard labial sounds in word endings		

Two Kazakhstani speakers took part in the present study. One of them reported some knowledge of Kazakh due to having learned it in primary school. The speaker's home language was Russian, and he went to a Russian school, where all subjects were taught in Russian (apart from Kazakh, which was taught as a second language). The second Kazakhstani speaker claimed to know several standard phrases in Kazakh but said she would only use them when talking to a person who does not speak Russian very well. Both speakers reported zero exposure to the Kazakh language after they moved to the UK.

Based on the discussion above, it is reasonable to conclude that Russian holds a more dominant position in the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan compared to the national languages. Additionally, the four speakers indicated minimal to no proximity with the corresponding national languages, especially after moving to the UK. According to the above-discussed research, the Russian-speaking population of the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan have specific characteristics in common: they (a) come from a bigger city, (b) have higher education, and (c) are younger. The four speakers come from the state capitals or regional capital cities; they are highly educated and belong to the younger (25 years old; 29 years old; 33 years old) and middle generation (38 years old). Therefore, it can be confidently stated that the four non-Russian speakers that participated in the study can be considered Russian native speakers and eligible to provide reliable voice data in Russian.

Table 5 presents the information about bilinguals' length of residence in the UK (henceforth LOR; M = 11.3, SD = 3.8), age of arrival (henceforth AOA; M = 18.7, SD = 5.2), and age of onset (henceforth, AOO; M = 8.7, SD = 6.1). Participants' reported LOR is

comparable among speakers except for Speaker 7 and Speaker 8, whose LOR is 18 and 5 years, respectively. As reasoned by Mägiste (1979) and Goral et al. (2008), attrition occurs in the first years of the stay in the L2 environment. Accordingly, bilingual speakers' LOR was set to be five years or more, which was considered a sufficient minimum. Six speakers arrived in the UK in their teenage years (11-17), whereas four other speakers moved to the UK in their twenties (21-28). Overall, reported AOA attributes all the speakers to the category of late bilinguals.

Table 5
Sex, length of residence, and age of arrival (in years) for bilingual participants

Participant	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	BP9	BP10
Sex	m	f	f	f	m	f	m	f	f	m
Length of residence	10	10	8	10	11	11	18	5	14	16
Age of arrival	16	16	21	16	28	17	15	25	11	22

Late bilingual speakers who immigrate in their adolescence or adulthood rarely lose contact with their L1. Consequently, bilingual speakers recruited for the study consistently used both Russian and English in their daily life. However, as previously reported, consistent exposure to L1 may prevent bilinguals from first language deterioration (de Leeuw et al., 2010). Therefore, care was taken that total daily exposure to English was prevalent for the majority of the speakers compared to their native language. In the Language Proficiency and Experience Questionnaire, bilingual speakers indicated the approximate amount of L1 and L2 contact in percent. For the data on L1 and L2 exposure reported by the speakers, see Table 6. Apart from using English and Russian, four speakers also used a third language on a daily basis, but the exposure was negligible (<5%).

Table 6
Percentage of current exposure of the bilingual participants to English and Russian

Participant	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	BP9	BP10
English	90%	70%	90%	69%	60%	70%	60%	70%	60%	50%
Russian	10%	25%	9%	30%	40%	25%	40%	30%	40%	50%

Participants rated their English proficiency (speaking, reading, understanding) on an 8-point Likert scale, where (1) corresponds to zero knowledge and (8) corresponds to excellent knowledge. Four speakers indicated their English language skills to be good (6), three speakers described their language skills as very good (7), and two described their skills as excellent (8). As self-assessment scores may appear somewhat subjective and unreliable, the bilingual group also took the LexTALE test (Lemhöfer & Broersma, 2012), a visual lexical-decision task that measures vocabulary knowledge (for scores, see Table 7). The task consisted of 60 trials; the participants had to indicate the words that exist in English. According to Lemhöfer and Broersma (2012), the LexTALE test is a reliable tool to check general proficiency even among learners of various backgrounds. On this test, bilingual speakers scored an average of 82.75% correct responses (range 96.3% – 68.3%; standard deviation 10.76%). According to the general interpretation of the scores, the LexTALE score of 80%-100% corresponds to C1 and C2 proficiency levels of Common European Framework of Reference for Languages (CEFR), and the LexTALE score of 60%-80% corresponds to the CEFR level of B2 (Lemhöfer & Broersma,

2012). Accordingly, seven speakers can be considered advanced (C1) or proficient (C2) speakers of English, and three other speakers are of upper-intermediate (B2) level according to CEFR (Council of Europe, 2021). The results of the LexTALE test roughly correspond to the self-assessment scores.

Table 7
Self-rating, LexTALE test scores, and corresponding CEFR proficiency levels for bilingual speakers

Participant	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	BP9	BP10
Self-rating	Excellent (8) (C1/C2)	Very good (7) (C1/C2)	Excellent (8) (C1/C2)	Excellent (8) (C1/C2)	Excellent (8) (C1/C2)	Very good (7) (C1/C2)	Good (6) (B2)	Good (6) (B2)	Very good (7) (C1/C2)	Good (6) (B2)
LexTALE Score	91.3% (C1/C2)	88.8% (C1/C2)	96.3% (C1/C2)	93.8% (C1/C2)	91.3% (C1/C2)	88.8% (C1/C2)	68.3% (B2)	70% (B2)	83.8% (C1/C2)	77.5% (B2)

Note. BP stands for bilingual participant.

3.2 Procedure

The task of the present study included two parts: (1) a monologic spontaneous speech picture task in Russian and English (henceforth referred to as the *Picture Task)*, and (2) a dyadic conversation on socio-linguistic topics in both Russian and English (henceforth referred to as the *Dyadic Conversation*). The Picture Task and the Dyadic Conversation in Russian were managed by a native speaker of Russian (the author). A native speaker of British English managed the Picture Task and the Dyadic Conversation in English. The information about the interviewers' linguistic background, the recording procedure, and each part of the task is provided further.

3.2.1 The interviewers

The interviewer choice for the monolingual groups was made to ensure experimental symmetry and avoid foreigner-directed speech. As illustrated by Beebe (1977) in her study on the influence of the listener on code-switching, the interlocutor's identity can alter the speaker's quality of pronunciation. The research showed that Chinese native speakers of Thai altered their pronunciation when they spoke to an ethnically Chinese person as opposed to an ethnically Thai person. The speakers used Chinese-sounding vowels and consonants more frequently with a Chinese interlocutor, whereas with the Thai interlocutor, the speakers used Thai variants more often. Therefore, to eliminate a similar effect, the tasks in Russian and English were managed by the native speakers of the respective language.

The Picture Task and the Dyadic Conversation in Russian were conducted by the author (female, 25 years old; henceforth referred to as *Interviewer 1*), a native Russian speaker of the Southern Russian dialect. Interviewer 1 is an advanced speaker of American English (CEFR level C1), and she also speaks Dutch at a basic level (CEFR level A2). Interviewer 1 moved to the Netherlands when she was 24 years old. The second interviewer (male, 27 years old; henceforth referred to as *Interviewer 2*) is a native speaker of British English and was recruited to conduct the Picture Task and the Dyadic Conversation in English. He was born in the USA and moved to the Netherlands when he was 22 years old. Interviewer 2 has an SSBE accent, and throughout his childhood and adolescence, he consistently spoke British English with his family and relatives from the UK. However, since Interviewer 2 had lived in the USA before moving to the Netherlands, his SSBE may have acquired features of American English.

Interviewer 2 is of various proficiency in the following languages: (1) British English (native), (2) Dutch (CEFR level C1), (3) French (CEFR level C1), (4) Spanish (CEFR level B1), (5) German (CEFR level B1), (6) Italian (CEFR level A2). However, Interviewer 2 reported being predominantly exposed to English and Dutch daily.

An issue that arises because of the demographic characteristics of the interviewers is how their knowledge of several languages could have affected their native language. First, both Interviewers 1 and 2 started learning their dominant foreign language(s) relatively late. Interviewer 1 started learning English at the age of 16; Interviewer 2 started learning French and Dutch (his most dominant languages, both of CEFR level C1) at the ages of 15 and 22, respectively. As established, late language learners tend to attrite less than early bilinguals, primarily when consistent L1 contact is maintained. Second, according to the research into native language pronunciation in immigrants' speech (de Leeuw et al., 2010; Major, 1992), the frequency of contact with the native language plays a significant role in predicting a foreign accent in immigrants' native speech. In their studies, the speaker group that was more systematically exposed to the contacts in their native language was perceived to sound more foreign-accented when speaking their native language. As the interviewers reported being in consistent contact with their native languages on a daily basis, the change in their native pronunciation was set to be minimal. Third, the length of residence of the Interviewers 1 and 2 in a foreign country (the Netherlands) was 1.1 years and 5 years, respectively. Evidently, Interviewer 2 had spent remarkably more time in a foreign country than Interviewer 1. Based on the findings of Bergmann et al. (2016), the length of residence was reported to be negatively correlated with native pronunciation in participants' L1. Therefore, Interviewer 1 may have displayed nonnative-like pronunciation in his native language caused by the length of residence in a foreign country. Overall, the analysis demonstrates a minimal chance of perceived foreign accentedness in the native speech of Interviewers 1 and 2. However, Interviewer 2 may have exhibited a nonnative-like pronunciation due to a prolonged stay (5 years) in the Netherlands while being exposed to Dutch on a daily basis.

3.2.2 The picture task

The Picture Task is a spontaneous speech task. The task was set to be based on spontaneous speech and not scripted speech for several reasons. First, according to the quantitative research conducted by Nakamura et al. (2008), spontaneous speech is remarkably different from scripted speech. Spontaneous speech is filled with natural pauses, hesitations, and filler sounds, and it is produced at a higher speaking rate. All of those characteristics contribute to modulating real-life utterances and allow for inspecting the speech as it is produced in reality. Secondly, the same study by Nakamura et al. revealed that the variance of each phoneme is significantly accelerated in spontaneous speech compared to that of read speech. Thirdly, multiple studies (Hammond, 1982; Oyama, 1982; Thompson, 1991) have examined perceived foreign accent in spontaneous and read speech. The results yielded evidence for read speech being rated as more accented than spontaneous speech, which is believed to be predisposed by possible unfamiliarity with specific words from the provided text or their orthography. Apart from that, the task where the speakers are expected to read aloud and be recorded causes stress and a certain amount of discomfort, which can divert participants' attention from concentrating on the task and correct pronunciation (Munro & Derwing, 1994). Lastly, in her research on investigating the prosodic boundaries in spontaneous and read speech, Blaauw (1994) found a notable difference in distribution and realization of the prosodic boundaries in the two types of speech production, which is believed to drastically affect the perceptual difference between the spontaneous and scripted speech. The discussed findings suggest contrasting differences in acoustic properties between spontaneous and read speech, which may cause heterogeneous

results in both impressionistic and acoustic analyses. Therefore, the format of spontaneous speech was chosen for the Picture Task in the present study as it was believed to be more representative of the "real-life" speech.

As the name implies, the Picture Task was constructed so that images were involved in the task. However, the task does not implement the procedure of the classical picture task, which often includes picture naming or picture description. Instead, the pictures presented during the task were used for information elicitation and creating a set structure for a regulated speech-sampling procedure (Cooper, 1990; Thompson et al., 2004). Thus, the term Picture Task is used rather loosely as it does not include picture description, picture naming, or narration per se.

After examining the research on different speech-production task types, the preference for the speech format in the Picture Task was given to monologic speech. The support for the stated choice was provided by Derwing et al. (2004), who inspected speakers' performance in relation to fluency, comprehensibility, and accentedness between the three types of tasks: picture description, monologue, and dialogue tasks. The speakers performed significantly better on monologue and dialogue-based tasks than on picture description based on the results. Further, choosing between the monologic and dialogic speech tasks, researchers commonly give priority to the former. As explained by Tavakoli (2016), monologue-based tasks are usually easier to control, allowing for predictability of speakers' performance. Dialogue-based tasks, in contrast, present a high amount of speech disruptions such as interruptions, between-turn pauses, and simultaneous speaking. Moreover, a speaker's performance vastly depends on their interlocutor during a dialogue (Tavakoli, 2016). Therefore, the Picture Task was set to be a monologue-based speech task.

The national celebrations were the theme for the Picture Task. The theme of national celebrations was chosen for the following reasons: (a) both English and Russian speakers were expected to be familiar with the celebrations discussed, (b) images of national celebrations are visually representative and help to elicit enough information during the speaking task, (c) the topic of national celebrations easily draws on personal experiences and memories in relation to at least one of the celebrations. The groups were presented with three pictures featuring three national celebrations of their native country: *Christmas, Guy Fawkes Night,* and *Easter* for the task in English (Fig. 1); *Maslenitsa, Orthodox Epiphany,* and *Orthodox Easter* for the task in Russian (Fig. 2). Guy Fawkes Night in the UK and Maslenitsa in Russia can be considered the most cultural celebrations; therefore, brief descriptions are provided further for each of the two celebrations. First, Guy Fawkes Night, or Bonfire Night, is an annual commemoration on November 5th and celebrates the failure of the Gunpowder Plot of 1605, an assassination attempt against King James I organized by English Catholics. There are bonfire celebrations with fireworks all over the country, although some people prefer to make a small bonfire in their garden (Britannica, 2020). Second, Maslenitsa, roughly translated as "butter week", is a seven-day winter festival usually falling at the end of February every year. The festival is an old pagan Slavic tradition that marks the beginning of the spring and blesses the upcoming harvest. During the seven days, people eat pancakes and participate in various festivities, including singing, dancing, fistfights, and pole climbing (Express to Russia, 2020).

From the information sheet (Appendix A) presented upon recruitment to both monolingual and bilingual participants, the speakers learned about the aim of the study and the procedure they would undergo. The speakers were informed about the time estimate of the procedure and how the conversation recording is executed. The study informed the speakers about the topic of the task (national celebrations) to avoid the familiarity bias. As Derwing et al. (2004) explained, since the bilinguals had two task sessions and were presented with two sets of pictures, not informing them about the topic may have caused the difference in picture judgment simply because speakers would not know what to expect. However, the speakers did

not know about the exact celebrations they would have to talk about and what questions they would be asked regarding the topic of the celebrations; the participants only knew that the speaking task would concern English or Russian celebrations.

The three images of English and Russian national celebrations were arranged in two PowerPoint slides presented at the beginning of the task. The task was carried out identically between the two monolingual groups to facilitate comparison. Russian monolinguals were presented with images of Russian national celebrations, and English monolinguals were shown the images of English national celebrations. Upon presenting the pictures, the speakers were asked to choose a national celebration they would recommend their (fictitious) international friend to visit. Additionally, the participants were asked about the reasons to attend the celebration and the standard course of the activities on the day/days. After the speakers addressed the questions, they were also asked to recall a childhood memory in relation to one of the three celebrations. For the description of how the task was managed, see section 3.3.4 on *The Recording Procedure*.

Figure 1
Pictures used in the Picture for the conversations in English: (a) Christmas, (b) Guy Fawkes Night, (c) Easter

(a) (b) (c)

Figure 2

Figure 2
Pictures used in the Picture Task for the conversations in Russian: (a) Maslenitsa, (b) Orthodox Epiphany, (c) Orthodox Easter

(a) (b) (c)

3.2.3 The dyadic conversation

After the task, a semi-structured dyadic conversation was held as an additional source of spontaneous speech material and information about participants' language background and experience. The Dyadic Conversation included questions on sociolinguistic topics such as the use of language at home, the importance of learning a language, the language background of the participants, and personal attitudes towards Russian and English. The approximate sets of questions are presented in Table 8. The monolingual groups were asked similar questions for

the reason of shared language background (monolingual). As the bilingual group had two recording sessions (in Russian and English), there were two conversations in the corresponding language following the Picture Task. The questions in Russian and English were constructed so that the answers would potentially involve only Russian/English untranslatable lexicon or cultural references in the corresponding language. In other words, the question construct aimed at avoiding the inter-language lexicon or using the vocabulary of the other language. The Dyadic Conversations in Russian were held by Interviewer 1, and the Dyadic Conversations in English were held by Interviewer 2. The speakers who were not born in Russia (speakers from the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan) were asked follow-up questions about (1) the status of their native language and Russian in their hometown and the whole country/region; (2) the use of Russian and their national language at home and in school throughout their childhood, adulthood, and at present, (3) how proficient the speakers were in their corresponding native language, (4) and frequency of contact with other people in the corresponding national language.

Table 8
The questions for the Dyadic Conversation grouped by the language background (monolingual; bilingual) and the language spoken (Russian; English)

Background/ Language	Russian	English
Monolingual	1. How did you like your first English teacher?	1. What foreign languages did you learn in school?
	2. What was your impression of the first English classes at school?	2. What are the gains from being able to speak a foreign language?
	3. What are the gains from speaking English if you are a Russian person living in Russia?	3. Do you try to pick up some of the foreign languages when you travel abroad?
Bilingual	1. How are British people different from Russian people?	1. What are the gains from being able to speak a foreign language?
	2. How did you start learning English?	2. What is the next language you are going to learn?
	3. How do you view your identity after having lived in the UK? Do you identify yourself with the British or the Russian culture?	3. Have you noticed the differences in accents across the UK?

The study information sheet described the procedure during which the task (Picture Task and Dyadic Conversation) was performed as "conversation." In line with the findings reported by Major (1992), who researched native language attrition, second language interference is more present in casual speech production tasks rather than formal ones. Given this point, the study aimed to avoid an overly formal attitude from the participants' side towards the task by using a more casual description ("short conversation").

3.2.4 The recording procedure

Given the present world situation and the Covid-19 measures that curb the possibilities for face-to-face research, it was decided to perform the recording procedure remotely. All participants were in their homes during the recording procedure.

The Zoom conferencing service was used to establish a video connection with the speakers, and an online voice recorder (https://mmig.github.io/speech-to-flac/) collected the voice data in WAV file format. Zoom is a general video calling service that is easy to navigate, provides good video and sound quality, and is commonly used by people in Europe and Russia. The online voice recorder mentioned above was chosen to be the recording tool for several reasons: (1) it does not require registration or providing personal details; (2) the interface is straightforward, and the recording procedure is easy to manage; (3) the recorder proved to work well simultaneously with Zoom, and it did not interfere with the sound connection during the Zoom call. The voice recorder allows for two audio formats: FLAC and WAV. FLAC files are compressed audio files, whereas WAV format allows for uncompressed audio files. Therefore, WAV format was chosen for the recordings as it provides higher sound quality, making the audio files more suitable for acoustic analysis. The input sample rate was set at 44100 Hz, and the compression level was set on 5 by default; the settings were not subject to change. In order to start the recording, the user has to press *Start Recording*. Once the recording starts, the Start Recording button becomes inactive and *Recording…* appears on the screen. Once the user presses *Stop Recording*, the recording stops, and the recorded WAV file immediately downloads on the device on which it was recorded. To provide the best audio quality possible, the participants (and not the researcher) recorded the conversation from their end. Subsequently, they sent the recorded file to the researcher via WeTransfer (https://wetransfer.com/), an internet-based file transferring service. The online voice recorder can only be used on a laptop or a desktop and does not operate on a tablet or a smartphone. Therefore, the participants were asked to use their laptop/desktop for the Zoom call and the voice recording procedure.

The instruction sheet on how to record the conversation on their device was sent to the participants via email before the Zoom call. The participants were also strongly advised to make the call in a quiet place with a good internet connection. Once the video connection was established, the researcher ensured that the participants had started the recording before beginning the task. To prevent sound interruptions from the researcher's end in the recorded audio file, the researcher would mute their microphone in Zoom when the participants were speaking. Upon completing the task, the researcher instructed the participants to stop the recording, made sure the audio file was downloaded on the participant's device, and directed the participant to send the file to the researcher via WeTransfer.

The recording procedure for the Russian-English bilingual participants included two separate sessions: in Russian and English. Bilinguals first had the session in Russian to do the Picture Task and the Dyadic Conversation identical to those assigned to the Russian-speaking monolinguals. Then, they had the session in English to do the Picture Task and the Dyadic Conversation identical to the ones assigned to the English-speaking monolinguals. The two Zoom calls took place on different days or on the same day with at least one hour break between the sessions to minimize inter-language interference and ensure a homogeneous language environment for the speakers (Grosjean, 2001). According to the data collected from the LEAP-Q questionnaires, bilingual speakers interacted with both native English and native Russian speakers in their daily lives. Therefore, with the view to constructing natural linguistic scenarios in which a bilingual person would find themselves in on frequent occasions, Russian was spoken with the native speaker of Russian (Interviewer 1), and English was spoken with the native speaker of British English (Interviewer 2).

The duration of the task, including both the Picture Task and the Dyadic Conversation, was 4.65 minutes on average (max = 10.43 minutes, min = 1.36 minutes, standard deviation 1.67 minutes). For the duration details per speaker group, see Table 9.

Table 9
Duration of the task grouped by language background (monolingual; bilingual) and language spoken (Russian; English) in minutes

Background/Language	Mean	Std. Deviation	Maximum	Minimum
Monolingual/Russian	4.07	1.08	6.38	3.07
Monolingual/English	3.87	1.38	5.5	1.36
Bilingual/ Russian	5.27	1.64	8.22	3.01
Bilingual /English	5.31	2.13	10.43	3.22

3.3 Data analysis

3.3.1 Speech material

The recordings were manually divided into utterances using PRAAT (Boersma & Weenink, 2021). The recorded speech data was composed of 1131 utterances. However, not all the utterances extracted from the recordings were chosen for the acoustic analysis. During the speaking task in Russian, Russian-English bilingual speakers occasionally used words from English. Therefore, the excerpts in Russian that contained English words were not analyzed. The selected bulk of analyzable excerpts contained no background noise, non-vocalized sounds (e.g., laughter, coughing), long pauses, and simultaneous speaking. In addition to that, the study also avoided utterances with speech disfluencies such as filler sounds, word cutoffs, self-corrections, and repetitions. Based on the results delivered by Shriberg (1999), disfluencies may affect various aspects of speech on the phonetic level. For instance, most of the disfluency markers are related to error repair, which manifests in word cutoffs in spontaneous speech. Cutoff points signal detection of an error by the speaker and precede the repair, often causing laryngealization (creaky voice). Laryngealized parts of speech result in F0 dips and amplitude drops based on Gerfen and Baker (2005). To avoid instances of speech distortion caused by speech disfluencies (filler sounds, word cutoffs, self-corrections, repetitions, restarts), the excerpts containing those were not included in the analyzable set of utterances. Thus, 127 utterances (11.2% of all utterances) were excluded. The analyzable corpus included 1004 utterances (mean = 25.13; max = 39; min = 6; standard deviation 6.79 utterances). For the number of utterances per speaker group, see Table 10.

Table 10
The number of utterances per speaker group grouped by language (Russian; English) and background (monolingual; bilingual)

Background/Language	Mean	Std. Deviation	Maximum	Minimum
Monolingual/Russian	27.2	5.87	37	20
Monolingual/English	19.11	6.66	29	6
Bilingual/ Russian	28.3	6.86	39	15
Bilingual /English	25.3	4.66	32	20

Ladd and Johnson (1987) suggested that pitch range may be positively related to the length of an utterance. Thus, only utterances of comparable length were chosen for the analysis. The average mean of utterance duration was 1.87 seconds (max = 7.32 seconds, min = 0.72 seconds, standard deviation 1.02 seconds), and the word and the syllable count for each utterance group are represented in Table 11.

Table 11
The total number of words and syllables of the analyzable corpus of utterances grouped by language background (monolingual; bilingual) and language spoken (Russian; English)

Background/Language	Russian		English	
Monolingual	Words	Syllables	Words	Syllables
	1741	2437	1523	2152
Bilingual	Words	Syllables	Words	Syllables
	2252	3152	1899	2748

3.3.2 Impressionistic analysis

Before the acoustic values were instrumentally measured, impressionistic analysis of bilinguals' Russian speech was performed by 13 Russian monolinguals. The monolingual speakers acted as raters of nativelikeness of the Russian speech of bilingual speakers. Since most of the bilingual speakers came from the Central Federal District, it was assumed that they acquired the Central Russian dialect. Therefore, it was decided to recruit the raters from Moscow and the Moscow district where the Central Russian dialect is spoken to decrease the chance of false judgments based on dialectal differences. Therefore, the Central Russian dialect was established as the point of reference for the impressionistic analysis. The raters were to rate 30 short audio excerpts (three excerpts per speaker) randomly chosen from the bulk of analyzable utterances extracted from the recordings of the bilingual speakers. The raters used Qualtrics (https://www.qualtrics.com) for rating the audio excerpts. Before the rating procedure, the raters were strongly recommended to use headphones and stay in a quiet place to eliminate background noise that could affect the raters' judgment. For the impressionistic analysis, the raters were to indicate how "native" the participants sound in Russian, their native language, on a 9-point Likert scale where (0) is No Foreign Accent and (8) is Very Strong Foreign Accent. The raters were allowed to replay each of the excerpts an indefinite number of times before they rated them.

Trofimovich et al. (2017) discovered that the listeners' accent ratings are correlated with intonation errors and the F0 range. According to the results, more foreign-accented speech is associated with more intonation errors and a wider F0 range. Although Trofimovich inspected accentedness in the non-native speech of L2 learners and not speakers' L1, the study yielded significant evidence for the link between the acoustic characteristics of the speech and speech ratings. McCullough (2013) reported similar results, according to which VOT, F1 frequency, and F2 frequency correlate with the perceived foreign accent of native English speakers in their L1. In light of the above-discussed research findings, the impressionistic analysis results were predicted to corroborate Hypothesis 4, according to which bilingual speakers are expected to produce lower pitch values than Russian monolinguals.

To avoid confirmation bias, the description of the procedure did not mention the subjects' linguistic background and referred to the subjects as "Russian speakers." Had the description mentioned that the audio excerpts were produced by the Russian immigrants living in the UK, the raters may have assumed that the subjects' speech was accented a priori. Nevertheless, when analyzing the results of an impressionistic analysis, it is important to keep in mind that raters' validity of judgment may be affected by their own beliefs, expectations, and opinions about the topic of the study. Therefore, the impressionistic analysis of the present study was not spared possible construct-irrelevant variance caused by raters' personal convictions (Bogorevich, 2018).

The Mann-Whitney U test was performed to inspect possible differences in pitch values between the speakers with the most and the least perceived foreign accent. The test was performed using JASP (version 0.14.1, JASP Team, 2020). The results of the impressionistic analysis and the Mann-Whitney U test are presented in *Results* (section 4.1).

3.3.3 Acoustic analysis

3.3.3.1 Measurements

The study extracted and analyzed five parameters of pitch: (1) mean pitch, (2) pitch variability, (3) pitch range, (4) pitch maximum, and (4) pitch minimum. Although the differences in pitch values between males and females were predicted (Daly & Warren, 2001), the study also focused on possible interactions between sex and mean pitch values.

Mean pitch is a measurement frequently examined in acoustic research in order to see how high or low the average pitch is in the speech of a particular group of speakers.

Pitch variability is the frequency of pitch excursions rather than their extent, i.e., whether people have frequent rises and falls in pitch, rather than how large the rises and falls are. Pitch variability is usually measured in two ways: (1) F0 normalized standard deviation (SD) or (2) SD/ F0 mean. Many research projects (Castro et al., 2010; Elbert & Dijkstra, 2014; Hirschberg & Rosenberg, 2005) measured pitch variability using F0 standard deviation. However, according to Pisanski et al. (2018), the second way (SD/M) to calculate pitch variability is more representative of perceptual F0 salience as it controls for the nonlinearity of pitch perception. In addition, standard deviation reflects the number of pitch excursions, whereas SD/F0 mean shows how quickly these excursions are made (Henton, 1995). Therefore, pitch variability was measured by standard deviation divided by the mean across an utterance.

Pitch range has always been determined contextually depending on the field and nature of research (Patterson & Ladd, 1999). According to the definition of Mennen et al. (2014), "pitch range refers to the variation in F0 values that are used in speech" (Mennen et al., 2014, pp. 304-305). Patterson and Ladd (1999) suggest that pitch range should be characterized by using the terms of pitch level (overall pitch height) and pitch span (difference between pitch maximum and pitch minimum). However, other studies define pitch range as simply the difference between pitch maximum and pitch minimum. (Benders et al., 2021; Bonneh et al., 2011; Fernald et al., 1989). Similarly, pitch range was defined as the difference between pitch maximum and pitch minimum of an utterance for the present study.

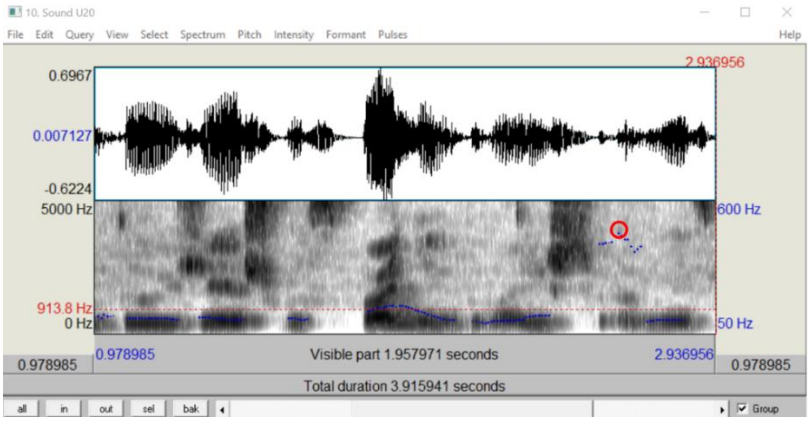
Sometimes, mean **pitch maximum** and **pitch minimum** may differ between speaker groups even when the pitch range is the same. Therefore, the pitch minimum and maximum were analyzed separately to fully capture the acoustic patterns of pitch use between the speaker groups. Figure 3 shows how pitch maximum and pitch minimum are located in a speech sample opened as a Sound Object in PRAAT.

ERB was the choice for the pitch scale in the present study. All pitch values were obtained in Hz and then converted to ERB using the formula in (1) below (Glasberg & Moore, 1990).

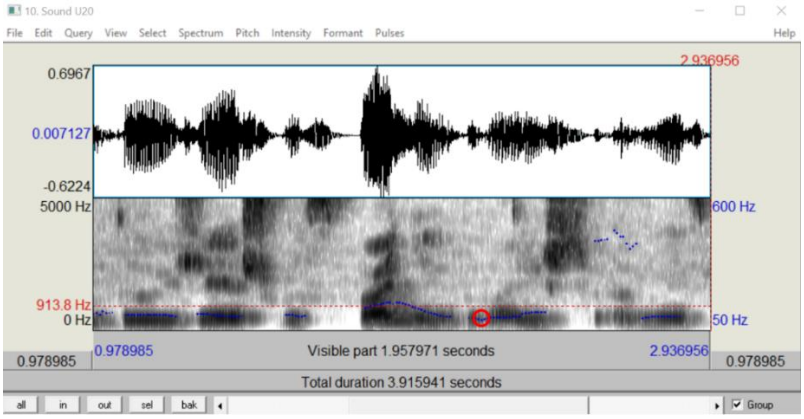
(1) $21.4 * \log10(0.00437 * f + 1)$, where f is Hertz.

Figure 3
Points of (a) pitch maximum and (b) pitch minimum (circled in red) of a speech sample opened in PRAAT

(a)



(b)



3.3.3.2 Pitch extraction and inspection

Before measurements were obtained, the pitch tracks were examined in PRAAT to ensure they were in good order. This was important as the data were obtained remotely. The inspection showed that some of the recordings exhibited extremely high pitch values (above 500-550 Hz) that could not be explained by pitch doubling (the doubling of the F0 value due to an algorithm error). Nothing audible was detected in the regions. The outliers were removed from all analyzable utterances before the collection of the values. The extreme values were manually selected and unvoiced from the audio files opened as Pitch Objects in PRAAT. Figure 4 presents an exemplary audio file before and after the removal of the outliers.

After correcting the audio excerpts, the pitch values were extracted from the *Pitch Info* window queried in the *Query* menu for each audio excerpt opened as Pitch objects in PRAAT. The search range was set to 75– 600 Hz. An example of a Pitch Info window with relevant pitch values is presented in Figure 5.

The pitch values for each of the 1004 utterances were extracted in Hz and arranged in an Excel file. After that, the values were converted into ERB using the formula (see above). As the number of utterances per recording varied greatly, the study calculated the averages for each of the five pitch measurements across all utterances per recording to provide comparability. As the calculation of the pitch variability commonly produces low values, the obtained values were multiplied by 1000 to make them more comprehensible.

Figure 4

An audio file opened as a Pitch Object in PRAAT (a) before and (a) after removal of the extreme pitch values

(a)

(b)

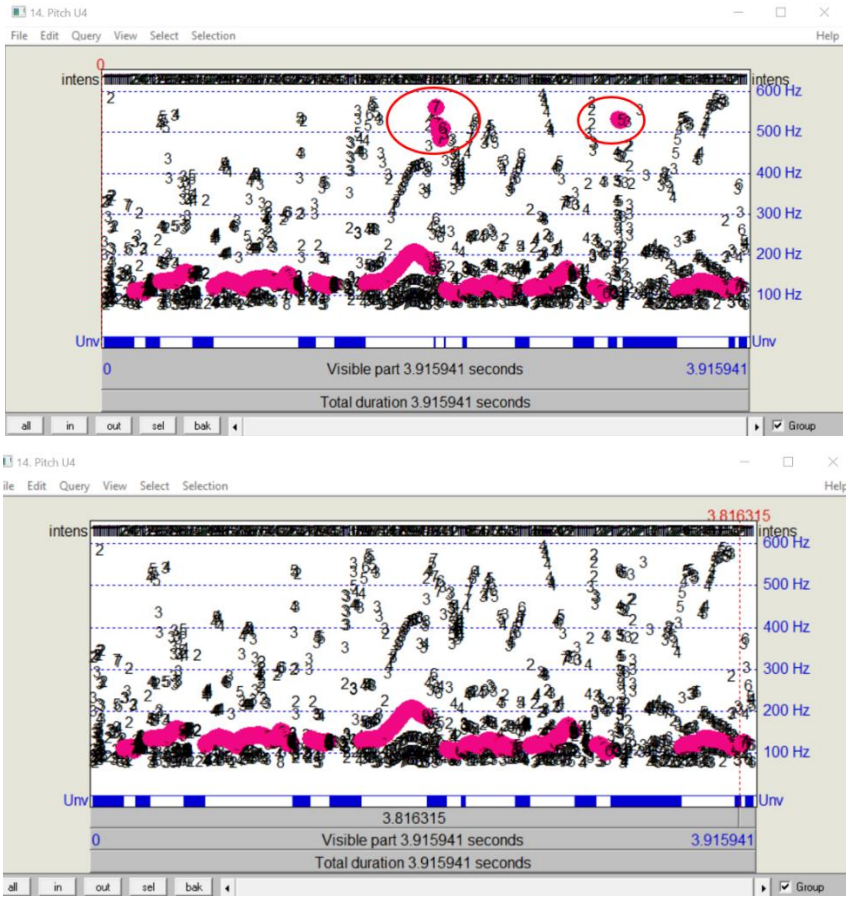
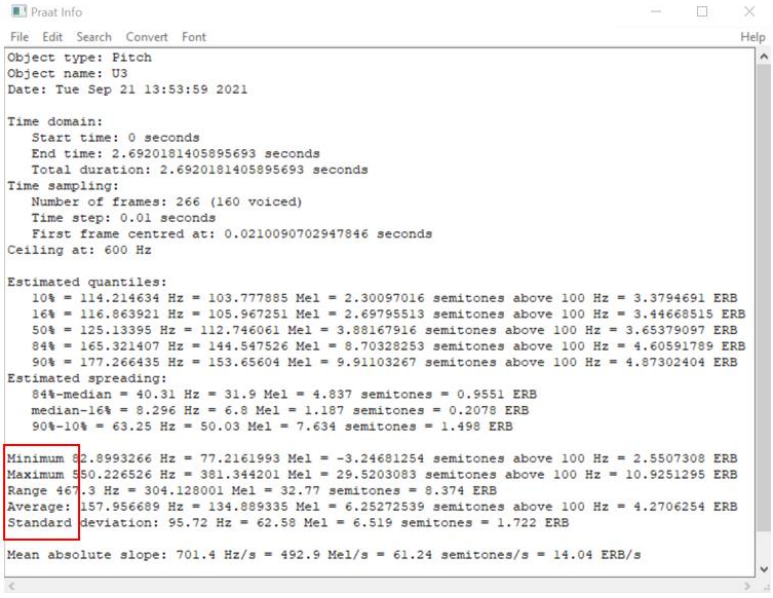


Figure 5

Pitch Info window with acoustic information



3.3.4 Statistical analysis

The experiment represents a between-subjects and a within-subjects design for comparisons between three groups of participants. A between-subjects design is used to compare recordings of (1) Russian monolinguals, (2) English monolinguals, and (3) Russian-English bilinguals. A within-subjects design was used to examine differences between English and Russian recordings of the bilinguals. The five continuous dependent variables included: (1) mean pitch, (2) pitch variability, (3) pitch range, (4) pitch maximum, and (5) pitch minimum. The independent variables were dichotomous: language spoken (Russian; English), language background (bilinguals; monolinguals), and sex (male; female). The data were analyzed using JASP. Four separate tests were performed between the three groups: (1) Russian monolinguals, (2) English monolinguals, and (3) Russian-English bilinguals. A repeated-measures Analysis of Variance (ANOVA) was used to compare Russian and English speech of the bilingual speakers (within-subjects), and one-way ANOVA was used to examine the differences between the following groups of speakers (between-subjects):

1. Russian monolingual speakers vs. English monolingual speakers;
2. Russian-English bilingual speakers (English) vs. English monolingual speakers;
3. Russian-English bilingual speakers (Russian) vs. Russian monolingual speakers.

Another possible choice for statistical analysis was to use the Linear Mixed Effects model that would have allowed to run one test with the speaker variable set as a random factor. The Linear Mixed Effects model would have allowed separating the language from the participant group. However, running four separate ANOVA tests was decided to be more suitable for the analysis because it allowed to discriminate between within-subjects and between-subjects comparisons. Therefore, the option of using the Linear Mixed Effects model was rejected, and running four separate tests was chosen for the statistical analysis.

4. Results

4.1 Impressionistic analysis

The speakers were rated on a scale from (0) to (8), where (0) corresponds to No Foreign Accent and (8) refers to Very Strong Foreign Accent. The results of the impressionistic ratings are presented in Table 12. According to the mean, median, and mode, the highest scores (the most foreign accent) were assigned to Speakers 3, 7, and 9, and the lowest scores to Speakers 4, 5, 6, and 8.

Table 12
Mean, median, and mode of the impressionistic analysis results

	Mean	Standard Deviation	Mode	Median
Speaker 1	0.58	1.93	0	1
Speaker 2	1.5	1.72	0	1
Speaker 3	2.14	1.74	1	2
Speaker 4	0.67	1.17	0	0
Speaker 5	0.92	1.4	0	0
Speaker 6	0.69	1.55	0	0
Speaker 7	2.11	1.75	2	2
Speaker 8	0.56	1.08	0	0
Speaker 9	2.33	2.18	0	2
Speaker 10	1.28	1.47	0	1

The Mann-Whitney U test inspected possible differences between the speakers with the most foreign accent (Speakers 3, 7, and 9) and the least foreign accent (4, 5, 6, and 8) across the pitch variables (mean pitch, pitch variability, pitch max, pitch min, and pitch range). The test showed no significant difference in the mean pitch values between the speakers (for results, see Table 13).

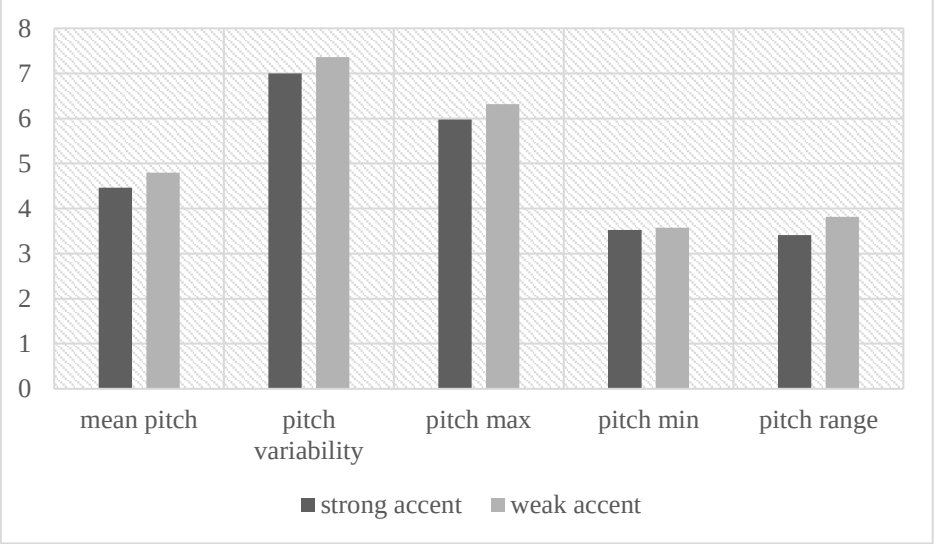
Table 13
Results of the Mann-Whitney U test for pitch differences between the speakers with the most and the least perceived foreign accent

Variables	W	*p*	Effect size
Mean pitch	4.000	0.629	-0.333
Pitch variability	4.000	0.629	-0.333
Pitch range	5.000	0.857	-0.167
Pitch maximum	5.000	0.857	-0.167
Pitch minimum	6.000	1.000	0.000

Although the Mann-Whitney U test did not show significant differences between the speakers with the most and the least perceived foreign accent, Figure 6 shows a common trend across the

variables. It is noticeable that the speakers with a strong perceived foreign accent have lower pitch values in their speech compared to the speakers with a weak foreign accent.

Figure 6
Mean ERB values of bilingual speakers with the highest and the lowest perceived foreign accent

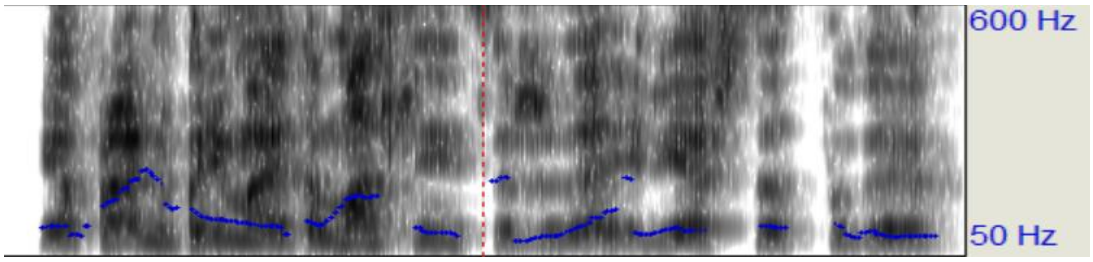


As mentioned before, high scores may have been caused by other speech alterations, e.g., incorrect sound articulation. Below, the author of the present study describes the excerpts for non-native speech characteristics in the speech of the bilinguals. The most frequently detected deviations from standard Russian across the excerpts included in the impressionistic analysis are listed below:

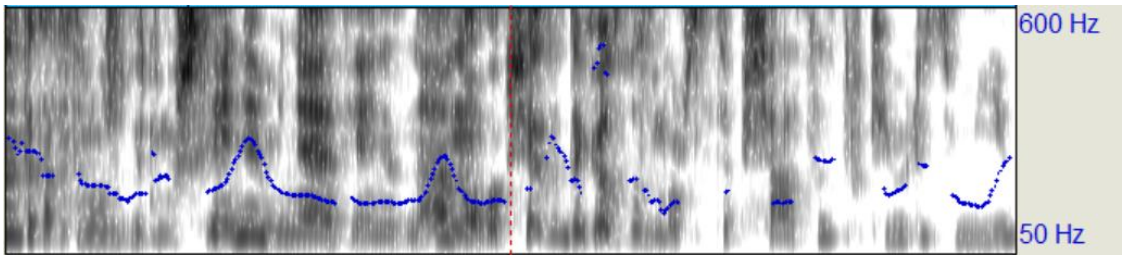
1. Several speakers aspirated the voiceless stops /p/, /t/, /k/ in their Russian speech, similar to how they are aspirated in English. However, the sounds /p/, /t/, /k/ are not aspirated in Russian according to the standard pronunciation (Bashirnezhad & Gapanchi, 2017).
2. Consonant like /t/, d/, /n/, and /l/ are dental in Russian, meaning that the tongue touches the back of the teeth, whereas in English, they are alveolar (the tongue touches the roof of the mouth). Several speakers articulated the /t/, d/, /n/, and /l/ sounds as they are in English, making them alveolar (Bashirnezhad & Gapanchi, 2017).
3. The sound /r/ was sometimes not articulated as the Russian alveolar rolled sound /r/. Instead, /r/ sounded softer, similar to the post-alveolar sonorant /r/, like in English (Sokolova, 1997).
4. The Russian /h/ is much stronger compared to English. The /h/ sound was sometimes not articulated with enough friction and was rather similar to the English /h/, which is produced by a short gasp of breath (Sokolova, 1997).
5. The last point to be mentioned is unusually “lively” intonation in specific excerpts. Some of the utterances sounded too animated and dynamic, causing a foreign accent effect. The reason for this may lie in interference of the intonational contours from English. According to Leed (1965), Russian and English intonational contours differ across sentence types. Therefore, the habit of using English intonation patterns may have manifested itself in participants’ Russian speech. Figure 7 provides examples of two similar utterances produced by a monolingual female Russian speaker and a bilingual female Russian-English speaker. The phenomenon of liveliness can be associated with the more various pitch behavior in utterance (b).

Figure 7
Pitch behavior in the speech of female monolingual and bilingual Russian speakers. Utterance (a) shows the speech of a female monolingual speaker. Utterances (b) shows the speech of a female bilingual speaker.

(a)



(b)



4.2 Statistical analysis

The statistical analysis included four separate tests to inspect the differences in pitch values between the three groups of speakers. The four tests concerned the following pair-wise comparisons:

1. Russian monolinguals vs. English monolinguals
2. Russian-English bilinguals (English vs. Russian speech)
3. English monolinguals vs. Russian-English bilinguals (English)
4. Russian monolinguals vs. Russian-English bilinguals (Russian)

The four tests examined the dependent pitch variables (mean pitch, pitch variability, pitch range, pitch max, and pitch min) in ERB using one-way ANOVA to detect between-subjects differences and ANOVA repeated measures for within-subjects differences. The study also examined the possible relationship between the mean pitch values and sex.

4.2.1 Russian monolinguals vs. English monolinguals

A one-way ANOVA test was used to reveal between-subject differences in Russian and English monolinguals (see results in Table 14). The fixed factors were *language* (Russian; English) and *sex* (male; female). Figure 8 presents mean ERB values of the five dependent variables of Russian and English monolingual speakers. Russian monolingual speakers exhibited higher ERB values in pitch maximum ($F_{1, 15} = 5.216$, $p < 0.05$, $\eta 2 = 0.054$) and pitch range ($F_{1, 15} = 4.579$, $p < 0.05$, $\eta 2 = 0.086$) partially confirming Hypothesis 1. The test showed expected differences between males and females across all the variables (apart from pitch variability). No significant interaction of sex and language was found.

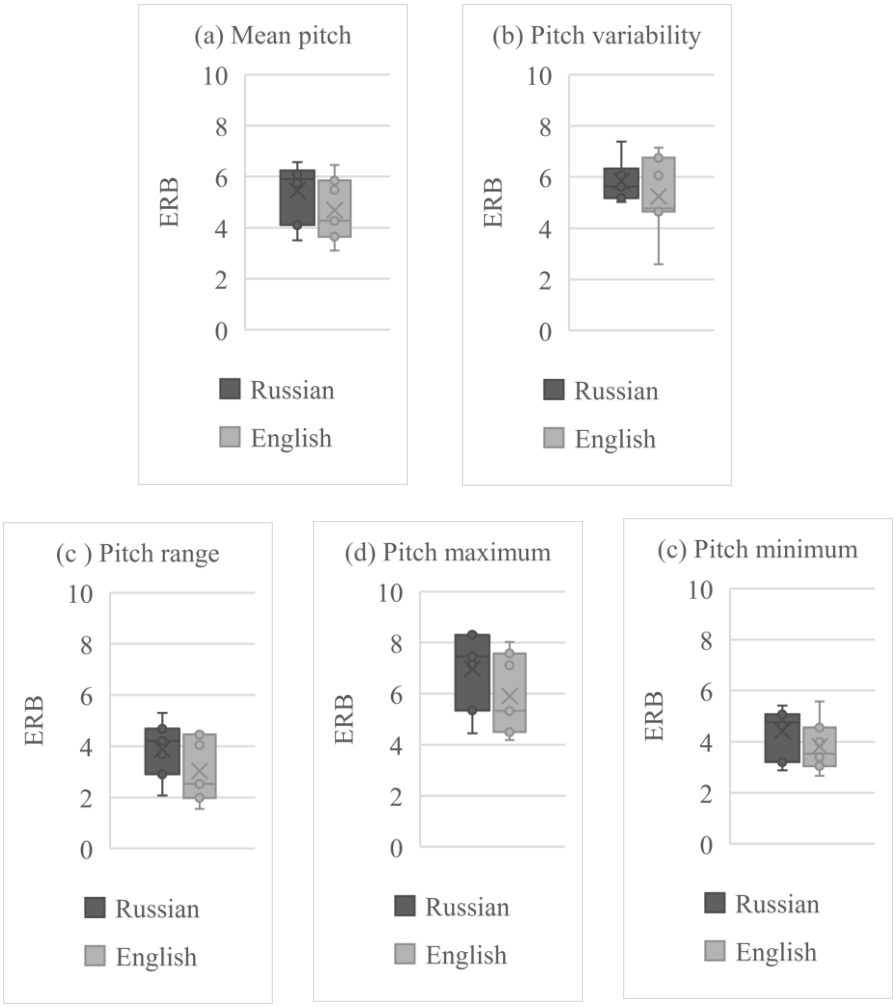
4.2.2 Russian-English bilinguals (Russian vs. English)

An ANOVA repeated measures test was used to reveal within-subject differences in bilinguals' speech (see results in Table 15). The within-subject factor was *language* (Russian; English), and the between-subject factor was *sex* (male; female). Figure 9 shows mean ERB values for the five dependent pitch variables between two sets of bilingual speakers' recordings (Russian;

Table 14
ANOVA results for Russian and English monolingual speakers

Variables	Sum of Squares	df	Mean Square	F	*p*	*η2*
Mean pitch	0.449	1	0.449	2.842	0.113	0.020
Pitch variability	4.729	1	4.729	2.615	0.127	0.123
Pitch range	1.772	1	1.772	4.579	**0.049***	0.086
Pitch maximum	1.894	1	1.894	5.216	**0.037***	0.054
Pitch minimum	0.254	1	0.254	1.374	0.259	0.017

Figure 8
Mean ERB values for dependent variables in Russian and English monolingual speakers

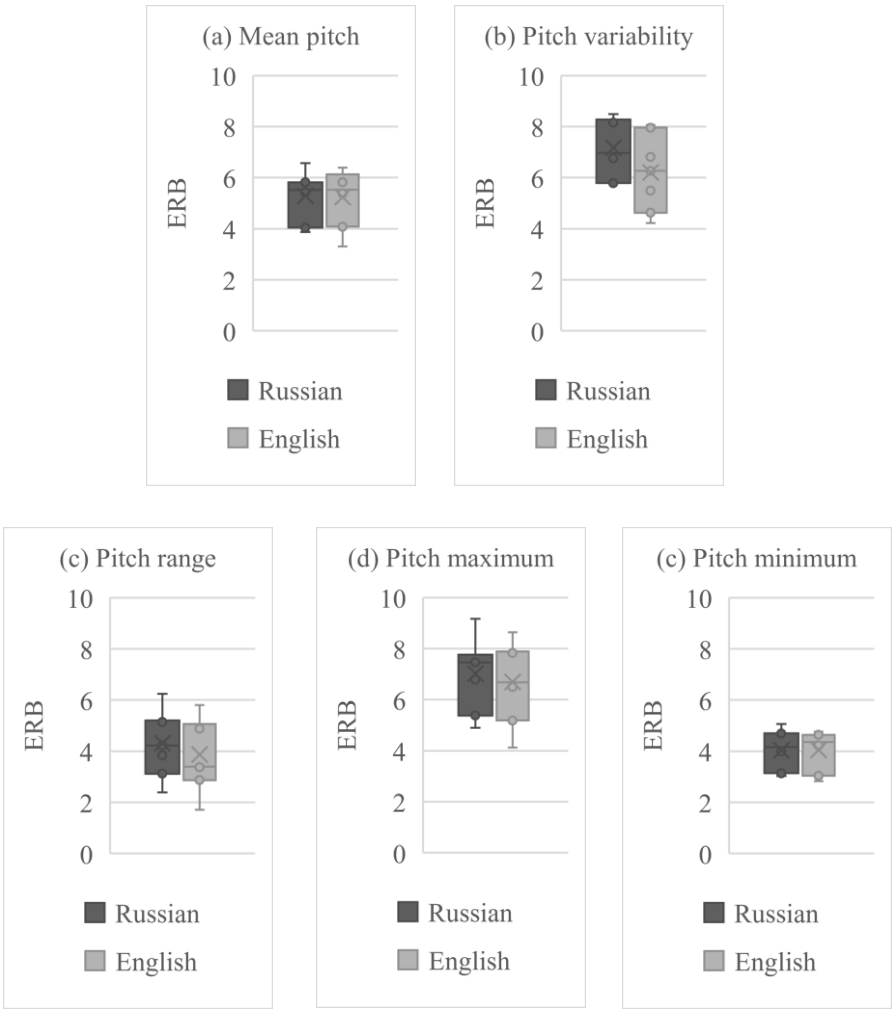


English). The y-axis displays pitch values in ERB, and the x-axis displays the language: Russian and English. The results display a common trend across three pitch values where Russian speech scores significantly higher than English speech of the bilinguals in regard to pitch maximum ($F_{1,8}$ = 8.138, $p < 0.05$, $\eta 2$ = 0.016), pitch variability ($F_{1,8}$ = 26.010, $p < 0.001$, $\eta 2$ = 0.137), and pitch range ($F_{1,8}$ = 23.610, $p < 0.01$, $\eta 2$ = 0.036), partially confirming Hypothesis 2. The test showed an expected significant difference in sex across all mean values (apart from pitch variability) but revealed no significant interaction of sex and language.

Table 15
ANOVA results for Russian and English speech of bilingual speakers

Variables	Sum of Squares	df	Mean Square	F	*p*	*η2*
Mean pitch	0.045	1	0.045	0.731	0.417	0.002
Pitch variability	6.371	1	6.371	26.010	< **0.001***	0.137
Pitch range	1.003	1	1.003	23.610	**0.001***	0.036
Pitch maximum	0.612	1	0.612	8.138	**0.021***	0.016
Pitch minimum	6.311e -4	1	6.311e -4	0.008	0.933	4.691e -5

Figure 9
Mean ERB values for dependent variables in Russian and English speech of bilingual speakers



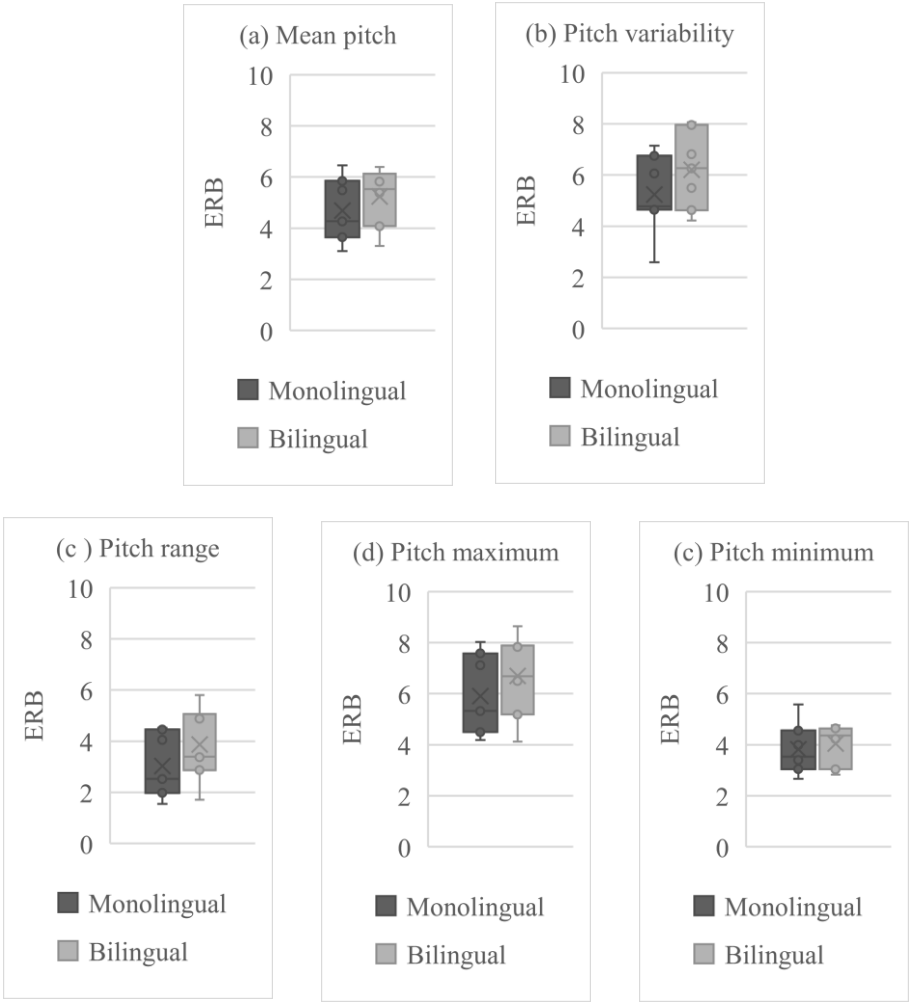
4.2.3 English monolinguals vs. Russian-English bilinguals (English)

Figure 10 shows the mean ERB values of the five dependent variables in the English speech of Russian-English bilinguals and English monolinguals (see results in Table 16). The fixed factors were *background* (monolingual; bilingual) and *sex* (male; female). Although the plots displayed a common trend across all dependent variables, there was no significant effect. The

Table 16
ANOVA results for English speech of English monolinguals and Russian-English bilinguals

Variables	Sum of Squares	df	Mean Square	F	*p*	*η2*
Mean pitch	0.006	1	0.006	0.036	0.853	2.772e -4
Pitch variability	3.550	1	3.550	1.610	0.220	0.086
Pitch range	0.637	1	0.637	1.137	0.303	0.025
Pitch maximum	0.150	1	0.150	0.351	0.562	0.004
Pitch minimum	0.073	1	0.073	0.439	0.518	0.006

Figure 10
Mean ERB values for dependent variables in English speech of English monolinguals and Russian-English bilinguals



test showed expected significant differences in sex across all mean values (apart from pitch variability). However, no relationship between sex and background was found.

4.2.4 Russian monolinguals vs. Russian-English bilinguals (Russian)

A one-way ANOVA test was used to reveal between-subject differences in Russian and English monolinguals (see results in Table 17). The fixed factors were *background* (monolingual; bilingual) and *sex* (male; female). Figure 11 shows mean ERB values of the five dependent variables in the Russian speech of Russian-English bilinguals and Russian monolinguals. For this comparison pair, only the variable of pitch minimum showed statistical significance ($F_{1, 16}$ = 4.491, p = 0.05, $\eta 2$ = 0.036), showing a higher pitch minimum in Russian monolingual speakers. Although Figure 11 shows common trends between the pitch range and pitch variability, the effect was not significant. The test showed expected significant differences in sex across all mean values (apart from pitch variability). The test revealed no relationship between background and sex.

Table 17
ANOVA results for Russian-English bilinguals (Russian) vs. Russian monolinguals

Variables	Sum of Squares	df	Mean Square	F	*p*	*η2*
Mean pitch	0.152	1	0.152	1.284	0.274	0.007
Pitch variability	4.964	1	4.964	2.328	0.147	0.121
Pitch range	0.210	1	0.210	0.314	0.583	0.010
Pitch maximum	0.051	1	0.051	0.117	0.736	0.002
Pitch minimum	0.583	1	0.583	4.491	**0.050***	0.036

Figure 11
Mean ERB values for dependent variables in the Russian speech of Russian monolinguals and Russian-English bilinguals

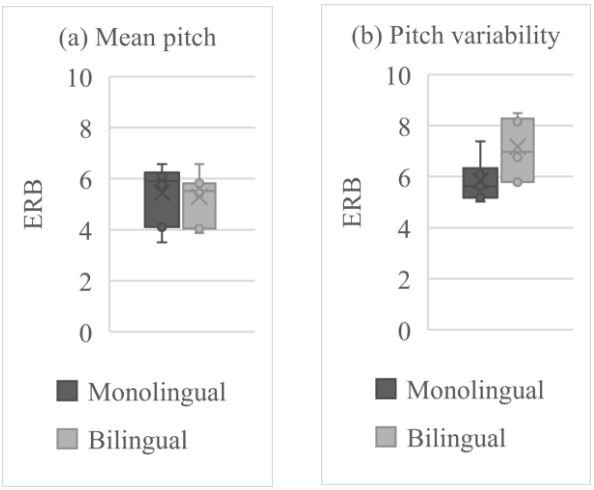
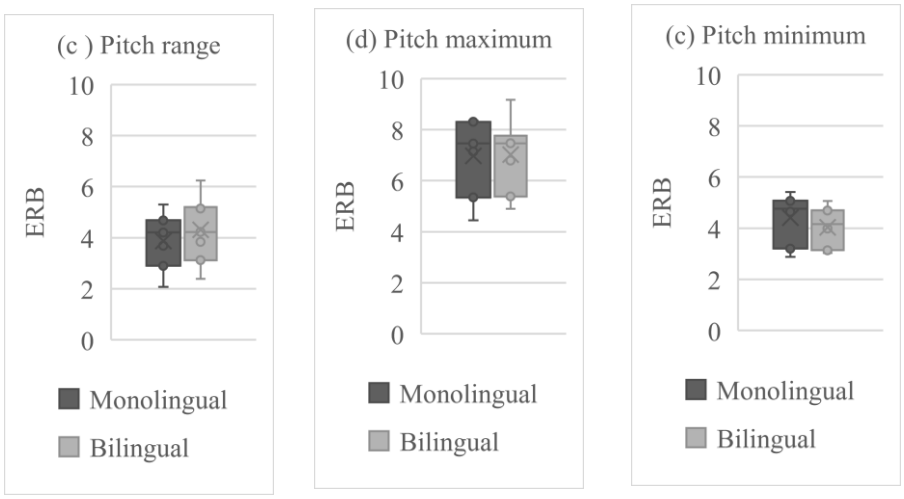


Figure 11 (continued)



4.3. Summary

Impressionistic analysis of the Russian speech of the Russian-English bilinguals to indicate the degree of the foreign accent showed heterogeneous results. According to the ratings, only Speakers 3, 7, and 9 consistently scored high on foreign accentedness, whereas Speakers 4, 5, 6, and 8 scored reasonably low. The Mann-Whitney U test was run for possible differences in the pitch values between the speakers scoring the highest and the lowest showed but it showed no significance.

As for the statistical analysis, the results showed significant results confirming Hypotheses 1, 2, and 3. Hypothesis 4 showed partially significant results that may be interpreted as evidence of pitch interference in bilinguals' L1. All in all, the results support the following conclusions:

1. The speech of Russian monolinguals has a higher pitch maximum and a wider pitch range than the speech of English monolinguals (Hypothesis 1).
2. The Russian speech of the bilinguals showed higher pitch variability, higher pitch maximum, and a wider pitch range than their English speech (Hypothesis 2).
3. No difference was found between the English speech of Russian-English bilinguals and English monolinguals (Hypothesis 3).
4. Monolingual Russian speakers exhibited a higher pitch minimum compared to the Russian speech of bilingual speakers (Hypothesis 4).

The results showed expected sex-related differences across all variables (apart from pitch variability), but no relationship was found between speakers' sex and background (monolingual; bilingual) or language (Russian; English).

5. Discussion

The present study aimed to investigate the patterns of pitch use by Russian native speakers of British English in an immigrant setting. Three groups of speakers were compared: (1) Russian monolinguals, (2) English monolinguals, and (3) Russian-English bilinguals. First, an impressionistic analysis for perceived foreign accent in the Russian speech of bilinguals was conducted. Second, the recorded speech of the three groups was analyzed for the use of pitch in ERB (dependent variables: mean pitch, pitch variability, pitch range, pitch maximum, pitch minimum). The general prediction of the study was that the Russian-English bilinguals use pitch differently from Russian monolinguals because of second language interference caused by their prolonged stay in an L2 environment and high amount of L2 contact. The chapter first discusses and interprets the results of the impressionistic analysis. Second, the results of the statistical analysis are analyzed regarding the four hypotheses. Lastly, the limitations of the study are acknowledged.

5.1 Impressionistic analysis

The speech of Russian-English bilinguals was analyzed for perceived foreign accent by 13 Russian monolingual speakers. Out of 10 speakers that were rated, only three speakers received fairly high scores (strong foreign accent), and four speakers received fairly low scores (weak foreign accent). The Mann-Whitney U test was performed to compare the speakers with the most and the least perceived foreign accent to investigate a possible relationship between the ratings and the pitch values. Although the test showed no significant difference between the speakers with the strongest and the weakest perceived foreign accent, Figure 6 (section 4.1) exhibits a common trend across all pitch variables. Figure 6 shows that the speakers rated high on foreign accentedness have a lower mean pitch, pitch variability, pitch maximum, pitch minimum, and a narrower pitch range. The discrepancy in pitch values between the two groups can be explained by assuming that bilingual speakers rated higher on perceived foreign accent showed more interference from their L2. It has been established by the results that Russian has higher pitch values and a wider pitch range than English. Thus, interference from English is expected to manifest in lower pitch values when participants speak Russian. Accordingly, the production of lower pitch values in Russian, which is supposedly caused by L2 interference, is expected to make bilingual speakers sound less native. However, other prosodic features could have also influenced the accent ratings.

As described in section 3.1, some of the excerpts presented in the impressionistic analysis sound more dynamic and lively compared to the standard Russian pronunciation. Speech that sounds more varied, animated, and dynamic is usually associated with higher pitch values (Daly & Warren, 2001; Hincks, 2005). Daly and Warren (2001) suggested that pitch range and pitch dynamism (corresponds to pitch variability of the present study) are correlated with speech liveliness. The study examined five male and six female speakers who performed two reading tasks in their native language (New Zealand English). The acoustic analysis confirmed that female speech has higher pitch dynamism and uses a wider pitch range than male speech production. The authors implied the relationship between perceived liveliness and acoustic characteristics by describing the female speech as “more high-pitch, shrill, over-emotional, and swoopy” (Daly & Warren, 2001, p. 85). Another study by Hincks (2005) investigated the relationship between pitch variation (corresponds to pitch variability of the present study) and liveliness of intonation in oral presentations. The author analyzed 18 recordings of oral presentations in technical English delivered by a gender-balanced group of Swedish students. The study analyzed the recordings for pitch variation in order to reveal its

possible correlation with perceived liveliness. Eight university English teachers rated the excerpts from the presentations on an undivided scale with two endpoints of "lively" and "monotone" (Hincks, 2005, p. 581). The ratings showed that pitch variation is positively correlated with the liveliness of the speech. Since bilinguals' Russian speech showed instances of speech liveliness, it should have shown higher pitch variability and a wider pitch range compared to monolinguals' speech based on the studies discussed above (Daly & Warren, 2001; Hincks, 2005). However, it should be borne in mind that the excerpts chosen for the impressionistic analysis exhibited the effect of liveliness only sometimes, and it was primarily found in the speech of bilinguals who scored high on perceived foreign accent. Possibly, the number of instances of unusually lively speech was not enough to influence the pitch values.

5.2 Discussion of the hypotheses

5.2.1 Hypothesis 1

Russian monolingual speakers were shown to have higher pitch values than English monolingual speakers. Specifically, the pitch maximum is significantly higher, and the pitch range is significantly wider in Russian than in English. The results go in line with the findings reported by Andreeva et al. (2014), according to whom Slavic languages have higher pitch values than Germanic languages. Overall, the comparison between monolingual standards of Russian and British English contributes to the empirical record of cross-language differences in pitch range. Apart from that, the findings support the statement that genetically close languages share similar pitch characteristics. In the study by Andreeva et al., Polish and Bulgarian (Slavic languages) were shown to have higher pitch values compared to English and German. Accordingly, Russian, which is also a Slavic language, also displayed higher pitch values compared to English.

5.2.2 Hypotheses 2 and 3

The results regarding Hypotheses 2 and 3 are discussed together because both are related to the patterns of pitch use in L2. As expected, the Russian speech of bilingual speakers yielded higher pitch values compared to their English. The comparison showed that Russian speech is characterized by higher pitch variability, higher pitch maximum, and a wider pitch range than English. Since English uses lower pitch values than Russian (Hypothesis 1), bilingual speakers were expected to lower pitch values in their English to approximate the monolingual English norm. Ullakonoja (2007) and Flege and Eefting (1987) showed that the pitch range of L2 learners becomes more native-like with a higher proficiency level. Therefore, Russian-English bilinguals may have learned to use pitch in their English accordingly to how native speakers of English use it. However, bilingual speakers have been reported to frequently compress their pitch in their L2 regardless of the target language (Mennen, 1998; Zimmerer et al., 2014). Therefore, either of the two or both suggested reasons contributed to the lower pitch production of bilingual speakers in their L2. The comparison of English speech between English monolinguals and Russian-English bilinguals revealed no significant difference in the use of pitch. Even though there is no significant difference in pitch production between English monolingual speakers and the bilingual group, Figure 10 (section 4.2.3) shows that the pitch values are not exactly the same between the two groups. Therefore, bilingual speakers managed to approximate the monolingual English norm in their English, but they did not attain the perfectly native pitch production.

5.2.3 Hypothesis 4

Hypothesis 4 concerns the use of pitch by Russian-English bilingual speakers in Russian compared to Russian monolinguals. The hypothesis can be partially confirmed because bilinguals were shown to have a significantly lower pitch minimum when they speak Russian compared to Russian monolingual speakers. Since bilingual speakers showed lower (and not higher) minimum pitch compared to the monolingual Russian norm, it is unclear if the change was caused by universal patterns of pitch behavior in bilingual speakers (Cantor-Cutiva et al., 2019; Cantor-Cutiva et al., 2021) or if it was predisposed by language-specific pitch characteristics (Scharff-Rethfeldt et al., 2008). Either way, the difference in pitch minimum between the two speaker groups can be explained by interference from their L2. According to the results, bilingual speakers use lower pitch values (pitch variability, pitch maximum, pitch range) in their English compared to Russian. The habit of adjusting the articulatory apparatus in order to match the native English norm may have led to English phonatory inclusions in bilinguals' L1 over time (Scharff-Rethfeldt et al., 2008).

One of such inclusions may appear to be a relatively recent phenomenon in linguistics referred to as vocal fry. Vocal fry (creaky voice or glottalization) refers to "a phonation type characterized by a train of relatively discrete laryngeal excitations (or glottal pulses), with nearly complete vocal tract damping between successive glottal pulses, accompanied by extremely low fundamental frequencies from about 7 to about 78 Hz" (Ishi et al., 2007, p. 47; Kuang & Liberman, 2016). As described by Catford (1964), perceptually, vocal fry sounds like "a rapid series of taps, like a stick being run along a railing" (p. 32).

The use of vocal fry was reported to have increased in different English varieties in the last decade, especially among young women in the United States (Yuasa, 2010). However, Henton (1988) discovered that vocal fry was reported in the 1980' among male British speakers who used vocal fry six times more often than females. A more recent review by Lindsey (2019) states that vocal fry used to be a predominantly male speech feature appearing at the end of utterances in British speakers; however, more and more female speakers of British English adopt the feature of vocal fry as well. The author assumes that the vocal fry trend among young women in the UK came from the United States, where vocal fry is used more extensively. The feature is believed to have originated from media and popular TV shows (Dallaston & Docherty, 2020). Specifically, Kim Kardashian became famous for her "creaky voice," which is perceived to sound sexy (Croffey, 2016). The extensive influence of American media could have ignited the trend for creaky voice across many varieties of English. Apart from American and British English, the increasing tendency to use vocal fry has also been reported in Australian and New Zealand English (Dallaston & Docherty, 2019; Hornibrook et al., 2018). Accordingly, Russian-English bilinguals may have also adopted the feature of vocal fry in their L2, which, over time, started interfering in their native language. If participants' L2 indeed influenced the change in bilinguals' pitch minimum, the results can be considered evidence for phonological interference from L2 in late bilinguals.

There is no concrete acoustic evidence of Russian speakers using the feature of vocal fry in their speech because PRAAT does not reliably report instances of very low frequencies (Dallaston & Docherty, 2019). Additionally, the F0 threshold of vocal fry varies between men and women and may also be speaker-specific (Melvin, 2015). Nevertheless, particular bilingual speakers (specifically those rated higher on perceived foreign accent) showed instances of very low fundamental frequency values in their English and Russian. Figure 12 shows the pitch behavior in two utterances produced by a bilingual female speaker in English and Russian. Both

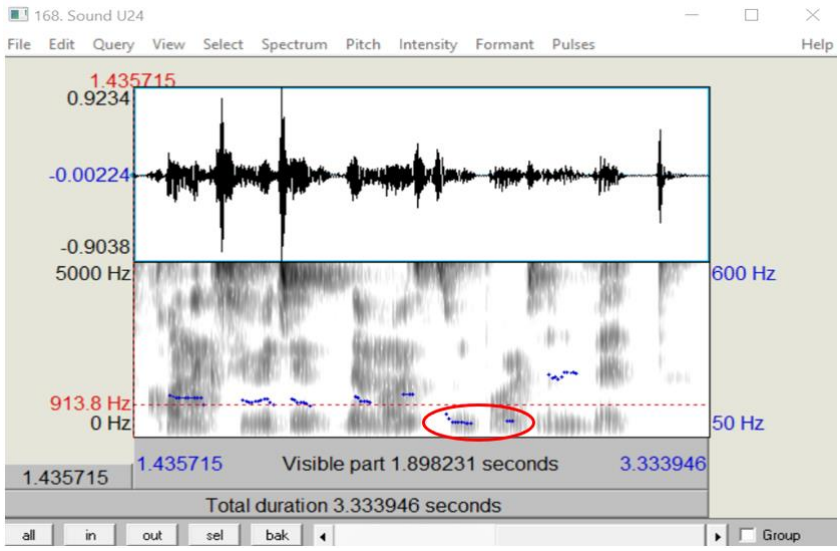
utterances are opened as Sound Object in PRAAT and show occurrences of low fundamental frequency.

Taken together, the dynamic shown in the native speech of bilinguals manifests itself as a separate prosodic system with its own patterns and functionalities, some of which could be caused by intensified L1 characteristics and others by L2 prosodic transfers (de Leeuw et al., 2012). Possibly, specific pitch characteristics transform or alter in a more salient way than others. Even though only one out of five pitch variables was found significantly different between the two speaker groups, the results of the present study contribute to the research in phonological interference and attrition in late bilinguals. As it can be seen from the results, phonological interference in the use of pitch among late bilingual speakers is possible, although it is not extensive.

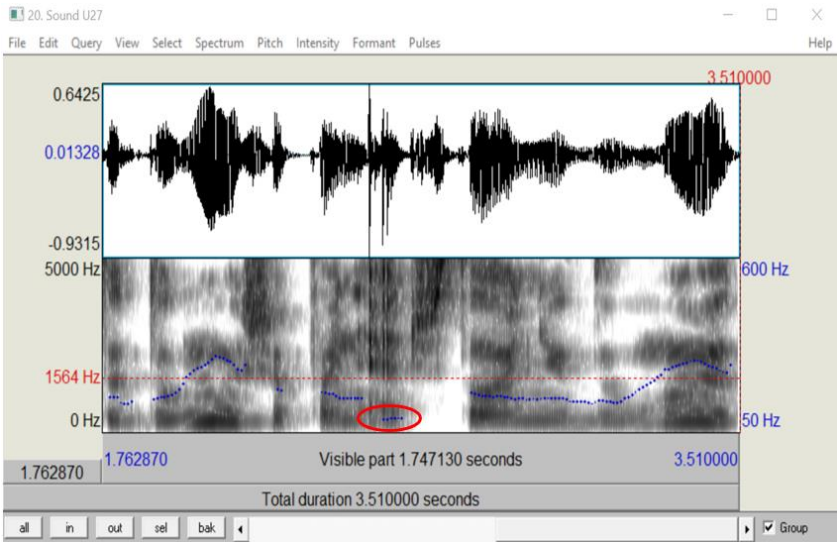
Figure 12

Utterances in English (a) and Russian (b) produced by a bilingual female speaker showing instances of low fundamental frequency.

(a)



(b)



5.2.4 Hypothesis 5

Hypothesis 5 that regards sex differences in the use of pitch was partially confirmed. The study found expected pitch differences across all variables apart from pitch variability. This finding contradicts the results obtained by Daly and Warren (2001), who found that females have higher pitch dynamism (corresponds to pitch variability of the present study) than males. However, the present study results reinforce the conclusion of Henton (1995), who earlier inspected possible differences in pitch dynamism (corresponds to pitch variability of the present study) between men and women and found no significant difference. She suggested that the term "swoopy" is often used to describe female speech more likely roots from sexism rather than actual acoustic characteristics (Austin, 1965, p. 36). Sex-related differences regarding language spoken (Russian; English) and participants' background (monolingual; bilingual) were not found, which means that language-specific sex differences more often than not appear not to be the case.

5.3 Limitations

The present study has certain limitations. The by far most serious limitation is the number of participants. The study compared three groups of speakers with 9-10 participants per group, which may not be enough to reveal significant differences in the inspected pitch variables. The mean values exhibit specific trends across variables shown in Figure 6 (section 4.1) and Figure 11 (section 4.2.4), but the test results yielded no or partial significance effect. Possibly, with a larger participant pool, more results would obtain significance.

Another limitation that concerns impressionistic analysis is the dialectal variety of the native language of the bilingual participants. As established in the description of the impressionistic analysis, the raters were recruited in Moscow or Moscow district since five of the bilingual speakers speak the Central Russian dialect. However, four participants were from the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan. Apart from that, one speaker came from Krasnodarskii Krai, which is in the South of Russia. Although the participants from the Republic of Kalmykia, the Republic of Belarus, and the Republic of Kazakhstan were considered reliable sources for voice data in Russian, it is unknown if the dialectal varieties the mentioned participants speak influenced the ratings.

Another possible limitation of the present study relates to familiarity bias in regard to the speaking task. Before the task, all participants read about the purpose of the study that briefly described the research question. Although the participants may not have been familiar with such terms as pitch and interference, knowing that the study was language-related may have predisposed the participants to speak more carefully or adopt a more formal style (Beebe, 1980; Labov, 1994; Major, 1992).

It is worth mentioning that Russian and English monolingual speakers may not be considered purely monolingual speakers. At present, foreign language education is compulsory in all public schools in the UK as well as in Russia. Therefore, the study cannot exclude possible influences from the foreign language that monolingual speakers had to learn at some point during the years of primary, secondary, or higher education. Apart from that, four Russian-English bilingual speakers indicated regular exposure to a third language. Although the exposure to a third language was negligible (<5%), possible variation of speech data caused by the acquired knowledge of a third language shall be admitted (Mennen et al., 2014).

6. Conclusion

The present research aimed to find evidence of phonological interference and attrition in the use of pitch among late Russian-English bilinguals. This thesis yielded partially significant results showing that late learners experienced linguistic interference from their L2 in the domain of phonetics. According to the results, bilingual Russian-English speakers produced a lower pitch minimum compared to monolingual Russian speakers. Although other variables were not significantly different between the speaker groups, they provided space to discuss potential differences that may reach significance with a greater participants pool. The present research is largely limited in the number of participants that took part in the research, which prompts further studies to investigate the use of pitch in the context of linguistic interference and attrition with more participants. Apart from the topic of language loss, the study contributes to such research areas as (a) language-specific pitch settings, (b) sex differences in cross-language pitch production, (c) listeners' ratings of perceived accentedness, and (d) acquisition of pitch by L2 late learners.

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Appendix A

Information sheet (in English)

Radboud University

INFORMATION ABOUT THE RESEARCH STUDY

Introduction
We would like to invite you to participate in a research study *The Role of L2 Immersion on the Use of Pitch among Russian native speakers of British English*. Participation is voluntary. If you want to participate, we will ask you to sign a consent form. Before you decide whether or not to take part, we will give you information about the study. Please take time to read the following information carefully. If something is not clear, or you would like more information, please ask the researcher.

Outline and aim of the research study
In this research study we want to see if pitch-related values of Russian immigrants are changing under the influence of English when they speak their native language.

What is going to happen to you?
In this research study you will fill in a Language Knowledge and Experience Questionnaire and have a short conversation with the researcher. The conversations will be audio recorded with the help of an online audio recording tool.

Voluntary participation
Your participation in this research is voluntary. This means that you can withdraw your participation and consent at any time during the research, without giving a reason. Even up to two weeks after participating you can have your research data and personal data removed, by sending a request to sedakovam@outlook.com.

What will happen to my data?

Audio recordings will be made during this study. These recordings are used for analyzing acoustic values of the speech. These recordings will be kept on a secure password-protected server to be used for scrutiny of the results by third parties or for reanalysis. These recordings may also be used for the illustration of the results (e.g., conference presentation, supplementary materials of published papers). Researcher will ensure anonymity of the recordings. However, the speakers may be identified by their voice. Any audio clips that include personal information will be removed from the files and will not be shared by others.

Payment
You will be compensated with 4 pounds for your time. The money will be transferred via PayPal.

More information?
If you have any questions or would like more information about the research study, please contact us using the contact information at the bottom of this letter.

Ethical assessment and complaints
Should you have any complaints regarding this research, please contact the researcher.

You can also file a complaint with the secretary of the Ethics Assessment Committee Humanities of Radboud University (etc-gw@ru.nl)

For questions on data processing in this research, please contact: dataofficer@let.ru.nl

Consent form
If you want to participate in this research study, we ask you to sign the consent form (it is available online in the Qualtrics survey). With this written consent, you declare that you have understood the information we have provided and consent to participate in this research study.

Kind regards,

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