

Phonology and Attrition: Sociolinguistics of (Ukrainian) Sound Perception

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Abstract

This article's research question is to explore the role of sociolinguistic factors in combination with phonology-driven perception. The preliminary hypothesis is that sociolinguistic factors like bilingualism and L2 interference (attrition, as in de Leeuw, E., Chang, C. 2023) may have a decisive role in the process of sound perception and is based on the example of English-Czech/Slovak and English-Ukrainian loanword adaptation cases involving the phonemes /g/, /h/, /ɦ/, and /x/: Czech and Slovak speakers adapt [h] as [ɦ] while Ukrainian speakers tend to adapt the same phoneme as [x] despite having /ɦ/ in their phonological inventory. This tendency seems to correlate with phonological attrition (L2 interference of Russian) and has been a topic of active discussions, especially so since the 2022 full-scale Russian invasion of Ukraine.

The research method is based on a questionnaire with audio samples containing both already existing and made-up proper names and words. Half of the test vocabulary units are designed to contain the chosen sounds, the rest of the units are represented by established, already existing, names, and units that do not contain the chosen sounds to provide a cover for the experiment. The respondents are asked to listen to the audio samples and write down the units as they hear them using Ukrainian alphabet. The respondents were provided with a fake description, and a fake goal of the experiment to exclude possible bias.

Keywords: phonetics, phonology, language attrition, language drift, English, Ukrainian, Czech

Streszczenie

Fonologia i atrycja: Socjolingwistyka (ukraińskiej) psychoakustyki

Celem badawczym tego artykułu jest zbadanie roli czynników socjolingwistycznych w połączeniu z percepcją opartą na fonologii. Wstępna hipoteza głosi, że czynniki socjolingwistyczne, takie jak dwujęzyczność i interferencja L2 (atrycja), mogą odgrywać decydującą rolę w procesie percepcji dźwięku i opiera się na przykładzie przypadków adaptacji zapożyczeń angielsko-czesko/słowackich i angielsko-ukraińskich z udziałem fonemów /g/, /h/, /ɦ/ i /x/: użytkownicy języka czeskiego i słowackiego adaptują [h] jako [ɦ], podczas gdy użytkownicy języka ukraińskiego mają tendencję do adoptowania tego samego fonemu jako [x], pomimo posiadania /ɦ/ w swoim zasobie fonologicznym. Wydaje się, że ta tendencja koreluje z atrycją fonologiczną (interferencja języka rosyjskiego jako L2) i była tematem licznych dyskusji, zwłaszcza od czasu rosyjskiej pełnoskalowej inwazji na Ukrainę w 2022 roku.

Metoda badawcza opiera się na kwestionariuszu z próbkami dźwiękowymi zawierającymi zarówno istniejące, jak i wymyślone nazwy własne i słowa. Połowa testowanych jednostek słownictwa ma zawierać wybrane dźwięki, pozostałe jednostki są reprezentowane przez ustalone, już istniejące nazwy, a jednostki, które nie zawierają wybranych dźwięków, pomagają jedynie ukryć cel eksperymentu. Respondenci proszeni są o odsłuchanie próbek audio i zapisanie jednostek tak, jak je słyszą, używając alfabetu ukraińskiego. Przedstawiono im nieprawdziwy opis i cel eksperymentu, aby wykluczyć ewentualne uprzedzenia.

Słowa kluczowe: fonetyka, fonologia, atrycja językowa, dryf językowy, angielski, ukraiński, czeski

1. Introduction

The concept of linguistic interference between L1 and L2 has now been present in linguistics for several decades. Many scholars like Esther de Leeuw, Kevin Tang, Andrew Nevins, Anita Bowles, Charles B. Chang, (de Leeuw, E., & Chang, C., 2023, Pandey, A. & Gogoi, P. & Tang, K., 2020, Stoianov, D. & Almeida da Silva, A. & Nevins, A., 2023, Chang, C. & Bowles, A., 2015) and many others have studied this phenomenon under various circumstances and in multiple language combinations as well as they have established terminological, and research frameworks. While it has already been confirmed that linguistic interference – in sound perception – is usually phonological, some instances suggest that the principles of phonology might be complemented by other factors. One such instance can be observed in the case of the perception and production of phonemes /g/ and /h/ by Ukrainian speakers.

A previous study confirmed that one of the typical features of the Ukrainian accent in English was the realisation of [x] instead of [h] and the occasional pronunciation of [ɦ] instead of [g] (Chybras, 2021). As mentioned before, the now dominant approach states that sound

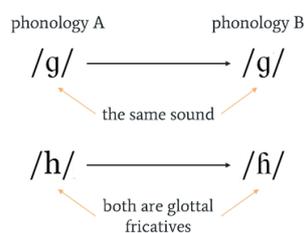


Figure 1. The proposed way of phonology-based adaptation by Chybras, Y.

perception and production in foreign languages are primarily based on phonology rather than phonetics (Chang, 2008).

This approach means that speakers tend to perceive and produce sounds of a foreign language through the prism of the phonological system of their L1. In other words, if a foreign language possesses a sound that is absent in the speaker's L1, that speaker is likely to substitute that sound with the phonetically, and *phonologically*, closest phoneme there is in

their L1's inventory. If then, this principle would be applied to the case of the Ukrainian accent in English, one would realise that there might be more to explore.

The phonology of Ukrainian possesses a phoneme /g/, spelt as <г>, note the little upwards-looking hook, as well as another phoneme – realised as a voiced glottal fricative – /ɦ/, spelt as <г>. Phonetics-wise, this glottal fricative creates a pair with its voiceless counterpart – [h]. That should mean that the most probable way for a Ukrainian speaker to perceive, and then produce, the voiceless glottal fricative of English is to simply make it voiced. Such a case, for instance, can be observed in phonologically similar Czech and Slovak. Both Czech and Slovak have /ɦ/ in their inventories, as well as the speakers of these two languages do as expected, that is, a typical feature of Czech and Slovak accents in English is the perception and realisation of [h] as [ɦ]. However, this pattern does not seem to hold for Ukrainian speakers despite the phonologically similar starting point.

2. Sociolinguistic and historical background

To gain a comprehensive understanding of the subject matter, there is a need to furnish relevant social and sociolinguistic context. The question arises when the conventional tenets of phonology alone are inadequate to explain the problem. Furthermore, it is evident that the issue under consideration is associated with the sounds [g], [h], [ɦ] and [x]. The first sociolinguistic detail is that these four sounds are often the subjects of active discussions about the rules of transliteration, as well as their perception of foreign speech, in the Ukrainian segment on the Internet. This means that the speakers are conscious about their phonetic perception, and phonetic perception of other speakers around them. Currently, there exist two competing traditions of transliteration.

2.1. Historical background

The old tradition traces its roots back to the orthographies of the late 19th century and the beginning of the 20th century. These traditions constitute the basis for the orthography of modern Ukrainian. The new tradition is based on the rules of transliteration of Russian that were to be (forcefully) adopted during the Soviet era. These two traditions utilise contradicting principles in the question of adaptation of foreign /g/ and /h/ phonemes. The OT is based on the phonetic similarities of /g/ and /h/ to the phonemes /g/ and /ɦ/ as the voiced velar plosive /g/ exists in Ukrainian, despite its marginal role in the phonological system, and the voiceless glottal fricative /h/ shares the same place of articulation with the voiced glottal fricative /ɦ/spelt as <г> and <г> respectively. Thus, the OT complies with the established principles of phonology-based

perception. Contrary to that, the Russian-based NT also utilises the expected phonological principles however, the phonology it is based on is Russian. Therefore, the foreign /g/ remains /g/, <г> in the spelling of Russian, and /h/ is phonologically approximated as /x/, the closest phoneme there is in the Russian phonology, spelt as <х>. When this tradition had to be assumed by the Ukrainian language, the rule was to eliminate <г> from Ukrainian orthography as having a *nationalistic and bourgeois* spirit (Народний Комісаріат Освіти УСРР, 1933) [People's Commissariat of Education of the USSR] which resulted in graphically similar forms, e.g., high-tech Rus. *хайтек*, Ukr. *хайтек* [khaitek, khaitek]; hacker Rus. *хакер*, Ukr. *хакер* [khaker, khaker]; Hemingway Rus. *Хемингуэй*, Ukr. *Хемінгуей* [Kheminguei, Kheminhuei] (compare with the OT *Гемінтвей* [Hemingvei])

2.2. Sociolinguistic background

The next sociolinguistic detail that must be mentioned is exposure to Ukrainian-accented Russian and its phonetics and phonology. The latest census surveyed 1000 adults from all the regions of the country, except for the regions under Russian occupation or the regions where Ukrainian mobile communication services were not available. According to it, about 13% of Ukrainians speak Russian at home (Rating Group, 2022). The number used to be higher before the full-scale Russian invasion, e.g., 37% in 2012, and 27% in 2018. Additionally, practically all Ukrainian speakers have been exposed to (Ukrainian-accented) Russian as a result of the *de facto* Russian acceptance policy before the 2017 language quota law, e.g., according to a Deutsche Welle 2017 article about 50-85% of programmes aired on TV were in Russian (*Український Телефір і Російська Мова* [Ukrainian television and the Russian language] – DW – 23.05.2017, n.d.).

The Ukrainian-accented Russian that was mentioned before is a regionally marked variety of Russian spoken in certain, primarily urban, areas in the South and East of Ukraine, as well as it became the basis for the so-called Southern accent of Russian that used to be spoken, and to a certain degree is still spoken today, in the areas with a considerable number of ethnic Ukrainians (*Мови Та Релігії у Повітах Російської Імперії* [Languages and Religions in the Districts of the Russian Empire] – *Datatowel.in.Ua*, n.d.), for example, the Kuban region, the Eastern Sloboda Ukraine, etc. One of the phonetic differences between Standard Russian and Ukrainian-accented Russian is the realisation of the phoneme /g/. In the standard variety, both the phoneme and its main phonetic realisation are [g], while in the Ukrainian-accented variety

the phoneme /g/ is often realised as [h], thus creating an allophonic relationship between [h] and [g]. In his 2008 article, C. Chang mentioned the following:

In the case of sounds. However, there seems to be a “sweet spot” of cross-linguistic acoustic similarity that results in L1 change: enough similarity to an L2 sound is needed to cause the L1 sound to be cognitively linked to, and thus be influenced by the L2 sound, but too much similarity (such that any L1-L2 acoustic disparity is so small as to be unnoticeable) may remove any trigger for L1 change.

(de Leeuw, Chang 2023: 7)

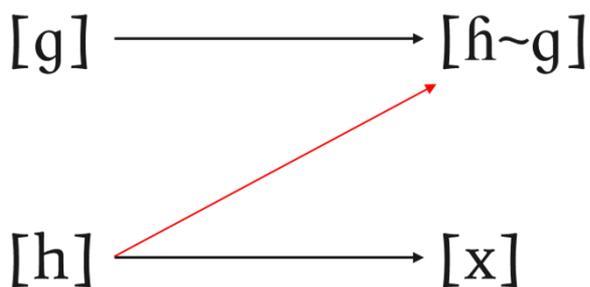


Figure 2 The proposed reason for the [x]-based perception by Chybras, Y. As the result of [g-h] being perceived as a variation of one phoneme, [h] cannot be perceived and/or adapted as [h].

This sweet spot, however, need not be only acoustic. In the case of Ukrainian-accented Russian, it seems plausible that the cause of the cognitive link was numerous cognates belonging to the basic vocabulary. It was, thus, easy to see a link between the two sounds even without any linguistic training, e.g., Rus. гора, город, горб, гром, горло, погода etc., Ukr. гора, город, горб, грім, горло, погода etc.

[mountain, city/yard, bump, thunder, throat, weather]. Exposure to the phonological system of Ukrainian-accented Russian, and possibly being a speaker of Ukrainian-accented Russian, as well as the established rules of loanword adaptation then collide with the phonological system of standard Ukrainian, and some of its regional varieties, thus creating two alternative phonological systems that differ in certain areas, namely the probable one-way variation status of [g] and [h]. The latter will be described in more detail further in the text. However, these two systems are not parallel to each other as they exist in a sort of spectrum. One end of the spectrum is the phonological system of one of the spoken varieties of Ukrainian where [g] and [h] are not allophonic and have no special connection, while the other end of the spectrum is the phonological system with significant phonological interference from Ukrainian-accented Russian where [g] and [h] are allophonic. This then creates a one-way variation pattern in an attrition-affected Ukrainian. One-way variation means that /g/ becomes marginalised in the phonological system of attrition-affected Ukrainian and, thus can be realised as [h], while /h/ cannot be realised as [g]. It is worth mentioning that these two systems differ in more than one feature, i.e., the variation relationship between [g] and [h], but also in several other features that

can be attributed to the phonological interference, for example, the realisation of /ɪ/ as [i̯] or the realisation of final /v/ as [f] instead of [ʋ] and many other. That means that speakers are less likely to be placed on either end of the spectrum, e.g., having a *pure* phonological system, but instead, their phonological systems are more likely to exist somewhere between the two ends exhibiting some features but not necessarily all of them. This sociolinguistic setting is remarkably similar to de Leeuw's and Chang's concepts of drift and attrition.

Table 1. Phonetic and phonemic comparison of /g/ and /ɦ/ in the studied languages

Russian	Attrition-affected Ukrainian	Standard Ukrainian
/g/	[g] is likely to be realised as [ɦ], while /ɦ/ cannot be realised as [g]	/g/
-		/ɦ/
/x/	/x/	/x/

In their conceptualisation, drift describes reversible changes in the speaker's idiolect that emerged as a result of short-term language contact. These changes are mainly phonetic and/or vocabulary. Attrition, then, describes hardly reversible changes in the speaker's idiolect that emerged as a result of long-term language contact. These changes, contrary to drift, tend to be phonological and grammatical (de Leeuw & Chang, 2023). Therefore, *drift* can be applied to the phonological system of Ukrainian which experiences less significant changes. *Attrition* can be applied to the long-term, phonetic and phonological, effects that occur in Russian-influenced [attrition-affected] Ukrainian.

The aforementioned phonological collision then leads to a peculiar case of perception dichotomy regarding the perception of [g] and [h]. Currently, it seems that in this regard Ukrainian speakers can be divided into two groups. The first group, U¹, tends to perceive the discussed sounds as expected according to the principles of phonology, e.g., renders [g] as [g] and [h] as [ɦ]. The second group, U², consists of speakers whose phonological system of Ukrainian experiences *attrition* as a result of exposure, bilingualism, and/or language shift (former Russian L1 (bilingual) speakers who deliberately chose Ukrainian as their *new L1*), and,

thus, tends to render [h] mainly as [x], while [g] is rendered as either [g] or [h] depending on the level of precision, that means, a broad adaptation is [h], while a precise adaptation is [g] with either of them being correct, and perceived as the same phoneme. While describing their transcription choices speakers of this type often refer to an argument *I rely on my hearing, not the rules of transliteration*. This leads to probable undifferentiation between [h] and [x] and is often supported by collisions of various rules of transliteration and loanword adaptation from different *eras* in the development of Ukrainian orthography. For instance, the first transliteration on the Wikipedia page about Georg Hegel is *Гегель* /hɛhɛli/ with *Геґель* /hɛgɛli/ mentioned as an alternative option.

3. The experiment

Since the previously described hypothesis belongs to the field of unsupported, common knowledge, there was a need for feasible material that could provide more details. Therefore, an experiment testing phonetic perception was created.

The study was designed to test participants' phonetic perception exclusively, which means, the primary goal was to avoid any connections between the written form and the phonetic realisation or any other established patterns that could be influenced by the respondents' subjective attitude. To achieve that, the respondents were asked to fill in a questionnaire on *Fantasy proper names in Ukrainian*, a disguise used to avoid bias to the topic, where they were asked to listen to 20 voice recordings, recorded by one voice, containing word samples. Nine out of these words were made up, while eleven of them represented already existing names from various fantasy universes of various levels of popularity. The words containing [h] were: ['hɑtənɑʊ], ['hadarak], ['hɑfɔθ], ['tʏsən,hʊf], [fəl,hɑfən'tɛriɑ], [gʏt:ɛhad], [alkʊɛ'hɛlɛntɑ], [fɑrəlhm], [ɛɔ:hɔ:], [xɛ:hɛntɛɪɪ]. The other words were: ['rɔxɑŋd], ['θeʔʒʏun], [tʏ'sɑ̃], ['ʔɔrtɑgɔr], ['ɛnɛrɑ:χ], [hɔwɔ'pɔlɛ], ['æf,mɑ:k], ['fɛɪwɔd], ['lɔ:dɛɪn], [xɔ'tɛɛbʏʃ]. Some of the words from both groups also contained [g]. The first group of words was designed to check the probable influence of position and surrounding sounds in addition to the primary subject of research interest. Respondents were instructed to listen to the word samples individually and write them down as they heard them using the inventory of the Ukrainian alphabet. A total of 34 respondents took part in the experiment.

4. Respondents

Respondents represented four age groups: 13-19 [9 respondents], 20-29 [17 respondents], 30-39 [3 respondents], and 50-59 [2 respondents], thus most respondents are teenagers and young adults. Out of 34 respondents, 21 stated they were males, and 13 stated they were females. In the section about education, 9 respondents stated they have a bachelor's degree, 16 stated they have a master's degree, and 9 stated they [at that moment] had received only secondary education, which means, 11 years of school.

The section of the questionnaire the aim of which was to reveal the respondents' linguistic background had to be treated differently and with caution. The sociolinguistic situation in Ukraine has been a complicated topic for at least a couple of centuries after much of its territory was conquered by Muscovy/the Russian Empire. More so in the first quarter of 2023 – the time when the experiment was being conducted – it had been a year since the full-scale Russian invasion. For many, it became a reason for rejection and dissociation with the Russian language as shown in a sociolinguistic survey conducted by Rating Group that found that the percentage of *Russian-only* speakers changed from 27% in September 2021 to 13% in August 2022 (Rating Group, 2022). Therefore, it was assumed that a simple *What is your native language?* might be problematic and lead to answers that satisfy the respondents' position. Another problem presented by such a question would lie in the wording and semantics in Ukrainian, i.e., the phrase *Яка ваша рідна мова?* [What is your native language?] has been known for frequent misinterpretations of the collocation *рідна мова* as a concept similar to *heritage language*. Thus, some Russian speakers in Ukraine, especially those of ethnically Ukrainian descent, may consider Ukrainian as their *native (heritage)* language, while from the point of view of linguistics Russian would be their first [native] language. Therefore, to avoid any bias, it was decided that the wording of the question should be *Якою мовою чи мовами ви найчастіше спілкуєтесь?* [What language or languages do you use most in communication?]. This allowed

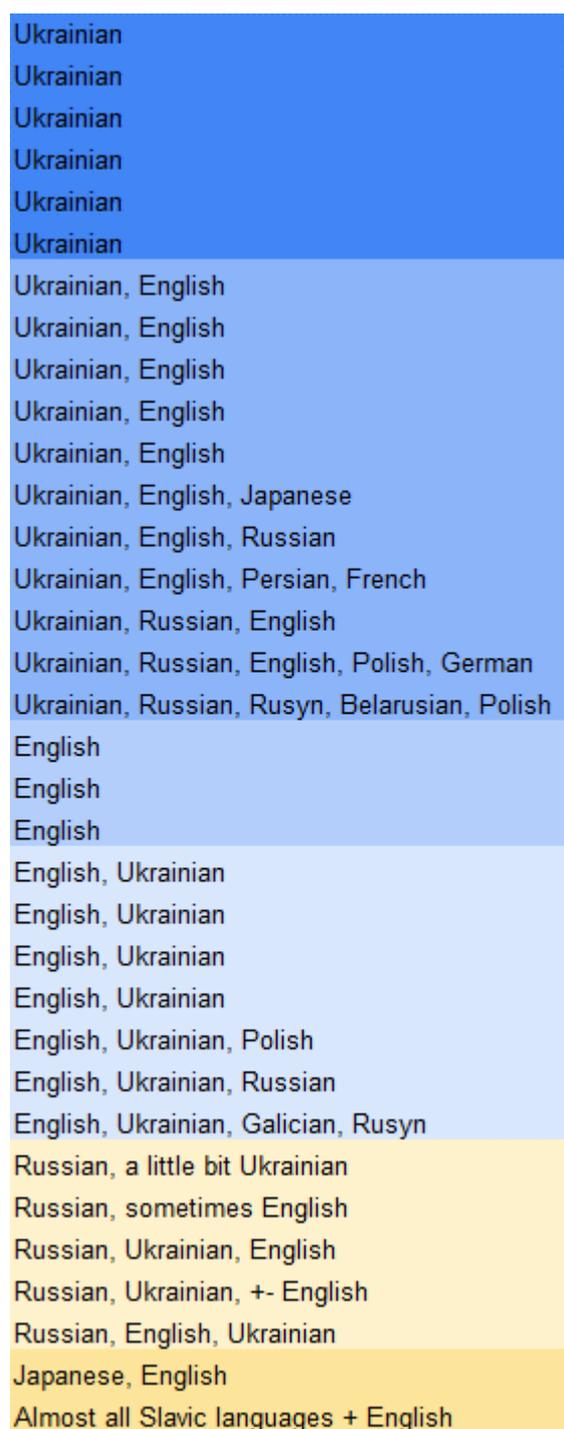


Figure 3. What is/are the language/s of your content consumption?

4.2%, and Belarusian, Bulgarian, French, Persian 2.1% each.

The last question in this section was aimed to reveal the respondents' exposure to other languages. Therefore, the question was put as *What is/are the language/s of your content consumption?* The responses are shown in Fig 3. As can be seen, Ukrainian is the main language of content consumption for 17 respondents, English for 10 respondents followed by Russian for

avoiding the problematic phrase and perception of nativity, and heritage. The responses to that question can be divided into seven categories: Ukrainian [14 respondents], Ukrainian and Russian [5 respondents], Russian and Ukrainian [5 respondents], Russian [3 respondents], Ukrainian (Galician) [2 respondents], English and Ukrainian [2 respondents], Both [2 respondents]. This data shows a couple of peculiar details. Firstly, respondents naturally tended to place the more frequently used language first. In the case of relatively equal use of both of them or referring to Surzhyk [a sociolect, generally perceived as a mixed Russo-Ukrainian -lect, an exhaustive description of which significantly exceeds the scope of this article] they would describe their language use as *...та мішанкою...* (*a mixture [of both] or [just] both [of them]*), *як коли (it depends)*. Secondly, two respondents explicitly stated that they speak *Galician*, i.e., one of the Western dialects spoken in Halychyna [also historically known as Galicia or Galizien], which can be interpreted as a strong sense of regionalism and local identity.

The next question asked *Do you speak any other language/s on level B2 or higher?*

Responses were as follows: English 43.8%, No 20.8%, Russian 12.5%, Polish 10.4%, Japanese

5 respondents with 5-6 more respondents mentioning Russian as *one of the languages* in which they consume content.

5. Null hypothesis results

For this study to be statistically relevant a null hypothesis had to be developed. Therefore, if the hypothesis is that some speakers of Ukrainian experience prolonged attrition and, therefore, the phonology of their idiolects has been undergoing changes, the null hypothesis should disprove the connection between attrition and perception. Hence, the most logical reason would be that it is not attrition that influences the perception but the phonetic environment and/or position. In this section, the results from the 34 respondents collectively will be covered. A more detailed interpretation of the results will be presented in the following chapter. Collective data for each entry will be now presented in a table. The studied sounds are marked in bold. The basic interpretation principle is that the transcription the respondents provided, that is the words written in the Ukrainian alphabet, are interpreted according to their phonetic value in standard Ukrainian. That means, for example, a transcription of [alkʊɛ'**h**ɛɫɛŋta] as <алквехелента> is interpreted as [alkvɛxɛlɛnta]. A detailed overview of each transcription case is provided in Table 2.

The first tendency that can be seen is that some Ukrainian speakers do render [h] as [x], while [g] was transcribed as either [g] or [ɦ] in approximately the same number of instances. Nevertheless, certain positional tendencies can be observed as well. The [x]-based perception occurs predominantly in:

- VhV – where [h] occurs in an intervocalic position as in [alkʊɛ'**h**ɛɫɛŋta] or [ɛɔ:**h**ɔ:] with 29 and 26 [x]-based transcriptions, respectively. A possible explanation could be that the voicelessness of [h] is more noticeable when juxtaposed with vowels which are naturally voiced.
- hVÇ – where [h] occurs in a word-initial position before a vowel and followed by another voiceless consonant as in ['**h**atɔnaʊ] or ['**h**afpɔθ] with 29 [x]-based transcriptions each. This position, similarly, to the previous one, shows [h] in juxtaposition to the voicedness of a vowel as well as regressive assimilation caused by a voiceless consonant.

The [ɦ]-based transcriptions can be, in their turn, observed in the following positions:

- Čh – where [h] occurs after a voiced consonant as in [fa.ɚə**h**im] with 20 transcriptions. The most likely explanation is progressive assimilation, i.e., the perception of voicedness spreads to the following consonant.
- hVČ – where [h] occurs in an initial position and is followed by a voiced consonant as in ['**h**adarak] with 16 transcriptions.
- xVhV – where [h] occurs in an intervocalic position and is preceded by [x] as in [xɛ:**h**entɛɾɪɫ] with 25 [h̥]-based transcriptions. This entry shows that when [x] and [h] are juxtaposed in proximity, Ukrainian speakers tend to differentiate these two phonemes.

The final observation that can be made is that the perception of [h] is often influenced by the phonetic environment in each specific case. Nevertheless, although there seems to be a tendency to [x]-based perception, it does not mean that it is possible to exclude other causes.

Table 1 Key sound transcriptions, general overview. The horizontal row shows the words containing the studied sounds (in bold). The vertical row shows transcriptions as written by the respondents. The numbers represent the number of times individual transcriptions were used by the respondents.

Transcription by respondents	[alkʏɛ'heleŋʲa]	[fɛl'hadɛn'tɛɾɪa]	[fa.ɚə h im]	[ɣɾɛ'tɛ'had]	[' h adarak]	[' h adpɔɟ]	[xɛ:' h entɛɾɪɫ]	[ɟɛɟɔɾɔɟɫ]	[' h atanau]	[.ɔɫ'ɔɛ]	['ɾɛsɛn'huɾɪ]
[h̥]	3	14	20		16	5		18	5	8	10
[x]	29	16	13		17	29	1		29	26	24
[xv]	2	1									
[h̥x]		1			1						
[v]		1									
[h̥], [x]				14							
[∅]		1									
[g]			1					16			
[g], [h̥]				5							
[h̥], [h̥]				2			1				
[g], [x]				9							
[h̥], [g]							1				
[x], [h̥]							25				
[x], [x]							6				

6. Czech and Slovak respondents

It was mentioned earlier that Czech, Slovak and Ukrainian share an important phonetic development – the change of Proto-Slavic *[g] into [h] (Pauliny, 1963; Šlosar et al., 1977; ШЕВЕЛЬОВ, 2002). The result of this phonetic change was that these three languages have similar phonological systems. While having similar phonological systems speakers of Czech, Slovak, and Ukrainian seem to exhibit different perceptions of [h], i.e., Czech, and Slovak speakers perceive it as [h], while Ukrainian speakers seem to perceive it mostly as [x] with certain positional variations. Therefore, Czech, and Slovak speakers present a precious control group.

The reason for having a control group consisting of speakers of phonologically similar languages was to check, whether the positional tendencies mentioned in the previous section are universal, and whether the Czech/Slovak [h]-based perception was a merely orthography-based analogy, i.e., in both Czech and Slovak <h> denotes /h/. If this proves to be true for Czech/Slovak speakers as well, it will mean that the cause for [x]-based perception is indeed the phonetic environment.

A total of 8 respondents, 7 Czech and 1 Slovak, took part in the control group experiment. The respondents received an identical questionnaire with the only difference being the language of instruction. Czech and Slovak speakers were 19-33 years old, mostly university students or post-graduates, English was mentioned as the dominant language of content consumption in all 8 responses, while Czech was mentioned as the dominant language of communication, followed by English, and Slovak.

The results gathered in the control group were as follows:

- [h] was perceived as [h] in 100% of cases.
- Expectedly, [g] was never rendered as [h] as there is no covert allophonic relation between the two sounds.

These results mean that the original reason of [x]-based perception should not be sought in the position or phonetic environment only, although certain positional tendencies cannot be denied. Hence the reason – as it was assumed earlier in the text – should be crosslinguistic influence.

7. Interpreted results

This section will be divided into two parts: Ukrainian-Russian comparison, and attrition-affected Ukrainian [mixed]-Ukrainian-Russian comparison. The reason behind this division is that if the

initial hypothesis is correct, there should be noticeable patterns in how respondents with more/less exposure to Russian perceive [h], and [g].

7.1. Ukrainian-Russian comparison

Initially, the detailed processing of data began with a simple comparison where respondents were divided into two groups. The first group consisted of respondents who mentioned Ukrainian as their dominant language in all spheres, and the second group consisted of respondents who mentioned Russian as their dominant language as well as respondents who mentioned Russian as (heavily) present in their life. Such a division allowed for a quick test of whether there were any patterns at all.

Table 2 Two-group analysis. X was transcribed as Y in Z% of instances

	Ukrainian	Russian
alkʊɛ'hɛlɛfɪta	[h] as [x] 79%	[h] as [x] 93%
fəl'hafən'tɛria	[h] as [x] 31%	[h] as [x] 73%
'fʊrəlhm	[h] as [x] 31%	[h] as [x] 47%
'gʏt:ɛhad	[h] as [x] 74% [g] as [fɨ] 26%	[h] as [x] 87% [g] as [fɨ] 87%
'hadarak	[h] as [x] 42%	[h] as [x] 60%
'hafpɔθ	[h] as [x] 89%	[h] as [x] 93%
'xɛ:hɛntɛrɪɔ	[h] as [x] 21%	[h] as [x] 13%
'ʔɔrtagɔr	[g] as [fɨ] 34%	[g] as [fɨ] 73%
'hatɛnaʊ	[h] as [x] 79%	[h] as [x] 93%
'ɛɔ:hɔ:	[h] as [x] 63%	[h] as [x] 93%
'tʏsɛn.hʊf	[h] as [x] 53%	[h] as [x] 93%

As can be seen from the table above, there are noticeable patterns. The first pattern is that the respondents from the Ukrainian-dominant group exhibit a significantly lower tendency to [g] - [fɨ] one-way variation with 26% and 34% versus 87% and 73% in the Russian-dominant group. Another important pattern that can be observed is a generally lower tendency to perceive

[h] as [x] in the Ukrainian-dominant group, although certain entries showed rather close results in both groups. Considering the results of the initial analysis, it can be stated that exposure to Russian seems to influence Ukrainian speakers' phonetic perception.

7.2. Ukrainian-mixed-Russian comparison

Having discovered a certain correlation between exposure to Russian and the tendency to [x]-based perception, it is now possible to proceed to the detailed analysis. This last step requires dividing respondents into three groups instead of the initial two-group division. For this analysis, respondents were divided into a Ukrainian-dominant group, a mixed group [attrition-affected] (Russian was mentioned as a language of communication and/or content consumption alongside Ukrainian), and a Russian-dominant (Russian was mentioned as the dominant language in all spheres).

Table 3 Three-group analysis

	Ukrainian	Mixed	Russian
alkʊɛ'helsɛŋta	[h] as [x] 79%	[h] as [x] 86%	[h] as [x] 100%
fəl,hafən'teria	[h] as [x] 31%	[h] as [x] 86%	[h] as [x] 62%
'fʌrəlhm	[h] as [x] 31%	[h] as [x] 57%	[h] as [x] 37%
'gʏt:ɛhad	[h] as [x] 74% [g] as [ɦ] 26%	[h] as [x] 86% [g] as [ɦ] 71%	[h] as [x] 87% [g] as [ɦ] 75%
'hadarak	[h] as [x] 42%	[h] as [x] 57%	[h] as [x] 62%
'hafpɔθ	[h] as [x] 89%	[h] as [x] 100%	[h] as [x] 87%
'xɛ:hɛntɛɪɫ	[h] as [x] 21%	[h] as [x] 29%	[h] as [x] 0%
'ʔɔrtagɔr	[g] as [ɦ] 34%	[g] as [ɦ] 71%	[g] as [ɦ] 75%
'hatənaʊ	[h] as [x] 79%	[h] as [x] 100%	[h] as [x] 87%
'ɛɔ:hɔ:	[h] as [x] 63%	[h] as [x] 100%	[h] as [x] 87%
'tʏsən,huf	[h] as [x] 53%	[h] as [x] 100%	[h] as [x] 87%

The arithmetic mean of all the entries shows that the Ukrainian-dominant group perceives [g] as [ɦ] in \bar{x} 30%, while the results for the mixed group, and Russian-dominant group are \bar{x}

71%, and \bar{x} 75% respectively; the results for [h] perception as [x] are \bar{x} 56.2% for Ukrainian-dominant, \bar{x} 80.1% for the mixed group, and \bar{x} 69.6% for Russian-dominant group, while the results for mixed [attrition-effected] and Russian-dominant group together is \bar{x} 74.5 %. These results reveal that there indeed is a correlation between being a (Ukrainian-accented) Russian speaker and/or having prolonged exposure to Russian with tendencies to experiencing one-way [g] - [h] one-way variation (see Table 1), and perception of [h] as [x].

The final step in the analysis was to check its statistical significance. Having filtered out outliers from the sample, using a z-test with the critical value = 1.5, statistical significance analysis proved the hypothesis to have a 95-99 % confidence level, meaning there seems to be a connection between [x]-based perception and *attrition*, as understood by de Leeuw and Chang. The more detailed analysis also shows several peculiar outcomes. It seems that the respondents from the mixed group generally showed an even greater tendency towards [x]-based perception in comparison to their Russian-dominant, and Ukrainian-dominant counterparts.

Table 4 Comparative table of the arithmetic mean of [h] as [x] perception

Group Feature	Ukrainian-dominant	Attrition-effected Ukrainian	Russian-dominant	AEU + RD as a single group
[g] as [h]	\bar{x} 30 %	\bar{x} 71 %	\bar{x} 75 %	\bar{x} 73.5 %
[h] as [x]	\bar{x} 56.2 %	\bar{x} 80.1 %	\bar{x} 69.9 %	\bar{x} 75 %

This can be attributed to the bilingual nature of these speakers' sociolinguistic environment, which means, they are likely to consume content in Russian and use it in certain situations of their daily life, and a form of Ukrainian as their *family language* which leads to them being familiar with the Russian/Russian-based transliteration tradition. It is also likely these speakers are explicitly aware of the so-called *зекання* [fɛkɑnʲɪːv] – a term denoting a phonetic realisation of [g] as [h] when speaking Russian – a typical feature of Ukrainian-accented Russian that, depending on circumstances, can be perceived as having low social prestige. Therefore, this sociolinguistic awareness combined with the one-way [g]-[h] variation relationship may play a

decisive role in their perception, that is, they may covertly tend to avoid [h]-based transcriptions because of the overt low prestige this phoneme has in *foreign speech* as well as to avoid collisions with [g] (which is often rendered as [h]). As well as some members of this group may also represent former (Ukrainian-accented) Russian L1 speakers whose phonological system of Ukrainian experiences a degree of influence of their L1 phonological system. Such a sociolinguistic environment creates unstableness in the phonological system and, therefore, fosters change.

8. Conclusion

The findings of this study can make a valuable contribution to the unresolved question concerning the permanence of effects caused by drift and attrition, as proposed by de Leeuw and Chang (de Leeuw & Chang, 2023). In their recent publication, they raise doubts about the possibility of attrition effects becoming permanent. It seems improbable that changes in an individual's native language phonological system can remain unchanged over extended periods. Nevertheless, their perspective focuses solely on individual cases of later second language (L2) learners, adult immigrants, and those exposed to other languages for prolonged durations. To gain a broader understanding, bilingualism in Ukraine has been examined, wherein persistent attrition, and cross-linguistic influence over time, if substantial enough, may indeed lead to permanent changes in the phonological system of the language itself, as spoken by a group of people who share similar sociolinguistic background, rather than merely an individual.

By analysing the data through a detailed two- and three-group analysis, several key conclusions can be drawn. It appears reasonable to argue that speakers belonging to the Ukrainian-dominant group experience intermittent drift due to occasional exposure to (Ukrainian-accented) Russian, and attrition-affected Ukrainian. In contrast, speakers from the mixed group undergo prolonged attrition, which can last for several generations. This attrition results in fundamental changes to the phonological system of their language, leading to an ongoing change towards [g] deletion, [h] perception as [x], and other examples of language interference beyond the scope of this article.

Furthermore, the results illustrate the interrelation between the sociolinguistic environment in which speakers live and their phonetic perception. The results show that phonology-based perception is indeed the main way of sound perception. However, considering the always-changing nature of individuals' and populations' phonological systems, and the pace of scholarly knowledge updates, deeper analyses should be made. That means each case should be

examined together with the broader sociolinguistic context that, under favourable circumstances, may significantly influence the outcomes that otherwise could have been based on insufficient, outdated, or erroneous data. These findings, therefore, contribute to the broader discussion on the role of phonology, and sociolinguistics in sound perception in general.

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