

A general characterisation of vowel harmony in Uralic languages

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Abstract

This study gives a systematic overview of the phenomena labeled as *vowel harmony* observable in Uralic languages. Here, the different vowel harmony systems are arranged into a loose network due to their holistic similarity instead of following the family tree, the geographical position of languages or arbitrary parameters. The paper suggests distinguishing three groups of vowel harmonies. The most widespread ones are canonical front/back harmonies, typical for many of the Uralic languages (dialects) belonging to different branches. Although they show considerable differences when compared to each other, they are strikingly similar when compared to other vowel harmony systems. The second group includes quasi-canonical harmonies, resembling canonical harmonies in some way but differing both from them and from each other in some other aspects. Finally, there are non-canonical harmonies, which consist of two distinct categories, one of which can be labeled *vowel harmony* only on historical grounds.

Keywords: vowel harmony, umlaut, vowel assimilation, typology, Uralic languages

1 Introduction

This paper aims to give a general characterization of vowel harmony systems in Uralic languages. Although not all types of vowel harmonies can be traced back to the protolanguage, a kind of vowel harmony is reconstructed to Proto-Uralic as well. Former overviews, such as Koizumi (1959), Collinder (1960: 208–215; 1965: 65–66) or Comrie (1988: 454–457), give important insights into harmony systems of various Uralic languages, but the overall picture remains somewhat obscure. This paper offers a systematic overview of the various vowel harmony systems of the Uralic languages. This task has two basic difficulties.

First, *vowel harmony* (VH) is an umbrella term labelling various phenomena. The disagreement on the existence or lack of VH in an idiom (henceforth, *idiom* is used as an umbrella term for dialect, language and group of languages) many times goes back to a disagreement on what VH is, not on whether a given phonological and/or morphological phenomenon exists. For example, Tamás (2006: 7) criticizes Bátori (1976) for denying the existence of VH in Saami. However, Bátori (1976: 279–281) is clearly aware of the existence of what Tamás labels “regressive height harmony”,¹ but he calls it “umlaut”, and he even argues that the emergence of this umlaut caused the disappearance of (progressive) VH.² Some researchers are even more exclusionary: Sammallahti (1980: 3–4) argues that while Turkish vowel harmony is “real harmony”, Finnish and Hungarian vowel harmonies are “pseudoharmonies” since some of the vowels are neutral.

The description of VH in this paper attempts to be as inclusive as possible, and it aspires to discuss all the instances which have been called VH in the literature on Uralic languages. It even addresses phenomena that are similar to a given phenomenon labelled VH in one Uralic language, but which have never been categorized as that. The minimal requirement for accepting a phenomenon as VH is the agreement between two vowels in at least one feature (nonetheless, phenomena not fulfilling this requirement but labeled as VH will also be discussed). Typically, VH can be observed in vowel alternation, i.e. when a morpheme has different allomorphs with different vowels, and the alternants are used depending on the quality of vowels in another (typically neighbouring) morpheme.³ The alternating vowel is called

¹ Rédei (1986: 200), debating with Bátori (1976), argues that umlaut is VH “in a wider sense”. Rédei also states that Bátori denies the possibility of height harmony, labelling it as *umlaut*. However, Bátori (1976: 273) defines VH as progressive distant assimilation, while he defines umlaut as a regressive process (Bátori 1976: 278). Nonetheless, he accepts the term *regressive VH*. This indicates that (contrarily to Rédei’s claims) the opinions of the two researchers are not as distant as Rédei suggests.

² This argumentation can be rejected easily by the counterexample of Vakh–Vasyugan Khanty, which also exhibits umlaut but preserved progressive front/back harmony.

³ Theoretically, it is also possible to speak about morpheme-internal, typically stem-internal VH. In this case, vowels inside a morpheme must share a given feature. Thus, even a language completely lacking affixation could exhibit VH, but in such a language it would be impossible to ascertain which vowel is the trigger and which is the target. Additionally, it is practically impossible to determine what proportion of the morphemes (stems) should obey the expected regularity to declare that the given language exhibits VH. On the contrary, if there is just one morpheme in a language that has an alternating vowel, which assimilates to a vowel in another morpheme, that language has at least a marginal VH.

target, whose quality depends on another vowel, the *trigger*.

Second, Uralic languages exhibit diverse VH systems, which can be differentiated according to the vowel systems they are based on, the features concerned, the length of the harmonic domain, the direction of harmony, the set and the behaviour of neutral vowels, or the role of consonants etc. Very different types of VH may be observed in closely related languages or dialects. Nevertheless, geographically and historically different languages may exhibit similar types of VH. According to Saarikivi (2022: 31–32), 7–9 branches of the Uralic language family can be undoubtedly distinguished: 1. Saamic, 2. Finnic, 3. Mordvinic, 4. Mari, 5. Permic, 6. Ugric: a. Hungarian, b. Mansi, c. Khanty, 7. Samoyedic. There is no consensus on how the family tree branches before reaching these nodes. Concerning the Ugric group, it is contested whether it is a branch or a Sprachbund. In all the seven groups there are idioms with or without VH – or at least some phenomena labeled as VH in the literature (see § 4).

To overcome these difficulties, this paper offers a network model, focusing on various types of vowel-induced vowel alternations. As a consequence, different harmonic phenomena of the same idioms are discussed in different parts of the paper, and similar phenomena of various idioms are discussed together. Three main concentric groups of VHs are distinguished here (see Figure 1 at the end of the article).

The central type is *canonical vowel harmony* (§ 2), in which vowels are divided into two harmonic classes by a certain feature, and the members of different classes cannot co-occur inside a domain (typically the word, i.e. a stem with suffixes). In canonical VH, feature agreement can spread across more than two vowels (i.e. syllables). As the assimilation process is iterative, some vowels can be targets and triggers at the same time. Canonical VH is central in two senses. First, this is the most widespread type in Uralic, and it mostly originates from the Uralic protolanguage. Second, and that is why it is labeled *canonical*, it is the phenomenon originally labelled as VH. One of the earliest accounts of VH in Uralic is from Castrén (1854: 23), who defines VH as the regularity according to which the initial vowel of the stem determines the quality of the subsequent vowels in the word (and his explanation suggests that these vowels are either back or front). This double centrality is not a coincidence: as Castrén mentions as well, the concept of VH comes from the grammars of the “Altaic” languages (which was a term for languages classified today as Uralic, Turkic or Mongolic at that time).

Quasi-canonical harmonies (§ 3) form a loose zone around the central group. In these, the harmonic domain can extend to more than two syllables, i.e. assimilation is iterative, but some peculiarities of the harmony systems show deviation from the canonical type in very different ways. Thus, quasi-canonical harmonies are quite different from not just canonical VHs but also each other. While cases of canonical harmonies can be quite similar in different, not necessarily closely related languages, there are no similar cases of quasi-canonical harmonies in different languages.

Non-canonical harmonies (§ 4) are cases of vowel-to-vowel assimilations: these are not iterative, and no harmonic classes can be distinguished. Two basic subtypes of such cases can be distinguished, and for one of them it is questionable whether one can speak about VH, i.e. about vowel-to-vowel assimilation (which can be supposed historically, but cannot be detected synchronically).

In this classification, certain peculiarities are ignored or play a minor role. First, idioms may be different from the perspective of how many of the potentially alternating vowels actually alternate or which vowels trigger alternation. E.g. Wiik (1988: 49–161; 1989: 43–72) demonstrates that vowel alternations due to harmony in Estonian and Veps dialects show a kind of hierarchy with respect to the size of the territory they occur in. The alternation /a/ : /æ/ is the most widespread one, and it occurs everywhere, where VH occurs. The alternation /u/ : /y/ is less widespread, but it is present in all the areas where the alternation /o/ : /ø/ (and /e/ : /ɘ/ in Estonian dialects) is present. These alternations can be triggered by different vowels: triggers show a reverse hierarchy: /æ/ is the weakest and /ø/ is the strongest trigger of front vowels.

Another peculiarity ignored in the classification is that VH can be more or less morphologized. In various languages, only some morphemes show a given type of alternation. In Hungarian, suffixes containing /i/ usually do not alternate, except for certain verbal suffixes, cf. /ne:z-i/ |look-3SG.DO| vs. /la:t-jɒ/ |see-3SG.DO|. In Finnish, only the illative suffix undergoes total harmony (i.e. its vowel is completely assimilated to the preceding vowel, see § 4.1.5). In other cases, otherwise alternating vowels do not alternate: e.g. Hungarian /øt-kor/ (*/øt-kør/) |five-TEMP|, /he:t-kor/ (*/he:t-kør/) |seven-TEMP|, although suffixal /o/ usually participates in an /ɛ/ : /o/ : /ø/ alternation due to front/back and rounding harmony. Similarly, it can also be morphologically (and lexically) determined whether vowels in certain morphemes can be triggers. E.g. in Hungarian, /i:/ behaves as a trigger in /vi:z/ ‘water’ (/vi:z-nək/ |water-DAT|) but not in /hi:d/ ‘bridge’

(/hi:d-nɔk/ |bridge-DAT|). This fact cannot be explained on phonological grounds. Potentially, every language could be characterized by the proportion of the suffixes undergoing VH as opposed to those that do not. If the number of such suffixes is not balanced, it could be determined which behaviour is the marked (exceptional) one. However, these parameters can be very different for individual vowels within a given language (cf. Rebrus–Törkenczy 2016). Moreover, the vowel systems also considerably differ from each other. Thus, there is no obvious way of doing such a comparison.

The present paper is based on various sources. The harmony systems of the various Uralic idioms have not been explored to the same extent. Some grammatical sketches or comprehensive grammars give good descriptions of the most important traits of the VH systems, but others lack basic information. There are papers or even monographs on the VHs of some languages, but not for others. The purpose here is to refer to the most informative sources on the parameters discussed. There are also sources in which information on some kind of VH is available, but the details remain obscure, and there are no better sources on the phenomenon. Such sources are referred to, but the cases mentioned in them are ignored in the analysis.

2 Canonical vowel harmony

Canonical front/back VH is typical for the Uralic languages. It occurs in Hungarian, in variants of Finnic, Mari, Udmurt, Mansi, Khanty and Kamas.

Canonical harmony is usually defined as a limitation of the co-occurrences of given phonemes within a word⁴ (cf. Lightner 1965: 244; Archangeli & Pulleyblank 2007: 354). This means that phonemes (in the case of VH, vowels) can be classified into two groups, so-called harmonic classes, and the members of one class typically do not co-occur with vowels of the other class. The members of the two classes are usually (but not necessarily, see e.g. Anderson 1980: 7–9) divided by a phonetic feature (such as frontness/backness, roundedness, height), and the harmony itself is named after that feature (front/back or palatal harmony, rounding harmony, height harmony etc.). The limitation can be interpreted as an iterative assimilatory process, spreading from syllable to syllable. Still, not all the vowels must belong to one of the two harmonic classes: some vowels can combine with the members of both classes. E.g. in Finnish, /i/ and /e/ can co-occur both

⁴ Compound constituents usually count as distinct words.

with /u/, /o/ and /ɑ/ on the one hand, and /y/, /ø/ and /æ/ on the other hand; nonetheless, the members of the latter two groups cannot co-occur inside the domain. The vowels remaining outside the opposed harmonic classes are referred to as *neutral vowels*.

In all likelihood, there is not a single language in which the given limitation is always applied to the full word. The harmonic domain, i.e. the sequence in which vowels belonging to different harmonic classes do not combine, can be shorter than the word owing to several factors: foreign words are not always adopted to the regularities of VH; neutral vowels can be opaque, i.e. they can appear after any vowel, but after them a vowel belonging to one of the classes can or even must occur, irrespective of the vowel preceding it; the vowels in some morphemes may be exempt from harmony (despite that the same vowel otherwise harmonizes) and begin a new harmonic domain; even some consonants can intervene in VH.

Languages in which the length of the harmonic domain may be shorter than the whole word only due to specific factors mentioned above can be labelled as *languages with a word-long harmonic domain*. However, if the harmonic domain cannot (or does not necessarily) reach the third or fourth syllable under given circumstances (e.g. depending on the quality of the trigger and the target, or sometimes even the consonants between them), the language has a *shortened harmonic domain*. For example, in Southern Veps (Wiik 1989: 54–72), /æ/ usually occurs (instead of /ɑ/) in the third syllable after a second-syllable /æ/, /y/ or /ø/. On the contrary, /æ/ occurs only exceptionally in the fourth syllable after a third-syllable /æ/. The same suffixes generally contain /ɑ/, but /æ/ may occur only if it is separated from the target by only one consonant, usually /h/. After the fourth syllable, /æ/ never occurs. Thus, the length of the harmonic domain is restricted to the first three-four syllables of the word in Southern Veps. Actually, it is even shorter for /y/ and /ø/, which never occur after the second syllable. They can occur only after a first-syllable /y/ or /ø/, but not /æ/.

The exceptionality or usuality of cases when the harmonic domain is interrupted is gradual. Therefore, it is more practical to define canonical harmony in a way that there are harmonic classes, and the harmonic domain can spread further than two neighbouring syllables. All canonical harmonies in the Uralic languages are front/back harmonies. § 2.1 discusses canonical VHs of the Uralic languages in respect of the length of the domain, while § 2.2 presents the distribution of some vowel types in different languages.

2.1 Domain length

The harmonic domain is usually the (phonological) word in Hungarian (Törkenczy 2011: 2965, 2981), Finnish (Hakulinen et al. 2004: §16–18), Karelian, Votic (Ariste 1968: 4–6; Lauerma 1993; Markus & Rozhansky 2017: 30–34), Võru/Seto (Kiparsky & Pajusalu unpublished), Western (Hill and North-Western) Mari (Alhoniemi 1993: 24–25; Ivanov & Tuzharov 1970: 46–57), Southern Mansi (Kannisto 1914) and Vakh–Vasyugan Khanty (Tereshkin 1961: 17–20; Gulya 1966: 37–39; Filchenko 2007: 9–16).

Kamas front/back harmony can also be mentioned here. There was only one kind of alternation: /a/ : /e/, and other vowels could prevent the harmonic domain from being stretched along the whole word.⁵ Nonetheless, the main point here is that even if the domain is interrupted, a new domain begins, and it stretches to the end of the word – or until another non-alternating vowel occurs. The alternation of harmonic vowels is not restricted by their position, e.g. by standing too far from the initial syllable. Even if the word is not a single continuous domain, all its syllables must be considered as a part of a harmonic domain (even this might be not straightforward when looking at any given form, but it is clear from a comprehensive view).

As for Finnish, the harmonic domain can even cross word boundaries and spread to enclitics (/ko/ : /kø/ ‘whether’, /kɑ:n/ : /kæ:n/ ‘neither’, /han/ : /hæn/, /pa/ : /pæ/ (discourse particles with various modal functions), etc.).

In some languages, the harmonic domain is shorter than the word, but does not have a fixed length (e.g. three syllables). The length can depend on the quality of the trigger and target vowels and can also vary under the same circumstances (vacillation). The further we get away from the first syllable, the less likely it is that the vowel will harmonize with the preceding one (*harmonicity slope*, see Fejes 2021c). These types of harmonies are usually not distinguished from harmonies typically spreading along the whole word and could hardly be. This is the case in Veps and many dialects of Estonian (Wiik 1988; 1989), in which back rounded and low vowels are preferred over front ones more and more with each syllable. In addition, only rounded triggers can cause the fronting of rounded targets (and usually not behind the second syllable), and /æ/ also occurs rarely in the fourth (or third) syllable and after. These harmony systems form a gradual transition between

⁵ Urmanchieva (2019: 97), relying on an unpublished manuscript of Jarmo Alatalo states that there is [æ] : [o] alternation due to VH in Selkup as well. However, some other sources (e.g. Helimski 1998b: 553) deny the existence of VH in Selkup.

the variants of Finnic such as Standard Finnish or Võru/Seto, in which the harmonic domain is the word, and such as Standard Estonian, in which VH is completely missing, and front rounded and low vowels are practically prohibited in non-initial syllables (the exceptions are foreign words and some obscured compounds).

The case is similar in Khanty. While Vakh–Vasyugan Khanty exhibits a quite regular VH system with the word as the harmonic domain, the Southern dialects, extinct in the middle of the 20th century, exhibited VH with harmonicity slopes (cf. Vértes 1977; Fejes 2021c: 134–137).

In Southern Khanty, in contrast to Finnic, front vowels were preferred in non-initial syllables. The harmonicity slope had no strict boundaries as in some Finnic variants, in which front rounded and low vowels are simply prohibited after the third or fourth syllable. Based on Southern Khanty texts collected by Karjalainen, Vértes (1977: 65–85) states that the switch from back to front vowels could happen only under certain circumstances. It is regular after palatalized consonants or /j/. It may occur after /i/ or /e/ following back vowels, in two ways. Either these vowels are realized as front ones and can be followed by just front alternants of harmonic vowels; or they are realized as allophones [i] and [ɘ], respectively, and they can optionally be followed by just front alternants of harmonic vowels.⁶ In the last syllable /æ/ can occur instead of /a/ without any reason. Based on some Konda texts collected by Paasonen, Vértes (1985: 5–6) claims that back vowels can occur in the second syllable only if the first syllable is open (to put it in another way, consonant clusters block harmony), and in the third syllable only if there is /x/ or /l/ in the second syllable.⁷ (Switching from front to back vowels occurs only with the past 3SG ending *-ot/*, which cannot be followed by anything.) As a consequence, Vértes (1977: 95–96) could not find any words containing only back vowels and being longer than four syllables at the same time. (We must add that the proportion of the five- and six-syllable-long words containing only front vowels is also extremely low, less than half a percent in all of the dialects.)

Surgut Khanty, spoken in the territory between the Southern and the Vakh–Vasyugan dialects, exhibited VH similar to the Southern dialects at the beginning of the 20th century, but lost it by the second half of the century:

⁶ Vértes (1977: 157–162) analyzes these as phonemes, but her arguments are weak (cf. Fejes 2021c: 135). In initial syllables, these back unrounded vowels occur only next to velar consonants, while in non-initial syllables, they appear due to VH.

⁷ She apparently means that on the boundary of the second and third syllables.

today, only front vowels occur in non-initial syllables (Vértes 1999). By all probability, the fate of Southern Khanty VH could have been similar as well.

Harmonicity slopes can occur also in emerging harmony systems, as in the Tatyshly, the Krasnoufimsk⁸ and probably in the Tashkichi dialects of Udmurt. Unfortunately, the research on these harmony systems is not satisfactory. Harmony in the Tatyshly and Krasnoufimsk dialects is addressed by Kelmakov (1977; 1998: 72–73) and Fejes (2019), but even these accounts are based on small sets of data. Tashkichi harmony has not been analyzed in detail. According to the available sources, VH appeared due to the influence of Tatar/Bashkir and Mari in the above three dialects, while it does not occur in other variants of Udmurt.⁹ In these dialects, front rounded, low and reduced vowels¹⁰ can optionally be followed by similar vowels, against which similar back vowels are preferred in non-initial syllables. The further we get from the initial syllable, the less probable it is that we find a front low, rounded or reduced vowel. There are also differences between the vowels, e.g. although /ø/ is attested in initial syllables, it never occurs in non-initial ones (nonetheless, /o/ does occur, so rounded mid vowels are not prohibited in general).

Finally, some idioms without VH can be mentioned here. In variants of Finnic with harmonicity slopes, the probability for low or rounded vowels to be back rather than front is increasing with each syllable. Idioms without VH, such as Standard Estonian, can be considered as an extreme example (cf. Comrie 1988: 455–456). In such systems, front rounded and front low vowels are so strongly dispreferred that they are practically prohibited. Such languages are completely different from the languages without VH, in which any vowel can follow any other vowel. In these cases, only one member of the potentially alternating pairs of vowels can occur in non-initial syllables. This means that VH could be reintroduced to these languages without causing

⁸ Probably extinct.

⁹ Front/back harmony occurs in the easternmost dialects of Mari as well (Bereczki 1990a). However, due to the lack of detailed description, it will be ignored in this paper.

¹⁰ The term *reduced* is used in this paper as usually in Uralistics: it does not refer to vowels reduced due to their positions, but vowels which are generally shorter (overshort) than non-reduced *full vowels*, which are not necessarily long but can be lengthened. Although the main difference is in length, the full-reduced opposition can be distinguished from the short-long opposition, as reduced vowels are marked: in a vowel system with a full-reduced opposition there are more – but, in any case, not less – full than reduced vowels, and there are less oppositions between reduced than full vowels. In addition, full vowels are more frequent (at least in initial syllables). Furthermore, reduced vowels are usually centralized compared to full vowels.

any communication difficulties (i. e. homonyms). In the Hill Mari orthography used before 1994, the frontness of low and rounded vowels was indicated only in the initial syllable, because the frontness of these vowels was unequivocal in non-initial syllables if they were preceded by front vowels (cf. Krasnova et al. 2017: 46). As a consequence, Hill Mari, exhibiting a fairly regular and strict front/back VH, could have been considered similar to Estonian in respect of the lack of harmony based on written texts, if the reader was not familiar with this spelling rule.

Systems similar to the Standard Estonian can be considered as cases of “suppressed” (or “negative” or “hidden”) harmony, which are specific cases of canonical harmony. Because of the lack of any assimilation or agreement, these cases cannot be labeled as *harmony* in the literal sense of the term, obviously; nonetheless, they strongly resemble canonical VH in the sense that a feature, contrastive in initial syllables, does not function as a contrastive one in the subsequent syllables. In real harmonies, the feature value is determined by the preceding vowel, while in “suppressed harmonies”, it is determined by some other rules (e. g. back, if rounded or low, front otherwise).¹¹

2.2 Vowels in non-initial syllables

In all the Uralic languages with canonical front/back VH, low unrounded vowels alternate with each other i. e. /a/ (/ɒ/) : /æ/ (/ɛ/). In Standard Hungarian, which has no long front low vowel, the low back vowel alternates with a long front mid vowel: /a:/ : /e:/. (As demonstrated below, /e:/ can also be non-alternating.) There are no front low rounded vowels in any of the Uralic languages with canonical front/back VH, with the exception of Hungarian, which has a back low rounded vowel /ɒ/.¹² This vowel alternates with /ɛ/ (which can also alternate with /o/ and /ø/, see §§ 2.1.2 and 3.1). Low unrounded vowels alternate with each other in all the other languages belonging here: /a/ : /æ/ (/ɛ/).

¹¹ There are also languages, such as Western Mari, Komi, Mansi or Khanty, in which rounded vowels are practically prohibited in non-initial syllables. Theoretically, these could be analyzed as languages with „suppressed” rounding harmony. However, since there are no comparable systems of real canonical rounding harmony in Uralic, it is less interesting for us now. Nonetheless, such languages with “suppressed” rounding harmony could be important for a cross-linguistic comparison of rounding harmonies.

¹² The vowel /ɒ/ is also higher than /a:/. It is approximately of the same height as /ɛ/, although lower than /ɔ/ in languages like French; it is closer to the vowel in *lot* than in *north* in RP.

Non-low vowels exhibit a different behaviour in non-initial syllables. It is worth distinguishing two groups of non-low vowels: unrounded and rounded ones (discussed in §§ 2.2.1 and 2.2.2, respectively).¹³ The aim of the following overviews is to highlight the diversity of the harmony systems among the ones belonging to this type of harmony, but these will not give a complete picture of the situation of all the Uralic languages with canonical front/back VH.

2.2.1 Non-low unrounded vowels in non-initial syllables

Among non-low unrounded vowels, we should distinguish three types: high, mid and reduced ones. Practically, all Uralic languages with canonical VH have high and mid unrounded vowels, but just some of them have reduced ones.

Most Uralic languages with canonical VH have only one high unrounded vowel (front /i/): the exceptions are Vakh–Vasyugan Khanty, in which /i/ and /i̥/ are in opposition in initial syllables, and they alternate due to harmony in non-initial syllables; and Seto, in which /i/ and /i̥/ are in opposition in initial syllables, but only /i/ occurs in non-initial ones. In addition, in Southern Khanty, there was no phonemic /i̥/, but /i/ also had an allophone [i̥], which could occur in non-initial syllables due to VH (Fejes 2021c: 135). Hungarian is a specific issue, since there is no /i̥/, but /i/ can exceptionally alternate with /jɒ/ (/ne:z-i/ |look-3SG.DO| : /la:t-jɒ/ [la:ccɒ] |see-3SG.DO|) or /ja:/ (/ne:z-ik/ |look-3PL.DO| : /la:t-ja:k/ [la:cca:k] |see-3PL.DO|).

Similarly, most languages have no back unrounded vowel (/ə/) among mid vowels: the exceptions are Seto and Votic, in which /e/ and /ə/ are in opposition in initial syllables, and they alternate due to harmony in non-initial ones. (In Vakh–Vasyugan Khanty, there is no /ə/, and /e/ occurs only in initial syllables.) Again, in Southern Khanty, there was no phonemic /ə/, but /e/ also had an allophone [ə], which could occur in non-initial syllables due to VH (Fejes 2021c: 135). Standard Hungarian is peculiar again, since /e:/ sometimes stays away from alternation, and sometimes alternates with /a:/ (depending on the suffix: /ke:r-ne:k/ both |ask.for-COND.1SG| and |ask.for-COND.3PL.DO|, but /kɒp-ne:k/ |get-COND.1SG|

¹³ Since Mansi VH is described in Kannisto (1914), written before the concept of *phoneme* became general, and no reliable phonematization is available, (Southern) Mansi VH will be ignored. It is noteworthy that back members of the alternating pairs are usually lower than their front counterparts – it is not clear whether the difference is phonemic or phonetic.

and /kɒp-na:k/ |get-COND.3PL.DO|). In dialects preserving /e/, it alternates with /o/ due to front/back harmony, but in a front environment, it also alternates with /ø/ due to rounding harmony (/ke:z-hez/ |hand-ALL|, /la:b-hoz/ |foot-ALL|, /fyl-høz/ |ear-ALL|). In Standard Hungarian, in which /e/ and /ɛ/ were merged, /ɛ/ participates in the same alternation (/ke:z-hez/ |hand-ALL|), in addition to the /ɛ/ : /ɒ/ alternation (/kɛrt-bɛn/ |garden-INE|, /ha:z-bɒn/ |house-INE|).

In languages in which /i/ and /e/ are not alternating due to VH, these phonemes behave in various ways as triggers. Triggers might act in two ways: as sources and triggers with respect to other sources (cf. Rebrus & Törkenczy 2016: 240). In the former case, the question is whether they can or must be followed by the front members of vowel pairs alternating due to VH when they are in the initial syllable. In the latter case, the question is about transparency: whether they must or can be followed by an alternating vowel belonging to the same class as the one preceding them.

As for triggers as sources, one of the extremes is Udmurt,¹⁴ in which /i/ and /e/ never trigger the frontness of the alternating vowels – which is not surprising, as there is also vacillation after low and rounded front vowels. The other extreme is Western Mari, in which /i/ and /e/ are practically never followed by back vowels. Other languages are usually between the two extremes in their own way. E.g. in Southern Khanty, /i/ and /e/ could optionally be followed by back vowels only when they occurred with their back allomorphs (see Fejes 2021c: 134–137 for details). In Finnish, stems containing only non-low unrounded front vowels must be followed by the front allomorphs of inflectional morphemes (except for the cases of /ver-ta/ |blood-PART| and /mer-ta/ |sea-PART| – see Fejes 2021d for an explanation), while derivational morphemes can appear both with their front or back allomorph – usually depending on the suffix; sometimes even vacillation is possible. In Hungarian, monosyllabic stems with /i/ or /i:/ can be suffixed either with front or back suffixes, depending on the stem (/hi:d-nɒk/ |bridge-DAT|, /vi:z-nɛk/ |water-DAT|). There are some stems with /e:/ as well which take back allomorphs of harmonizing suffixes ($\widehat{tse:l-nɒk/}$ |target-DAT|), and also some exceptional stems with /ɛ/ which are vacillating between front and back allomorphs (/ʃvɛjts-bɛn/ ~ /ʃvɛjts-bɒn/ |Switzerland-INE| – also /ʃva:jts-bɒn/).

As for triggers with respect to other sources, Udmurt and Western Mari can

¹⁴ Below, Udmurt is always understood as the dialects of Udmurt exhibiting VH, especially Tatyshly and Krasnoufinsk Udmurt, the VHs in which are described in Kelmakov (1975; 1998: 72–73) and Fejes (2019).

be again considered as two extremes: in Udmurt, /i/ and /e/, which can follow any vowel, are always followed by the back members of alternating vowel pairs and in Mari with the front ones. However, these vowels are neutral in the sense that they can follow any vowel. In Western Mari, these vowels can be analyzed as neutral to the left but front harmonic to the right. Conversely, in Udmurt the analysis that they are neutral to the left but back harmonic to the right (despite being front phonetically) would be misleading. In Udmurt, there is a harmonicity slope favouring back vowels, and a third-syllable front low or rounded vowel is rare even after two front low or rounded vowels in the initial syllables. Finnish can be considered as a third kind of extreme, since non-low unrounded front vowels are always transparent.¹⁵ Hungarian is special again, since a single /i/ or /i:/ in the stem¹⁶ is always transparent (although see Fejes & Rebrus 2019), an /e:/ is transparent or vacillating, and /ɛ/ is opaque (followed by front or back vowels) or vacillating (the phenomenon is often referred to as *height effect*, see Hayes & Cziráky Londe 2006). In addition, front suffixation is more probable in those cases, where more of these vowels follow each other, e.g. /ɒli/ ‘Ali’ takes back suffixes, but /ɒlibi/ ‘alibi’ can take both front and back suffixes (the phenomenon is often referred to as *count effect*, see Hayes & Cziráky Londe 2006).

In the case of Kamas, the problem of transparency is a bit obscure. There is an /ɑ/ : /e/ alternation (Klumpp 2016: 41), and forms like /mõndõr-bi-ɑl/ |look-PST-2SG| (Klumpp 2016: 30) suggest that /i/ is transparent, or at least it can be transparent. Still, the existence of an additional phoneme, /æ/ is also possible (Klumpp 2016: 40). If /æ/ exists, we must suppose an /ɑ/ : /æ/ alternation instead of /ɑ/ : /e/. In this case, the behavior of /e/ is unclear. According to Castrén (1854: 36), /e/ can be transparent, but his example (*saderlam* ‘erschüttern’, |shake(?-FUT-1SG)|) seems to contain [ǝ]: cf. *sadër-i-m* |shake-FUT-1SG| – Klumpp 2016 : 70).¹⁷

¹⁵ For vacillating foreign stems like *adverbi* ‘adverb’, *arkkitehti* ‘architect’, *ateisti* ‘ateist’, *karamelli* ‘candy, caramel’, it is more likely that front suffixation is a result of analyzing them as compounds (cf. Kuznetsova 2006).

¹⁶ In suffixes, non-alternating /i/, /i:/ and /e:/ are always transparent, while /i/ and /e:/ in alternating suffixes are always followed by the front allomorphs. Stems containing a final-syllable /i/, /i:/, /e:/ or /ɛ/ preceded by a back vowel differ in whether they take just back or front alternating suffixes, or, if they vacillate, how much they prefer front or back suffixation – even stylistic parameters can play a role, see Forró (2013).

¹⁷ The identification of the two forms with each other is problematic, mainly because Castrén (1854) fails to define the form of the verb (*erschüttern* most probably must be interpreted as the infinitive, that is, as the base form of the verb). However, according to Klumpp (2016: 51) “The

Some of the Uralic languages with canonical front/back VH, such as Western Mari, Udmurt, Southern and Vakh–Vasyugan Khanty and Kamas, also have unrounded reduced vowels, and in all cases, front and back ones are opposed: /*ẽ*/ vs. /*õ*/.¹⁸ In all the languages except for Kamas, the two phonemes alternated due to VH in non-initial syllables. In Kamas, there was just one reduced vowel /*õ*/ in non-initial syllables (although, it underwent total harmony after rounded vowels, see § 4.1.2).

2.2.2 The behavior of non-low rounded vowels in non-initial syllables

While front non-low unrounded vowels occur in non-initial syllables in all the languages with canonical VH, back non-low rounded vowels are sometimes restricted in this position. In Hill Mari and Khanty, rounded vowels in non-initial syllables are practically prohibited. In Northwestern Mari, rounded vowels can occur in non-initial syllables due to rounding harmony (see § 3.5),¹⁹ in Kamas, due to total harmony (see § 4.1.2). In most of the Estonian dialects and in Udmurt, the distribution of back rounded vowels in non-initial syllables is restricted in another way: there is no opposition between the high and mid vowels. In most of the Estonian dialects, only /*u*/ occurs in non-initial syllables (and in some dialects it alternates with /*y*/).²⁰ In Udmurt, only /*o*/ occurs in non-initial syllables, but it never alternates with /*ø*/. In some other languages, e.g. Finnish or Hungarian, rounded vowels, both back and front ones, are common in non-initial syllables (see also § 3.1 on Hungarian rounding harmony).

most frequent future tense marker is -LA; less often, and only with transitive verbs, occurs -Lji”. Additionally, “in the »Fat dialect« [...] the initial *l* is dropped in the present tense of *r*-stems, e.g. *münör-ie-m* ‘I beat’ (< *münör-lie-m*)” (Klump 2016: 56). These claims support the assumption that, despite the phonetic differences, the grammatical forms are identical. Consequently, the vowel marked as *e* by Castrén (1854), which he claims to be transparent, is a schwa.

¹⁸ In Kamas, the traditional transcription for them is *i* vs. *ä* (Klump 2016: 40), which suggests a considerable difference in height as well.

¹⁹ Based on the texts published by Bereczki (1971: 39–47), the situation is similar in the Lipsha dialect.

²⁰ According to Kiparsky & Pajusalu (unpublished: 2), /*o*/ occurs in non-initial syllables in Seto, in the Northeastern and the Northern Tarto dialects, but it alternates with /*ø*/ only in Northern Seto and the Northeastern dialect. Nevertheless, according to Wiik’s map (1988: 153), the isogloss between the Seto dialects with and without /*o*/ : /*ø*/ alternation runs from north to south. Kiparsky & Pajusalu (unpublished: 5) also state that in “Western Seto (where our field work was done), the front vowel *õ* is restricted to initial syllables”, but in the footnote they contrast Western Seto with Northern Seto.

3 Quasi-canonical vowel harmony

In quasi-canonical harmonies, harmonic classes can be distinguished, and harmony can spread to several syllables; however, quasi-canonical harmonies show considerable differences from canonical ones. Quasi-canonical harmonies in the Uralic languages are very different from each other, every type represents a very distinctive system of VH. In the following sections, the Hungarian rounding harmony (§ 3.1), the Nganasan quasi-rounding harmony (§ 3.2), the Mordvinic vowel-consonant harmony (§ 3.3), the Eryza height harmony (§ 3.4) and the Mari strengthening harmony (§ 3.5) are discussed in more detail.

3.1 Hungarian rounding harmony

Only /ɛ/ (or dialectal /e/) and /ø/ alternate in rounding harmony. Their long counterparts /e:/ and /ø:/ do not show a similar alternation, despite that they are phonetically more similar to each other than /ɛ/ and /ø/. All front vowels (/i/, /i:/, /ɛ/, /e/ vs. /y/, /y:/, /ø/, /ø:/) serve as triggers, but back vowels are neutral, as they do not alternate and do not serve as triggers.

The domain of Hungarian rounding harmony is limited by the restricted set of harmonizing vowels: otherwise, rounding harmony can spread along even whole multisyllabic words such as /tɛr-ɛtɛk-hɛz/ |square-2PL-ALL| vs. /tø:r-øtøk-høz/ |dagger-2PL-ALL|. In suffixes exhibiting /ɛ/ : /ø/ alternation, there is also an allomorph with /o/ : /tor-otok-hoz/ |wake-2PL-ALL|.

However, it would be misleading to say that rounding harmony is parasitic²¹ on frontness: this could be said if there was at least one back rounded : unrounded pair of potentially alternating vowels, which would not participate in rounding harmony. Similarly, it cannot be stated that rounding harmony is parasitic on midness, since high front rounded vowels /y/ and /y:/ also trigger the roundedness of the short front mid vowels.

3.2 Nganasan quasi-rounding and front/back harmony

Nganasan has two different VH systems: quasi-rounding and front/back. Since the latter is stated to depend strongly on the former, they are discussed together.

²¹ As it is defined in Steriade (1981): a harmony due to a given feature is parasitic on another feature if harmony works only if both the trigger and the target share a given value of that other feature.

In the quasi-rounding harmony (Fejes 2018; 2019), two harmonic classes can be distinguished: U class²² contains all the rounded vowels, including the diphthong /ɨɑ/ (provided it is not an allophone of /ɑ/, cf. Fejes 2018) and /ɑ/; the Ī class²³ contains the unrounded vowels, except for /ə/, which does not belong to either class. Since the two classes do not clearly correspond to phonetically rounded vs. unrounded vowels, the term quasi-rounding harmony is reasonable.

The vowel /ə/ never alternates with any other vowel in suffixes, and the two other mid vowels, /e/ and /o/ never occur in suffixes (and generally in non-initial suffixes). All the other vowels, i.e. /i/, /ĩ/, /u/, /y/, /ɑ/, and the diphthongs, /ĩɑ/ and /ɨɑ/, occur in suffixes both alternating and not alternating due to VH. The alternation can be restricted to rounding (/i/ : /u/, /ĩ/ : /y/, and in the alternating part of diphthongs /ĩɑ/ : /ɨɑ/), affecting both height and rounding (/i/ : /ɑ/, /ĩ/ : /ɑ/, /i/ : /ɨɑ/, /ĩ/ : /ɨɑ/), and can be manifested in diphthongisation with partial fronting (/ĩɑ/ : /ɑ/).

It is generally held that it is a lexical feature of the stem which allomorph it is suffixed with (although there is no absolute consistency due to historical processes, mainly language loss). However, Fejes (2018) demonstrated that the harmonic class of the stem can be predicted with high probability based on the vowels in the stem, and even those cases can be well defined in which the harmonic class of the stem is not predictable. If a stem contains exclusively vowels belonging to the U or Ī class (more than 70% of the stems are such), in the overwhelming majority of cases (> 90%) the stem belongs to the same class. The case is similar if we just look at the last two syllables of the stem containing vowels belonging to different vowel classes: if the last two vowels belong to the same class, the stem belongs to that class in the overwhelming majority of cases. Still, if the last two vowels of a stem (being bisyllabic or longer) belong to different classes, or both vowels are /ə/, it is completely unpredictable which class the stem belongs to (50–50%). If the last two syllables contain a vowel belonging to a harmonic class and an /ə/, the stem will belong to the same class in 60-70% of the cases.

²² In the sources on Nganasan earlier than Fejes (2018), e.g. Helimski (1998a: 492), Várnai (2002: 57), stems were classified as belonging to either class U or class Ī. Instead of that, Wagner-Nagy (2018: 78–80) uses the term [+back] and [–back] stem classes, based on whether they contain historically back or front vowels. In this paper, vowels are also classified as belonging to either class U or class Ī, according to the type of stems they occur in. In harmonic suffixes, they occur after stems belonging to the given class.

²³ Or Ī (Várnai 2002) or I (Fejes 2018) class, depending on the transcription used.

The Nganasan quasi-rounding harmony exhibits many unusual peculiarities. There are many non-alternating suffixes with vowels belonging to one of the harmonic classes (that is alternating in other suffixes). There are relatively many antiharmonic stems (which belong to the opposite class instead of the one expected based on the quality of their vowels). Not even /ə/ is neutral in the way vowels are in other harmony systems: while it is neither transparent, nor opaque, it does not tend to any of the harmonic classes. It can spoil harmony even when it does not stand between the harmonic vowel of the stem (the trigger) and the vowel of the suffix (the target), but before both of them. Consequently, it is questionable whether it is well-grounded to analyze the Nganasan quasi-rounding harmony as a (morpho)phonological process. Maybe it is more reasonable to say that predictability is just a historical relic of a vanished VH system, which has no significance in synchronic phonology.

In addition, Nganasan exhibits front/back harmony, which occurs when both the trigger and the target are high. This means that if final-syllable /i/ or /y/ are followed by a suffix harmonizing in quasi-labial harmony, showing /i/ : /u/ or /i/ : /a/ alternation, /i/ appears instead of /i/, and /y/ appears instead of /u/ in these suffixes. The assimilation happens even when there is no agreement in rounding: /bahi-dy/ [reindeer-3SG] (Wagner-Nagy 2018: 80). Besides /i/ and /y/, /e/ is the only front vowel, occurring only in initial syllables, thus it has not got much chance to trigger the fronting of a suffix.

Based on the data presented in Fejes (2019: 110–114), it can also be concluded that front/back harmony is a strong tendency even inside stems. In 62% of bisyllabic stems containing high vowels, the two vowels are the same (in the case of even distribution, it would be 25%), and in the 80–100% of the cases both are front or back (while the correlation in roundedness is lower, 44–77%).

3.3 Mordvinic (Erzya) vowel-consonant harmony

The literature usually speaks about VH in Mordvinic (Keresztes 1990: 37; Bartens 1999: 66–67; Kabaeva 2001; Polyakov 2012: 262),²⁴ although some

²⁴ In the literature in Russian, in addition to *гармония гласных* ‘vowel harmony’, the term *сингармонизм* (~ synharmonism) is used. It is not always clear whether these terms are used as synonyms or they indicate distinct phenomena. Polyakov (2012) defines *сингармонизм* as “морфонологич. явление, состоящее в единообразном вокалич. (иногда и консонантном) оформлении слова” (morphophonological phenomenon, consisting in a uniform vocalic (sometimes consonantal) construction of the word). Kabaeva (2001: 5) also writes that “В мордовских языках сингармонизм отличается от гармонии гласных

researchers argue against it (Bubrikh 1953: 36).

As for Moksha, the phenomena labelled VH can hardly be accepted as cases of VH, since the trigger is always a consonant: e.g. /kaɫ-ga/ |fish-PROL| : /kaɫi-gæ/ |willow-PROL|. There are only some marginal dialectal phenomena which can be analyzed as vowel-to-vowel assimilation, e.g. the alternation in the abessive case suffix /-ftəma/ [-ftəma] : /-ftəmə/ [-ftəmə] (or : /-ftimə/ [-ftimə]) (Kabaeva 2001: 10), although it remains unclear even in this case whether the assimilation happens directly or through the allophonic palatalization of the consonant in between.

In the case of (Standard) Erzya, it seems to be more justified to speak about front/back VH, because there are cases when undoubtedly vowels trigger vowel alternation: /kudo-so-nzo/ |house-INE-3SG| : /velie-se-nze/ |village-INE-3SG|. In such cases, consonants do not participate in the alternation either as triggers or targets. At the same time, palatalized word-final consonants trigger the palatalization of suffix consonants: /kaɫ-t/ |fish-PL| : /kaɫi-ti/ |willow-PL|. The two processes are in such a strong interaction that they can be considered to be different manifestations of the same phenomenon. On the one hand, the frontness of a last-syllable vowel triggers the palatalization of the suffix: (/kudo-t/ |house-PL| : /velie-ti/ |village-PL|); on the other hand, the palatalizedness of the consonant triggers the frontness of the harmonizing vowel, either directly or through non-alternating consonants: /kaɫ-oni/ |fish-GEN| : /kaɫi-eni/ |willow-GEN|; /kaɫ-so/ |fish-INE| : /kaɫi-se/ |willow-INE|. Both the palatalizedness of the stem-final consonant and the frontness of the last-syllable vowel can trigger both the palatalization of the suffix consonant and the fronting of the suffix vowel: /kudo-vtomo/ |house-ABE| : /velie-vtieme/ |village-ABE|; /kaɫ-do/ |fish-ELA| : /kaɫi-die/ |willow-ELA|. As a consequence, it is more appropriate to speak about vowel-consonant harmony than VH. Nonetheless, as it can function as a simple VH as well (see the first example in this paragraph), it is reasonable to discuss this phenomenon in an overview of VHs in Uralic.

Among the consonants, only alveolars are in opposition with respect to palatalizedness: /t/ vs. /tʲ/, /d/ vs. /dʲ/, /s/ vs. /sʲ/, /z/ vs. /zʲ/, /ʈs/ vs. /ʈsʲ/, /n/ vs.

других финно-угорских языков. [...] мордовская гармония гласных тесно связана с палатализацией согласных [...]” (Synharmonism in Mordvinic languages differs from VHs in other Finno-Ugric languages [...] Mordvinic VH is closely related to the palatalization of consonants). Thus, we can conclude that at least some researchers use these terms as synonyms. Instead, Rédei (1976: 422) defines synharmonism as the agreement of consonants and vowels (both palatalized/front or velarized/non-palatalized/back), i.e. vowel-consonant harmony.

/nʲ/, /l/ vs. /li/, and /r/ vs. /ri/. All other consonants are neutral and transparent for harmony (although some of them can be palatalized phonetically). In inflectional suffixes, the alternations /t/ : /tʲ/, /d/ : /dʲ/ and /n/ : /nʲ/ are attested, while /s/ and /z/ never undergo harmony, and even prevent the palatalization of other consonants in the same cluster, even though they are transparent for VH. Alveolar affricates, laterals and trills are not attested in inflectional (or undoubtedly productive derivational) suffixes. But as Fejes (2021a) demonstrated, for laterals and trills, and also stops, there is a strong tendency to undergo harmony inside stems, while for sibilants and affricates this is not true.

Standard Erzya has a five-vowel phoneme system, but only /e/ and /o/ alternate with each other. It is noteworthy that the alternants differ both in frontness/backness and rounding. The vowel /u/ never occurs in suffixes and is rare in non-initial syllables; the vowel /i/ is also rare in non-initial syllables, but it occurs in suffixes, above all in some inflectional suffixes of verbs. Conversely, /a/ is quite frequent in non-initial syllables, and it can follow any other vowel. Non-harmonizing vowels are always opaque for front/back harmony.

There are some dialects in which there is an /u/ : /i/ alternation in all the positions where there is /o/ : /e/ alternation in Standard Erzya.

3.4 Erzya height harmony

Erzya also has dialects in which both alternations due to vowel-consonant harmony /o/ : /e/ and /u/ : /i/ occur. It depends on other vowels of the word whether high or mid vowels occur at a given position (Bubrikh 1953: 8–11; Cyganov 1959; Kabaeva 2001: 13–14). In some of these dialects, usually high vowels alternate with each other, but if the vowel in the initial syllable is mid, all harmonizing vowels are also mid vowels: /kudu-su-nzu/ |house-INE-3SG|, but /velʲe-se-nze/ |village-INE-3SG|. In some other dialects, /o/ : /e/ is the default alternation, but if the first vowel is high, it is followed by high harmonizing vowels, except for the last one: /kudu-su-nzo/ |house-INE-3SG| : /velʲe-se-nze/ |village-INE-3SG|. ²⁵ These phenomena can be analyzed as height harmony, and in the latter case, the harmonic domain spreads until the penultimate syllable.

²⁵ In both cases, high vowels are followed by high vowels, and mid vowels are followed by mid vowels. The default alternant is the one that is attested after /a/. However, when we find mid vowels after /a/, a possible analysis is that the default high vowel was lowered after a non-high vowel.

In other dialects, in which /o/ : /e/ is the default alternation, we find /i/ : /u/ alternation when alternating vowels are followed by /a/: /keniḡili-tiāno/ instead of Standard Erzya /keniḡeli-tiāno/ |lie-PRS.1PL|. Cyganov (1959) refers to this phenomenon as regressive assimilation. Still, it is clearly a dissimilation process, thus we cannot speak about harmony, despite that the phenomenon is obviously related to the ones presented above. It could be possible to analyze the process as follows: the rising of the vowel in the syllable before /a/ is dissimilation, but the rising of the preceding vowel(s) is regressive harmony. In this case, we should explain why similar rising does not happen before /i/ segments not derived by the assimilation process (but being „underlying”).

3.5 Meadow Mari strengthening harmony

Meadow Mari has seven full (/i/, /y/, /u/, /e/, /ø/, /o/, /a/), and one reduced vowel (/ǃ/). It is a unique phenomenon that /ǃ/ is the only harmonizing vowel, but only word-finally. In all other cases it is not just neutral (does not undergo harmony), but it is also transparent (in fact, the only transparent vowel): [kuḡo] ‘house’ : [kuḡǃ-fto] |house-INE| : [kuḡǃ-ftǃ-ʒo] |house-INE-3SG|. ²⁶ When the last full vowel is rounded, the word-final vowel is rounded and agrees in frontness/backness with that vowel: we find [o] after /u/ and /o/, and [ø] after /y/ and /ø/. (As rounded vowels usually do not occur in non-initial syllables in Mari, when the word-final vowel is round, the trigger is in the initial syllable, and all the other vowels can be only /ǃ/s, as in the example above.) In every other case, the word final vowel is [e], independently of whether the trigger is front or back.

This [e] : [o] : [ø] alternation can be compared to the Hungarian /ɛ/ : /o/ : /ø/ alternation. A striking difference is that while there is /o/ in a suffix after a stem with a final-syllable unrounded back vowel in Hungarian (/moskva:-hoz/ |Moscow-ALL|), [e] appears in a similar position in Meadow Mari ([moskva:-fte] |Moscow-INE|). This can be interpreted as front/back harmony is dominant over rounding harmony in Hungarian, and rounding harmony applies only when front/back harmony makes it possible, i. e. when

²⁶ According to Berczki (1990a: 28–29), there are dialects in which all /ǃ/s are assimilated to the preceding rounded front vowel. In a subdialect of the Vятka dialect, they become front rounded (marked as *ũ*, by all probability, IPA [ɥ]); in the Ufa dialects, they are completely assimilated to /y/ (they are also realized as full vowels), while they are realized as *ǃ̃* [ø] after /ø/. However, Berczki does not discuss what happens after back rounded vowels.

the vowel is front. On the contrary, in Meadow Mari, rounding harmony is the dominant one, and front/back harmony applies only when rounding harmony makes it possible, i.e. when the vowel is rounded.

Above, the phonetic transcription is used for Mari data, because it is not straightforward that Meadow Mari VH is phonemic. First, the assimilated vowel is usually shorter, and its articulation is not as clear as that of the phonemic /o/, /ø/ or /e/. Second, in Standard Meadow Mari the stress is always on the last full vowel, but never on [o], [ø] or [e] emerging due to VH. (The weaker articulation can also be explained by the unstressed word-final position.) In eastern dialects, mostly spoken in Bashkortostan, it is always the last syllable that is stressed (Bereczki 1990b: 15); therefore, it is more reasonable to see harmony as phonemic in these dialects.

The harmonic domain in Meadow Mari can be longer than two syllables in a very special way: when the trigger and the target are separated by transparent vowels. These transparent vowels differ from the target only in one aspect: position.

As harmony does not manifest on word-internal /ǝ/s, it seems that the main point of the phenomenon is not the spreading of an articulatory or perceptual feature, but the strengthening of the word final /ǝ/. The word-final, characterless /ǝ/ takes features from the closest full vowel to sound more characteristic. As strengthening is unusual in a word-final position, where rather weakening could be expected, it seems that this process has functional reasons. It is sure that some word forms are distinguished only by the word final /ǝ/, e.g. [kuðǝ-ʃt] |house-3PL| : [kuðǝ-ʃto] (in dialects without VH: [kuðǝ-ʃtǝ] |house-INE|. Since the loss of /ǝ/ in this case would result in homonymy in the paradigm, the strengthening of the /ǝ/ is reasonable. This issue needs further investigation.

As in Meadow Mari /ǝ/ is realized as [e] word finally after all unrounded vowels, including word forms with no other vowels than /ǝ/ (e.g. [jǝlmǝ-ʃtǝ-ʒe] |language-INE-3SG|), it is questionable whether these cases can be called harmony (assimilation, agreement). An alternative explanation for the unrounded realization can be that /ǝ/ is unrounded itself. If so, we can speak about harmony in the case of rounded vowels (but then about front/back harmony at the same time).

In Northwestern Mari, in addition to front/back harmony, there is also a type of harmony which is similar to the Meadow Mari one (Ivanov & Tuzharov 1970: 44–54). In Northwestern Mari, [o] or [ø] are attested after rounded vowels word-finally in morphemes where a reduced vowel occurs otherwise.

However, after unrounded vowels, [ɛ̃] or [ɟ̃] is attested both word-internally and word-finally (instead of word-final /e/ in Meadow Mari).²⁷ (The two reduced vowels /ɛ̃/ and /ɟ̃/ occur usually in the same position as /ɔ̃/ in Meadow Mari; but they are in a front/back opposition in initial syllables, and their distribution is controlled by front/back harmony in non-initial ones.)

4 Non-canonical cases of harmony

In non-canonical harmonies, vowels assimilate to each other, but there are neither harmonic classes, nor iterative assimilation. This section also presents cases in which vowel-to-vowel assimilation must or at least can be supposed historically but is not observable synchronically. § 4.1 discusses the cases of total harmony and § 4.2 describes alternations in initial syllables (umlaut).²⁸

4.1 Total harmony

In total harmony (TH), all the features of the trigger spread to the target, and there is full correspondence between the features of the vowels in the harmonic domain, i. e. the same vowel is attested in all the syllables of the domain. If all the vowels were triggers, and the domain was the word, every word could contain just identical vowels. Additionally, each vowel would form their own harmonic class. It is no wonder that, at least in the Uralic languages, usually just a restricted set of vowels trigger and undergo harmony, and the domain

²⁷ Berezcki (1990b: 13–14) argues that the Yoshkar-Ola dialect, classified as transitional between western and eastern dialects by Mari linguists, belongs to the western ones due to the greater proportion of western features. He mentions the lack of front/back harmony among the eastern features but does not mention the existence of rounding harmony. Nonetheless, the example text for the dialect (Berezcki 1990b: 84–85) shows the existence of rounding harmony (labeled as *strengthening harmony* in this paper). Furthermore, Berezcki (1963: 49) states that in the villages Petyal and Azyal, rounding harmony is stronger than in other Yoshkar-Ola subdialects. In some suffixes even (non-final) /e/ alternates with /ø/ after front rounded vowels. In addition, /ɔ̃/ is realized as [ɔ̃] after any rounded vowel (including front ones). In any case, the VH systems of Mari dialects need further investigation.

²⁸ According to Urmanchieva (2019: 97–98), there is another type of non-canonical vowel harmony in the Narym dialect of Selkup, different from any harmony systems discussed here. As she states, /e/ appears in verbal personal suffixes after tense or mood markers containing front vowels, while no vowel appears otherwise. This seems to be related to the historical optative suffix */læ/. The form with /e/ is synchronically attested after back vowels as well. Additionally, Urmanchieva states that a similar phenomenon is attested in Vakh–Vasyugan Khanty, but she does not present any examples or references.

of TH is usually not longer than two syllables, i.e. the trigger and the target are in two adjacent syllables.

The Uralic cases of TH are very different from each other. In Lule Saami (§ 4.1.1), only two phonemes take part in it. In Kamas (§ 4.1.2), only one phoneme can be the target, but a phonologically determined set of vowels can be triggers. In Tundra Nenets (§ 4.1.3), practically any vowel can be a trigger, but just a restricted set serves (or can serve) as targets. In Nganasan (§ 4.1.4), in more regular cases it occurs as the diphthongization of the target, and it seems to be highly morpheme-dependent. In Finnish (§ 4.1.5), any vowel can be the trigger, but the phenomenon is restricted to one morpheme, and it is almost impossible to determine what the target vowel is.²⁹

4.1.1 Total harmony in Lule Saami

Tamás (2006) devotes her paper to prove that there is VH in Lule Saami. She argues for no less than two different types of VH, a progressive and a regressive one (for the latter, see § 4.2.4). She labels the progressive one as *å*-harmony (Tamás 2006: 19–21), according to which initial-syllable /ɔ:/ cannot be followed by a second-syllable /ɑ:/, but an /ɔ:/ appears instead.³⁰ In Northern Saami words, corresponding to Lule Saami words such as /pɔ:r:ɔ:t/ |eat.INF|, /lɔ:hk:ɔ:t/ |read/learn.INF|, /tɔ:l:ɔ:/ |fire.NOM.SG|, /jɔ:hkɔ:/ |river.NOM.SG|, /o/ is attested in the initial and /a/ in the second syllable (/por:at/, /lohkat/, /tol:a/, /johka/, respectively). In Lule Saami paradigms, where there is an /e:/ : /ɑ:/ alternation in the second syllable otherwise (e.g. /koachte:/ |tent.SG.NOM| : /koachta:j/ |tent.SG.ILL|), /e:/ : /ɔ:/ alternation arises after initial-syllable /ɔ:/ : /mɔ:sk:e:/ |Moscow.SG.NOM| : /mɔ:s:kɔ:j/ |Moscow.SG.ILL|. Although Tamás does not state it explicitly, her data suggest that second-syllable /ɔ:/ occurs only after an initial-syllable /ɔ:/. According to Tamás (2006: 20–21), /ɔ:/ never occurs in further syllables.

²⁹ Based on Helimski (1998b: 553), Selkup also seems to have TH: “While there is no vowel harmony in Selkup, non-Northern dialects tend to assimilate the reduced vowels in their phonetic quality to the vowel of the first syllable: Ket’ *suurəm* [suurüm] ‘animal’, Tym *eləgu* [eləgu] ‘to live’, and this creates an effect similar to vowel harmony”. According to Helimski, the phenomenon is optional. As Helimski (1998b: 553) denies the existence of VH in Selkup, he apparently does not consider this assimilation as VH. Due to the lack of details, Selkup is ignored in this paper.

³⁰ Based on footnote 4 in Tamás (2006: 8), this phenomenon occurs only in the northern and central dialects of Lule Saami.

This is a case of vowel-to-vowel assimilation undoubtedly, but just one vowel assimilates another vowel totally. Although this phenomenon could be described as rounding harmony,³¹ only /ɔ:/ triggers it, and only /a:/ can be its target. The harmonic domain is strongly restricted to the initial two syllables of words. Although it is well-grounded to label this phenomenon VH in the sense of vowel-to-vowel assimilation, this assimilation process strongly differs from the canonical cases of VH, and also deviates from other cases of TH in Uralic languages.

4.1.2 Total harmony in Kamas

Due to the deficient documentation of Kamas (cf. Klumpp 2016: 12–31), many questions of Kamas phonology remain open. Based on the description of Klumpp (2016: 41), there was TH in Kamas: the realization of /ə/ was identical with the realization of the preceding vowel if that was rounded: /tĕme-bă/ [t^hĕmɛ:bă] |rope-3SG|, /sima-bă/ [si:mɑ:bă] |eye-3SG|, /bū-bă/ [bubū] |water-3SG|, /ulu-bă/ [ułubu] |head-3SG|, /koʔbdo-bă/ [k^hobdo:bo] |daughter-3SG|. Nonetheless, it is unclear how we know that stem-internal second syllable rounded vowels (e.g. /ulu/ ‘head’, /koʔbdo/ ‘daughter’) were not the realizations of /ă/. It seems that rounded vowels usually occurred in non-initial syllables when the initial syllable contained a similar vowel. Although the second syllable rounded vowel sometimes differed from the one in the initial syllable, as in /tyʒø/ ‘cow’, and rounded vowels also occurred after unrounded ones in initial syllables, as in /mazăro/ ‘smokehole’ or /măndo-/ ‘see’ (Klumpp 2016: 55), these seem to have been rather exceptional.

The case is complicated by the statement of Castrén (1854: 36–37), according to whom [o] and [ø] never occur in non-initial syllables, and only [u] or [y] can occur following an initial-syllable [o] or [ø], respectively.

4.1.3 Total harmony in Tundra Nenets

Salminen (1997: 36) distinguishes four degrees of vowel length in Tundra Nenets: in addition to plain and stretched vowels (which can be interpreted as short and long vowels), there is a “reduced vowel” (in Salminen’s

³¹ Tamás (2006: 8, 19) analyses it as rounding and height harmony. However, according to Figure 1 (Tamás 2006: 10), /a:/ is the only „lowest” vowel, which is not contrasted to any „low” unrounded back vowel. That is, height difference is phonetic, but there seems to be no reason to analyze it as phonemic.

transcription: ø, IPA /ɘ/) and a “schwa” (in Salminen’s transcription: °, IPA /ə/).³² The reduced vowel is overshoot, and schwa may be even shorter or unrealized.

According to Salminen (1997: 33–34; 1998: 521), any vowel can trigger TH, but only the „reduced vowel” and „schwa” and rarely /a/ can serve as a target. However, TH occurs only when the trigger and the target are separated by /x/, or rarely /ʔ/. Salminen argues that the phenomenon is phonetic, since although the target is qualitatively assimilated, there is still a quantitative difference between an assimilated and a plain or stretched vowel: the ones arising due to harmony are shorter than their plain and stretched counterparts (and assimilation is optional in the case of /a/).³³

4.1.4 Total harmony in Nganasan

Although the descriptions of Nganasan do not mention TH, Fejes (2021b: 249) discusses a case in Nganasan which can be considered as TH. Based on the corpus data of Brykina et al. (2016), there is an adverbializer and a homonymous pronominal lative suffix, both of which show similar alternations. While their form is /ʔa/ following an /a/, it is /ʔja/ following an /i/ or /i:/,³⁴ and /ʔua/ following an /u/. (These suffixes are not attested after any other vowel.) This phenomenon can also be considered a case of TH, although the target is not fully assimilated to the trigger: it is diphthongized, and the first element of it is the same quality as the trigger, while the second element of it retains its quality.

Fejes (2021b: 249) also discusses an augmentative suffix with similar allophones but not so regular alternation: both /ʔua/ and /ʔa/ occur following an /u/.

³² It is not easy to use IPA symbols for Tundra Nenets vowels, primarily because there is no front/back opposition: they are front after palatalized consonants, but back after non-palatalized ones, except for the diphthong /æɛ/, occurring only after palatalized consonants. Burkova (2022: 679) differentiates basic and long vowels, while she labels Salminen’s “reduced vowel” as short and uses the IPA symbol /ʌ/ for it. She labels Salminen’s “schwa” as reduced and uses the symbol /°/ for phonemic transcription (although it is not an IPA symbol) and [ɘ] for phonetic transcription. See Burkova (2022: 678) for further details on the history of terminology.

³³ Berezki (1990a: 28–29) also mentions phenomena which strongly resemble TH, see footnote 27 in § 3.5. Additionally, Zsófia Schön (p.c.) claims that in Surgut Khanty, especially in the Yugan dialect, schwa is usually totally assimilated to the preceding (rounded?) vowel – however, many details are unclear.

³⁴ After /i/, it also occurs in the form [ʔja], although [ja] is considered to be an allophone of /ja/.

Fejes (2021b) fails to mention another suffix sporadically undergoing TH. The perfective suffix usually occurs in the form /ʔə/ or /ʔi/ practically after any vowel, but also in a form /ʔa/ after /a/, /ʔia/ after /i/, sporadically /ʔy/ or non-phonemic [ya] after /y/ (/ʔy/ even after /u/). Although one can hardly speak about a regular alternation, the phenomenon shows some resemblance to TH.

4.1.5 Total harmony in Finnish

Collinder (1960: 208–209) states that “total vowel harmony is found in Finnish and in Yurak³⁵ after *h*”. Ultan (1973: 48–49), based on the evidence of Finnish and other languages, argues that laryngeal consonants are “by far the least resistant to the pervasion of vocalic assimilatory features”,³⁶ and suggests that the reason for TH to occur in the illative suffix in Finnish, in which only front/back harmony is attested in other constellations, is that the illative suffix begins with /h/.

This statement is not convincing. First, there is not always TH after /h/. There is another morpheme similar to the illative suffix -/hVn/,³⁷ the clitic /han/ : /hæn/ (used in various modal functions), which undergoes front/back harmony but not TH. Thus, TH seems to be rather morphologically than phonologically conditioned. (The possibility that the suffixes and clitics behave differently regarding VH cannot be testified, since there are no other cases similar to this.) Second, the illative suffix has an allomorph -/se:n/, occurring after polysyllabic stems ending in long vowels (cf. Hakulinen et al. 2004: §93): /vɑpɑ:-se:n/ |free-ILL|, /tarpe:-se:n/ |need-ILL|, /triko:-se:n/ |tricot-ILL|, /alue:-se:n/ |area-ILL| etc. In the plural illative, the stem-final long vowel changes into a diphthong with a second constituent /i/ (the quality of the first constituent is the same as that of the long vowel in the singular

³⁵ Nenets, see § 4.1.3.

³⁶ This assumption is supported by TH in Tundra Nenets and Nganasan, see also the discussion on Veps in § 2. However, we have to mention that Tundra Nenets /x/ is not a laryngeal (glottal) but a velar consonant, but it is even less “resistant to the preservation of vocalic assimilatory features” than the glottal stop /ʔ/.

³⁷ This allomorph is used after monosyllabic stems, usually ending in long vowels or diphthongs (the exceptions are pronouns, in the case of which we cannot speak about productivity). The other allomorph of the illative suffix is -/Vn/, used with polysyllabic stems ending in a short vowel: in this case, the creation of the form can be analyzed as adding /n/ and lengthening the preceding vowel. Harms (1964: 58) claims /h/ is inserted after monosyllabic stems, which can hardly be supported synchronically (/h/ is not an intrusive consonant in Finnish). Diachronically speaking, this assumption is definitely wrong, since the form with /h/ is older, and /h/ was lost after polysyllabic stems.

forms). This /i/ can be identified with a plural marker usually present in plural forms, and the illative suffix /si:n/: /vapa-i-si:n/ |free-PL-ILL|, /tarpe-i-si:n/ |need-PL-ILL|, /triko-i-si:n/ |tricot-PL-ILL|, /alue-i-si:n/ |area-PL-ILL| etc. This can also be analyzed as TH, restricted to plural forms. The alternation in these allomorphs also suggests that TH is morphologically and not phonologically conditioned. However, it cannot be excluded that the development of the allomorphy of the case suffix is related to the suffix-initial /h/ present in some allomorphs.

4.2 Initial-syllable alternations

Although theoretically it is possible to set up harmonic classes in systems with initial-syllable vowel alternation (henceforth ISVA), vowels cannot be classified into harmonic classes in the existing systems: in some cases, the target is never identical with any possible trigger; in other cases, the same vowel can occur both among the forms with and without the trigger in the second syllable. Moreover, in all cases discussed – Livonian (§ 4.2.1), Pite (§ 4.2.2), Skolt (§ 4.2.3) and Lule Saami (§ 4.2.4), and Eastern Khanty (§ 4.2.5) –, the trigger is synchronically missing in most of the cases, although, supposedly, the alternation historically emerged due to the influence of the vowel in the second syllable.³⁸

4.2.1 Umlaut in Livonian

Livonian exhibits ISVAs, which strongly resemble Germanic umlauts. Kallio (2016: 51–54) differentiates two kinds of umlaut in Livonian: one of the non-high front vowels (rising) and one of the back vowels (fronting – the latter exclusively through labial and velar consonants). As the original */a/s did not merge with the original */æ/s, the former change must have preceded the latter. Both changes were triggered by second-syllable /i/s, and since similar changes had happened before /j/, umlaut must have happened through the palatalization of the consonants (similarly to Germanic): */læmpi/ > */[læmʲbi] > /lem/ ‘warm’; */væljæ/ > */væljʲa/ > /ve:lʲa/ ‘sparse’; */tam:i/

³⁸ ISVA due to height is also suggested for Permic by Rédei (1968: 42; 1975; see also Rédei 1976: 421–422), who labels it as *horizontal harmony*. As he supposes this phenomenon for the era when stem-final vowels were present, it is improbable that the effect of the second-syllable vowel led to alternation (cf. Bátori 1976: 278). Additionally, we have no such alternations in Permic nowadays.

> *[tam:i] > /tæm/ ‘oak’; */topi/ > *[tɔbi] > */tɔbi/ > /teʔb/ ‘disease’; */lumi/ > *[lum:i] > */lymi/ > Old Livonian /lym/ > /luʔm/ ‘snow’ etc.

As stem-final /i/s were in alternation with /e/, and word-final phonemes were dropped, umlaut had the possibility to be grammaticalized, thus the difference in the vowel of the initial syllable gained the role of differentiating various grammatical forms of the same lexeme: */tam:i/ |oak.NOM| : */tam:en/ |oak.GEN| > */tæm:i/ |oak.NOM| : */tam:en/ |oak.GEN| > /tæm/ |oak.NOM| : /tam/ |oak.GEN|. Intra-paradigmatic analogy could delete the traces of umlaut, as in the case of /luʔm/ ‘snow’.

As the examples show, umlaut is not phonologically conditioned in Modern (20th century) Livonian. As it is not a vowel-to-vowel assimilation in any sense, it can hardly be labeled VH. It is also questionable whether it was ever a synchronically active, regular morphophonological phenomenon. It is not clear to what extent it was possible to consider it as VH, if it could have been triggered only through a palatalized consonant.

4.2.2 Vowel harmony and “umlaut” in Pite Saami

Two kinds of ISVA occur in Pite Saami according to Wilbur (2014: 78–81), one of which is labeled VH by him. This phenomenon is characterized by the following vowel alternations both in verbs and nouns: /ɛ/ : /i/, /e/ : /i/, /u̯a/ : /u/, /o/ : /u/, /a:/ : /ɛ/, /ɔ/ : /u/. In addition, the following alternations occur in verbs: /a/ : /i/, /a:/ : /i/, /a/ : /e/; while the /a/ : /ɛ/ alternation occurs only in nouns. The second alternant is always higher than the first one, but the degree of rising is varying. Additionally, in some alternations, the simplification of the syllable structure can also be observed (besides long /a:/ and the diphthong /u̯a/ above, /e/ and /o/ are also realized as a rising, although short diphthongs in initial syllables).

The label VH can be justified by the argument that the second vowel /i/ or /e/ of the stem triggers the change in the first one. However, in some cases, it is doubtful whether the change is assimilation. For example, in the case of /pasa/ |wash.PRS.2SG| : /pis:e/³⁹ |wash.PST.2SG| (Wilbur 2014: 80), a high-mid vowel would change the target from low to high. In cases like /atnet/ |have.INF| : /etne/ |have.PST.2SG|, the alternation cannot be triggered by the vowel of the second syllable, since it is the same in both forms. Furthermore, alternations show a quite chaotic picture; and it seems to be a lexicalized property of the

³⁹ The form /bis:e/ is a typo by all probability, as there is no phoneme /b/ in Lule Saami according to Wilbur (2014: 37, 41–45).

stem which alternation it displays. The alternating vowels cannot be classified into harmonic classes: /ɛ/ and /e/ both occur in the first and second alternants. Wilbur (2014: 79–80) also states that the second alternants appear in given slots of the paradigm, i.e. they are morphologized. Consequently, vowel-to-vowel assimilation can be observed only from a historical point of view, although it remains obscure whether these alternations were ever purely or dominantly phonological, or they have been strongly morphological all the time.

The other initial-syllable alternation discussed by Wilbur (2014: 78–79) is labelled “umlaut”: /ɛ/ : /e/ and /u̯a/ : /o/. Wilbur emphasizes that this type of alternation is not triggered by the phonological environment but occurs between given slots of the paradigm. It is also strongly connected to consonant gradation: usually, the first alternant occurs in the strong grade, while the second alternant in the weak one. It is not clear why the term *umlaut* was chosen by Wilbur, since it is generally used for alternations caused by vowels (Matthews 1997: 388); the common term for similar but phonologically unconditioned, purely morphological alternations is *ablaut* (Matthews 1997: 2).

4.2.3 Pseudo-metaphony in Skolt Saami

A similar phenomenon to Wilbur’s (2014) Pite Saami “vowel harmony” is presented by Feist (2015: 90–94) in Skolt Saami. Height alternation is much more regular in Skolt than in Lule Saami: one alternant is always lower by one degree than the other: /i/ : /e/, /ə/ : /ɐ/, /u/ : /o/, /o/ : /ɔ/. The only exception is when the difference is in frontness/backness, and the “high” alternant is a back /ɑ/, while the “low” alternant is a front /æ/. Height alternation also occurs among diphthongs: /iə/ : /eɐ/, /uə/ : /uɐ/; but there are cases with a simultaneous back/front alternation: /iɐ/ : /eæ/, /uɔ/ : /uæ/.

Feist (2015: 93–94) criticizes the literature using the term *metaphony* for the presented vowel alternations.⁴⁰ He argues that in contemporary Skolt Saami it is impossible to speak about *metaphony* as the presumed one-time triggers were lost, and the alternation occurs between forms lacking any suffix vowels. This argument holds against the use of the term *VH* as well.

⁴⁰ It must be mentioned that the only source Feist refers to is Sammallahti (1998: 61), where Sammallahti speaks about *metaphony* in Proto-Saami, but he does not use the term for any contemporary Saami language.

4.2.4 Regressive vowel harmony (umlaut) in Lule Saami

Tamás (2006) aims to prove that there is VH in Lule Saami (cf. § 4.1.1). She argues for the existence of a kind of regressive VH (in addition to å-harmony). According to her (Tamás 2006: 18–19), the alternation is not triggered by the height of the second-syllable vowel, but a change in the height of that vowel (“coordinated height shift or covariation”): /ɛ:l:o/ |wild.deer.SG.NOM|⁴¹ : /e:l:uj/ |wild.deer.PL.GEN| is an example for rising, /pe:s:et/ |escape.INF| : /pɛ:sa:/ |escape.PRS.3SG| is an example for lowering, and /pʲehket/ |slide.INF| : /pɛ:ka:v/ |slide.1SG| for lowering by two degrees. According to Tamás (2006: 18), Nystø & Johnsen (2001/2: 165–166) labels the same phenomenon “umlaut”.

Although this kind of alternation affects the phonological features of the vowels in the two initial syllables, it is not assimilation: the vowels do not agree in features, but their features change simultaneously. However, the alternation is phonologically conditioned, and differs from the typical cases of morphologized umlaut.

4.2.5 Stem-vowel alternation and progressive height harmony in Eastern Khanty

In Eastern Khanty, there are two kinds of height alternations: one in stems and one in suffixes. According to Filchenko (2007: 29–35), in Vasyugan Khanty we find the following stem vowel alternations:

- in nouns: /a/ : /u/;
- in verbs: /a/ : (/u/ :) /i/, /o/ : /š/, /e/ : /ě/, /š/ : /o/ (the latter only in one verb);
- both in nouns and verbs: /æ/ : /i/, /o/ : /u/, /ø/ : /y/, /ø/ : /ě/.

Alternation may affect height, roundedness or fullness/reducedness or more than one feature at a time (but frontness/backness is never concerned, which can be related to front/back harmony). Alternation is morphologically conditioned, and ISVA can occur even when the second syllable vowel does not change: /otʲ-tʲa/ |swim-INF| : /utʲ-a/ |swim-IMP.2SG|. Even the direction of the alternation can vary: /tšʲ-ta/ ~ /tšʲa-ta/ |throw-INF| : /toʲ-šm/

⁴¹ In other sources ‘reindeer herd’, cf. Ylikoski (2022: 142).

[throw-PST.1SG]; /wos-ta/ |jump-INF| : /wõs-a/ |jump-IMP.2SG| (Filchenko 2007: 30). Additionally, in many stems there is no alternation at all (although this occurs mostly with polysyllabic stems). Based on these facts – and similar descriptions of Vakh (Tereshkin 1961: 20–23) and Surgut (Csepregi 1998: 17–18) Khanty – no phonological reason for the alternation can be determined.⁴²

The height alternation can also be observed in some of the suffixes. According to Filchenko (2007: 29–35), the suffix vowel rises to high when there is a high vowel in the stem: /joyl-am/ |hunting.bow-1SG|, but /sir-im/ |part-1SG|. However, examples like /jo-s-õm/ |walk-PST-1SG| and /wõl-s-im/ |live-PST-1SG| pose the question whether /õ/ counts as a high vowel in this system (or maybe high as a trigger, but non-high as a target?). If there is vowel alternation in the stem, in some word forms the suffix vowel is adjusted to the original, but not the altered stem vowel: /aŋ/ ‘sheep’ : /uŋ-õm/ |sheep-1SG| (although the stem vowel is higher here than in the allomorph -/am/). In some cases, the stem and suffix vowels alter together: /al-ta/ |install-INF| : /ilt-i/ |install-IMP.2SG| (but also /wan-ta/ |gather-INF| : /win-t-a/ |gather-IMP.2SG|).⁴³ Although in the alternation of suffix vowels there are traces of vowel-to-vowel assimilation, it is rather a morphological phenomenon. Tereshkin (1961) does not discuss this process, but it is clear from the description of possessive suffixes (Tereshkin 1961: 33–42) that a similar phenomenon occurs also in Vakh Khanty. Based on Honti (1977) and Csepregi (1998), no similar phenomenon is attested in Surgut Khanty.

For a detailed history of the Khanty stem-vowel alternation, see Honti (1973; 1982: 73–103), Helimski (2001) and Zhivlov (2019). For an overview of these alternations, see Honti (1984: 31–34).

5 Conclusion

If one tried to typify Uralic VH systems based on parameters like the vowel systems they are based on, the features concerned, the length of the harmonic domain, the direction of harmony, the set and the behaviour of neutral vowels, the role of consonants etc., the result would be quite a chaotic picture.

⁴² Filchenko (2007: 32–35) claims some alternation types are accompanied by stress shift, although it remains unclear what the cause is and what the effect is if we can speak about causality at all.

⁴³ The segmentation is based on Filchenko (2007: 34). As Filchenko (2007: 47) describes, “morpheme-final stops preceding other morpheme-initial consonants are [...] frequently deleted”.

Harmony systems can resemble each other to a higher or a lower extent, but their similarities and differences can manifest themselves in very complex ways, and these relations are difficult to picture. Presenting these systems in a spatial arrangement gives a clearer image. In this model, the relations of the VH systems are conceptualized as a loose network, like the relations of the neighbourhoods in an urban area.

City centers are dense, the neighbourhoods are close to each other, although they can be very different from one another. Similarly, canonical front/back VHs in Uralic, if compared, differ greatly (and in various aspects), but compared to other harmony systems, they are strikingly similar. Somewhat paradoxically, similarity is manifested in the way how various harmony systems can be compared with each other: for example, the questions which vowels are neutral and whether they are transparent or opaque cannot even be addressed to non-canonical harmonies, and they are less unequivocally answerable with quasi-canonical harmonies. The iconic places of the city, which usually represent the whole city in the media, are usually found in the center. The iconic examples of Uralic VH, Finnish and Hungarian systems also belong there.⁴⁴

As downtowns are usually relatively densely surrounded by neighbourhoods closely belonging to them, Uralic front/back canonical harmonies can be divided into a central group (inner core) and a satellite group (outer core). VHs with a whole word harmonic domain may be considered as the inner core, while VHs with harmonicity slope belong to the outer core. Abandoned quarters can also occur near downtowns: “suppressed” harmonies can be compared to them.

In cities, there are neighbourhoods which are out of the city center, but belong to the city, and they are not on the periphery. They can be relatively far from the center and each other, separated by non-urban areas (meadows, forest belts, rivers, etc.). Among Uralic harmony systems, quasi-canonical harmonies belong to this group. They show considerable differences from all canonical front/back harmonies and from each other and are also very different from non-canonical harmonies.

⁴⁴ This fact is also driven by the relatively advantageous sociolinguistic situation of these languages. Nonetheless, choosing Hill Mari or Vakh–Vasyugan Khanty front/back harmony to represent Uralic VH would be much more agreeable than the choice of Erzya or Meadow Mari systems (let alone non-canonical ones), because they resemble other systems less than the former ones.

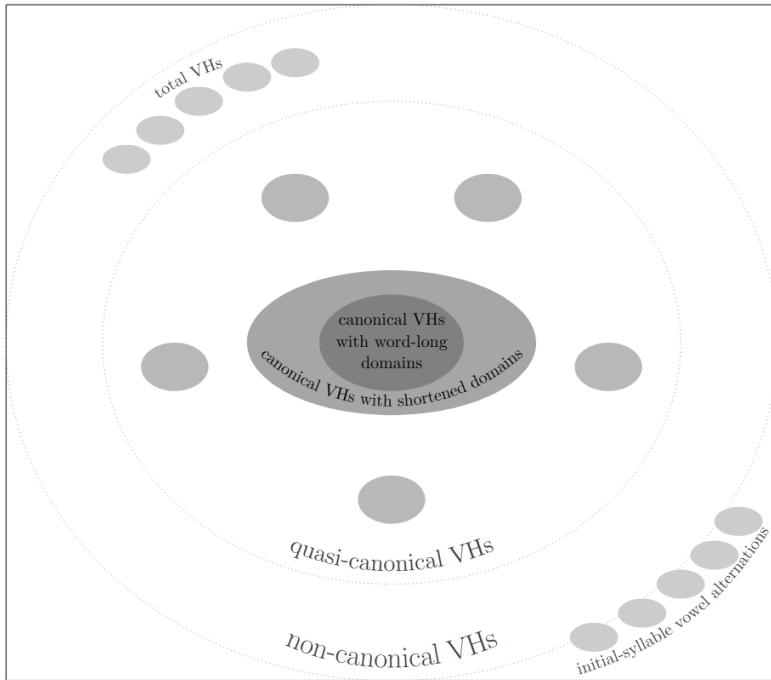


Figure 1. A schematic representation of the VH systems in Uralic languages

The city borders are usually sparsely inhabited, and the neighbourhoods can lie fairly far from each other, sometimes forming tight or loose assemblages. Sometimes it is not clear whether such a neighbourhood is an integral part of the city or rather functions as an independent settlement. Non-canonical Uralic VHs are very different from each other, but they form two loose clusters, those of total harmonies and those of vowel alternations in the initial syllable. The former group is clearly related to canonical and quasi-canonical harmonies in the sense that they exhibit vowel-to-vowel assimilation. However, the latter group fails to show such kind of assimilation (feature agreement); therefore, they must be placed outside the border.

Finally, in order to give an overview also from a taxonomical point of view, the seven groups of Uralic languages distinguished by Saarikivi (2022: 31–32) can be characterized as follows.

- None of the **Saamic** languages exhibits canonical or quasi-canonical VH, but TH and ISVA occur at least in some of them. However, it is completely morphologized and can be labeled as VH only historically.
- Most varieties of **Finnic** exhibit canonical front/back VH, although the harmonic domain stretches along the word in Finnish, Karelian, Votic and Võru/Seto, while it is shortened in Veps and in several Estonian dialects. Canonic VH is completely missing in several varieties of Estonian, including Standard Estonian, but they exhibit “suppressed” harmony. Additionally, Finnish exhibits a very marginal case of TH and Livonian ISVA, although the latter can be labeled as VH only historically.
- Among **Mordvinic** dialects, most of the varieties of Erzya, including the standard, exhibit vowel-consonant harmony with a front/back alternation among mid (or, dialectally, high) vowels and palatalized/unpalatalized alternation among alveolar consonants. Additionally, some dialects have height harmony as well. Moksha lacks VH, only some extremely marginal cases exist in some dialects.
- The varieties of **Mari** exhibit two kinds of VHs, a canonical front/back one, which is typical for Standard Hill Mari, and a quasi-canonical rounding and front/back one, which is typical for Standard Meadow Mari. Some of the dialects, e.g. Northwestern Mari, have both kinds of harmonies. Additionally, by all probability, some dialects exhibit some kind of TH as well.
- In general, **Permic** languages lack VH. In some Udmurt dialects, a kind of canonical front/back VH with a shortened domain emerged.
- All the **Ugric** languages exhibit canonical front/back VH, although not all the dialects of the Ob-Ugric languages. Southern Mansi had a canonical front/back harmony, a restricted variant of which could also be attested in Western Mansi. Harmony was lost in Eastern and Northern Mansi. Since only Northern Mansi is still spoken today, we can say that contemporary Mansi exhibits no VH. In Eastern and Southern Khanty, canonical front/back VH was witnessed at the beginning of the 1900s. The Vakh–Vasyugan group of Eastern Khanty dialects preserved it until today. The Surgut group of the eastern dialects, in which harmony was already vanishing, VH was lost during

the twentieth century. Southern Khanty became extinct before losing harmony. In Northern Khanty, canonical VH was never documented. Eastern Khanty also exhibits ISVA which can be considered VH only historically; additionally, the traces of a historical progressive height harmony are also observable. Hungarian, additionally to canonical front/back VH, also exhibits quasi-canonical rounding harmony.

- Most of the languages of the **Samoyedic** group lack VH. The exceptions are Nganasan with its quasi-canonical quasi-rounding and restricted front/back harmony, and Kamas with its restricted canonical front/back and non-canonical TH. Sporadically, very restricted cases of VH are also reported from Selkup.

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Abbreviations

1	first person
2	second person
3	third person
ABE	abessive
ALL	allative
COND	conditional
DAT	dative
DO	definite object
ELA	elative
FUT	future
GEN	genitive
ILL	illative
IMP	imperative
INE	inessive
INF	infinitive
ISVA	initial-syllable vowel alternation
NOM	nominative
SG	singular
PART	partitive
PL	plural
PROL	prolative
PRS	present
PST	past
TEMP	temporal
TH	total harmony
VH	vowel harmony

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