Constraints on vowel-zero alternations in Hungarian

by

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ABSTRACT

I analyze a large set of Hungarian nominal stems whose last vowel alternates with zero in certain contexts (Vago (1980), Siptár & Törkenczy (2000)): e.g. *bokor* [bokor], *bokr-ok* [bokr-ok]. I argue that the mechanism underlying these alternations is syncope, departing in this from earlier work (Vago (1980), Abondolo (1988), J. Jensen & Stong-Jensen (1988, 1989), Törkenczy (1995), Abrusán (2005)) which assumes epenthesis or metathesis.

My research focuses on which stems fall into this closed group of vowel-zero alternating stems. I show that there is an interaction between phonological processes that repair phonotactically illicit consonant clusters – like voicing assimilation, gemination, affrication – and vowel-zero alternations. I present a proposal relying on underspecification that correctly predicts that these phonological processes block vowel-zero alternations.

The grammar that generates this result includes a ranking schema where the constraint triggering syncope (referred to below as Syncope) is outranked not only by the Markedness constraints that define illicit CC-clusters in Hungarian but also by the faithfulness constraints that are normally violated in the repair of such clusters. The general ranking I will argue for is:

(1) Markedness (*CC for various CCs) » Faithfulness to Cs » Syncope » Max V

I also present results from a nonce word experiment, which confirms that Hungarian speakers are aware of the systematic restrictions my analysis characterizes.

The broad significance of the work is to document a large-scale conspiracy (Kisseberth (1970)) whereby permissible CC clusters emerge in at least two ways: through direct action of repair processes (assimilation or merger of two Cs into one) and through blockage of the syncope process that could yield the inputs to such repairs.

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Chapter 1

Introduction

Suffixes in Hungarian attach to most stems through simple concatenation without changing the stem itself, see example (1). However, certain stems are subject to vowel-zero alternations when followed by certain suffixes as shown in example (2) (cf. Vago (1980), Siptár & Törkenczy (2000)).

(1) szurony + -t [suroɲ+ -t] 'bayonet' + ACCUSATIVE → szuronyt [suroɲt] 'bayonet-ACC'

(2) bokor + -t [bokor + -t] 'bush' + ACCUSATIVE → bokrot [bokrot] 'bush-ACCUSATIVE'

The difference between examples (1) and (2) immediately raises two questions: (i) which stems are subject to vowel-zero alternations and (ii) which suffixes trigger these alternations. This dissertation is primarily interested in the first of these two questions and takes a closer look at the form of vowel-zero alternating stems. However, it also provides an overview of what the suffixes triggering this alternations look like and why exactly these suffixes are the ones that rigger this alternation.

Chapter one provides some necessary background on Hungarian. First, of all the vocalic and consonantal phoneme inventory of the language is introduced in section 2.1, followed by a section on consonantal processes 2.2 and one on vowel harmony 2.3. In section 2.2 three consonantal processes of the language are reviewed in detail: voicing assimilation in section 2.2.1, affrication in section 2.2.2 and gemination in 2.2.3. All three of these processes interact with stem-internal vowel-zero alternations in interesting ways as discussed in chapters 4–6. Vowel harmony is a quintessential part of Hungarian phonology, which is not only responsible for determining the backness and roundness features of suffixal vowels, but also shapes what vowel combinations are possible and impossible in stems in general, cf. section 2.3. Last, but not least, section 2.4 provides a categorization of suffixes based on their initial segments, which is essential to better understand which suffixes trigger vowel zero alternations. Moreover, the section on suffixes also provides some arguments for underspecification of vowel-zero alternating vowels in suffixes.

Chapter two is devoted to vowel-zero alternating stems – often referred to as 'epenthetic' stems in the literature since Vago (1980). This chapter is divided into two main parts: section 3.1 is devoted to nominal vowel-zero alternating stems, while section 3.2 describes verbal vowel-zero alternating stems. The main reason for this division between nominal and verbal vowel-zero alternating stems is that there is a difference in what kind of suffixes trigger stem-internal vowel-zero alternations in the two domains. In the nominal domain it is only vowel-zero alternating suffixes which trigger vowel-zero alternations in stems, while in the verbal domain both vowel-zero alternating and strictly vowel-initial suffixes can trigger stem-internal alternations. There is some variation among the suffixes in both domains in that some trigger stem-internal vowel-zero alternations more reliably than others. This variation is documented and discussed in chapter two as well.

Chapter three presents the results of a detailed study of the Hungarian lexicon. As part of the study of the lexicon two lists of dictionary entries have been created: (i) a list of stems that undergo vowel-zero alternations and (ii) a list of stems which have the same characteristics as vowel-zero alternating stems but which nevertheless do not alternate. First, the restrictions on the form of vowel-zero alternating stems are reviewed. The focus is first on the vowels in vowel-zero alternating stems in section 4.1. This section provides a characterization of the vowel-zero alternating vowels as well as of the vowels preceding the alternating ones. The consonants in vowel-zero alternating stems in particular the ones preceding and following the alternating vowel are under scrutiny in section 4.2. In particular, this section focuses on what clusters can and cannot result from vowel-zero alternations. Last, but not least, a statistical analysis of the comparison of the two lists – the one with vowel-zero alternating stems and the one with vowel-zero alternating stem lookalikes – is provided in section 4.3. The statistical analysis reveals that certain consonantal processes like voicing assimilation, affrication and gemination block syncope, while the presence of a liquid before or after a potentially alternating vowel makes it more likely for a stem to be alternating.

Chapter four provides a formal analysis of the process interactions discussed in chapter three. Although the analysis presented here relies on underspecification, it is not the only possible way to account for the fact that voicing assimilation, affrication and gemination block syncope. However, there is a variety of different issues any analysis should address. First of all, any analysis of vowel-zero alternating stems needs to be able to predict which stems are subject to alternations and which are not. Moreover, any and all analysis of this phenomenon need to capture which suffixes trigger this alternation and which do not. The analysis presented here addresses these issues in section 5.1. The analysis in chapter four also accounts for the fact that consonantal processes like voicing assimilation, affrication and gemination prohibit vowel-zero alternations as shown in section 5.2. Finally, a good analysis of stem-internal vowel-zero alternations also explains which vowels can undergo vowel-zero alternations. This is done here in section 5.3.

The last chapter, chapter five presents the results of an experimental study on vowel-zero alternations in nonce words. Even though, the vowel-zero alternation is not productive in Hungarian, native speakers of Hungarian have intuitions about when it is possible and when it is not possible in nonce words. The study presented here investigated whether the nature of the possible consonant clusters created after syncope have an impact on whether a stem undergoes vowel-zero alternations. The experiment required people to choose between two plural forms of each stem presented to the participants: one that underwent vowel-zero alternation and one that did not. Despite the forces choice task there is an overall high rate of vowel retention in the responses. Although the results are difficult to analyze due to the high rate of vowel retention, they suggests that stems that would necessitate voicing assimilation or affrication are less likely to syncopate than stems in which one of the two consonants surrounding the potentially alternating vowel is a liquid.

The conclusions of this thesis, namely (i) that there is a process interaction between stem-internal vowel-zero alternations and certain consonantal processes, (ii) that people have intuitions about when vowel-zero alternations are possible, and that (iii) vowel-zero alternating stems form only a subset of all stems of the relevant form are summarized in chapter six. Moreover, future research questions regarding the variation presented in vowel-zero alternating stems and in the triggering effect of vowel-zero alternating suffixes as wells as questions regarding potential future experimental investigations and potential alternative analysis are also discussed in chapter six. Last, but not least, a list of the experimental items and the two lists references in chapter 4 are given in the appendix.

Chapter 2

Background on Hungarian

Hungarian is a Uralic language spoken by ∼13 million speakers worldwide, most of whom (∼10 million speakers) live in Hungary in Central Europe. The author of this thesis is a native speaker of the Regional Standard of the Transdanubian dialect area. The Regional Standard of a dialect area is a mixture of Educated Colloquial Hungarian – the language of 'educated' people living in Budapest – and the traditional accent of the region (cf. Antal, Csongor & Fodor (1970), Benkő & Imre (1972), Nádasdy (1985)). This means that there are slight differences in the judgments of the author and the speakers of Educated Colloquial Hungarian in some cases. If and when these differences are relevant to the topic at hand, they will be noted to avoid any further confusion.

This chapter provides a short introduction to Hungarian focusing on phonotactics and some phonological processes relevant to the discussions in this thesis. Section 2.1 contains an overview of the phoneme inventory of Hungarian starting with the vowels in section 2.1.1, followed by the consonants in section 2.1.2. In section 2.2 I present three consonantal process which interact with vowel-zero alternations: voicing assimilation in section 2.2.1, affrication in section 2.2.2 and gemination in section 2.2.3. The third section in this chapter, section 2.3, focuses on the most studied phenomenon in Hungarian phonology: vowel harmony, while the last section, section 2.4, showcases some of the variation found in Hungarian suffixes.

2.1 Phoneme inventory

The Hungarian phoneme inventory consists of 14 vocalic and 24 consonantal segments. The vowels are described in section 2.1.1, while the consonants are discussed in section 2.1.2.

2.1.1 Vowels

Hungarian has 14 vowels: 7 long ones and 7 short ones as shown in Table 1. There are 8 front vowels: 4 of them are rounded and 4 of them are unrounded. The front high vowels are [i, y] and their long counterparts [iː, yː]. Among the front non-high vowels [eː, ø, øː] are taken to be mid, while [ɛ] is often described as phonetically low but phonologically mid (cf. Siptár & Törkenczy (2000)). The front vowel [ɛ] is considered to be low because it is lower than short [e]. However, [e] only exists in certain dialects of Hungarian. In standard Hungarian we find [ɛ] wherever [ɛ] or [e] surfaces in these dialects. This suggests that [ɛ] is described as phonetically low more for historical reasons and not because it is actually phonetically significantly lower than the other non-high front vowels (Miklós Törkenczy p.c.). In table 1 I follow the traditions in the literature in describing [ɛ] as low for the sake of consistency. In section 2.4 I show that [ɛ] behaves similarly to low back vowels in some suffixes, while it behaves like mid back vowels in other cases.

	[–back]				**[+back]**			
	[–round]		**[+round]**		**[–round]**		**[+round]**	
[+high, –low]	i	iː	y	yː			u	uː
[–high, –low]		eː	ø	øː			o	oː
[–high, +low]	ɛ					**aː**	ɒ	

Table 1: The vowel system of Hungarian

There are six back vowels in Hungarian and all but one of them is rounded. The only unrounded back vowel is the long low vowel [aː]. There is one more low back vowel, which is [ɒ]. There are two mid back vowels [o] and its long counterpart [oː] and two high back vowels [u] and [uː]. Length is a contrastive feature of Hungarian vowels, see examples (1) and (2).

(1) a. zug [zug] 'nook'
    b. zúg [zuːg] 'rumble'

(2) a. hidra [hidrɒ] 'hydra"
    b. hídra [hiːdrɒ] 'to the bridge'

In the case of high and mid vowels there is minimal to no quality difference between a short vowel and its long counterpart Siptár & Törkenczy (2000). However, there is more than just length difference in the case of [ɛ – eː] and [ɒ – aː]. These last two pairs are phonetically not really pairs the same way the other short-long vowel pairs are. However, phonologically these two pairs still behave just like all the other short-long vowel pairs. This can be seen in examples (3)–(6).

(3) út + -(V)k [uːt + -(V)k] 'street' + PLURAL → utak [utɒk] 'streets'

(4) kő + -(V)k [køː+ -(V)k] 'stone' + PLURAL → kövek [køvɛk] 'stones'

(5) kéz + -(V)k [keːz + -(V)k] 'hand' + PLURAL → kezek [kɛzɛk] 'hands'

(6) nyár + -(V)k [ɲaːr + -(V)k] 'summer' + PLURAL → nyarak [ɲɒrɒk] 'summers'

Examples (3) and (4) show that the stem internal long vowel in certain stems shortens when it is followed by a potentially vowel-initial suffix like the plural suffix -(V)k. In examples (3) and (4) the shortening vowels are high and mid, respectively, and thus, they only differ in length. Examples (5) and (6) reveal that the same alternation can be observed in the case of [eː – ɛ] and [aː – ɒ], respectively. This suggests that although [eː – ɛ] and [aː – ɒ] phonetically differ in more than just length, they phonologically behave like all the other short-long vowel pairs. Now that we have seen the important features of the 14 Hungarian vowels, let us turn our attention to the consonants.

2.1.2 Consonants

The consonants of the language established based on minimal pairs where they make a meaningful difference are shown in table 2[1]. Hungarian has obstruents – plosives, affricates and fricatives – and sonorants – nasal stops, liquids and a glide. Most of the obstruents come in voiceless–voiced pairs: plosives [p, b], [t, d], [c, ɟ], [k, g], affricates [t͜ʃ, d͜ʒ] and fricatives [f, v], [s, z] and [ʃ, ʒ]. The only two obstruents without a voiced counterpart are [t͜s] and [h], although both [d͜z] and [ɦ] exist on the surface. The reason why [d͜ʒ] is assumed to exists underlyingly while [d͜z] only appears on the surface is a difference in their distribution. The voiced affricate [d͜ʒ] appears word-initially, while [d͜z] does not. In other contexts their distribution is quite similar: neither of them appear postconsonantally, they appear preconsonantally only in a handful of suffixed forms, and when they appear intervocalically and finally they are always long. For further discussion of the status of [d͜ʒ] and [d͜z] see Siptár & Törkenczy (2000), Kiefer (2016). Hungarian also has two liquids [l, r], three nasal stops [m, n, ɲ] and one glide [j]. For a detailed discussion on whether [j] should be analyzed as [±cons] – that is whether it is a liquid or a glide – see Siptár & Törkenczy (2000), Kiefer (2016).

[1]The place of articulation categories does not distinguish between post-alveolar and palatal consonants. This might seem like oversimplification from a phonetic point of view, but it is sufficient for a phonological classification (cf. Siptár & Törkenczy (2000)).

	Labial		Dental		Palatal		Velar		Glottal
Nasal		m		n		ɲ			
Plosive	p	b	t	d	c	ɟ	k	g	
Affricate			t͜s		t͜ʃ	d͜ʒ			
Fricative	f	v	s	z	ʃ	ʒ			h
Trill				r					
Approximant				l		j			

Table 2: The consonant system of Hungarian

All consonants can be short or long on the surface, but length in consonants is not a contrastive feature (cf. Siptár & Törkenczy (2000), Kiefer (2016)). There are no long consonants word-initially, but all consonants appear word-initially in short form. Long consonants before or after another consonant usually shorten morpheme-internally. We do find long consonants intervocalically and word-finally after a vowel. However, in most cases underlyingly long consonants in these contexts are a result of derivation or they are due to loanword adaptation or they are onomatopoetic in nature where the length of a consonant expresses intensity but it is not contrastive. That is to say that minimal pairs where the only difference is the length of a consonant are rare and in most cases (at least) one of the elements of the minimal pair is a derived word. With this overview of the phoneme inventory of Hungarian in mind, let us turn our attention to some of the phonological process of the language that are relevant for the discussions in this thesis.

2.2 Consonantal processes

This sections is devoted to three phonological processes involving consonants: voicing assimilation in section 2.2.1, affrication in section 2.2.2 and gemination in section 2.2.3. The choice of these three processes is not arbitrary: in all three cases two consecutive consonants interact with each other in a way that a quality of one or both of them changes significantly. We will see below, in chapters 4, 5 and 6, how these three consonantal process interact with vowel-zero alternations in interesting ways.

2.2.1 Voicing assimilation

Hungarian has regressive voicing assimilation both intervocalically and word-finally (Vago (1980), Siptár & Törkenczy (2000)). That is to say that if there is a consonant cluster of two continuous obstruents with different voicing, the first one assimilates in voicing to the second one. This is shown in examples (7) and (8). In example (7) a suffix beginning with a voiceless obstruent follows a noun ending in a voiced stop, which assimilates to the voiceless stop during suffixation. Similarly, in example (8) the word-final voiceless stop assimilates to the suffix initial voiced stop.

(7) fog + tól [fog + toːl] 'tooth' + ABLATIVE → fogtól [foktoːl] 'from the tooth'

(8) rak + d [rɔk + d] 'put + IMPERATIVE' → rakd [rɔgd] 'put-IMPERATIVE'

It is important to note that the language does not have final devoicing, that is word-final obstruents show contrast in voicing. In (9) a minimal pair is given showing an example for meaningful difference between two nouns expressed through a single voicing difference in their final consonant.

(9) a. fog [fog] 'tooth'
b. fok [fok] 'degree/step'

Regressive voicing assimilation can be captured by the crucial ranking of a series of IDENT constraints and the markedness constraint AGREE[voice] (cf. Lombardi (1999), Baković (2005), Petrova et al. (2006), Siptár & Szentgyörgyi (2013)). The constraint AGREE [voice] – defined in (10) – ensures that two consecutive obstruents do not differ in voicing. The general IDENT[voice] constraint – according to its definition in (11) penalizes any changes in the voicing of consonant between their underlying and their surface forms, while the contextually restricted IDENT[voice]/_[+son] and IDENT[voice]/_# constraints – cf. (12) and (13) – only penalize a change in voicing in the given context: before a sonorant or word-finally, respectively.

(10) AGREE[voice]: Assign one violation mark for every pair of two consecutive obstruents that differ in voicing.

(11) IDENT[voice]: Assign one violation mark for every change in voicing between the underlying and the surface form of a segment.

(12) IDENT[voice]/_[+son]: Assign one violation mark for every change in voicing between the underlying and the surface form of a segment that precedes a sonorant segment.

(13) IDENT[voice]/_#: Assign one violation mark for every change in voicing between the underlying and the surface form of a word-final segment.

Tableau (14) shows how regressive voicing assimilation in an intervocalic context can be captured. In tableau (14) both in candidates a and b the voicing of a consonant differs between its underlying form and its surface form. In candidate a the consonant with the altered voice feature is the first consonant in the consonant cluster and thus, candidate a only violates the general faithfulness constraint IDENT[voice] since the consonant with the changed voice feature is not followed by a sonorant (and neither is it word-final). However, in candidate b the consonant which voice feature has changed is before a vowel and therefore, it not only violates the general faithfulness constraint IDENT[voice], but also the context-specific IDENT[voice]/_[+son] constraint as well. Since candidate a violates a proper subset of the constraints candidate b violates, candidate b is harmonically bound by candidate a. Therefore, as long as IDENT[voice]/_[+son] is included in the hierarchy, candidate b is less optimal than candidate a. Note that the context specific IDENT[voice]_[+son] constraint and the more general IDENT[voice] constraints are not crucially ranked with respect to each other. Following convention in the literature I present the more specific constraint above the general one in tableau (14).

(14)

fog + -toːl	AGREE[voice]	IDENT[voice]/_[+son]	IDENT[voice]
a. ☞ foktoːl			*
b. fogdoːl		*!	*
c. fogtoːl	*!		

In candidate c all segments have the same voicing feature underlyingly and on the surface and thus, candidate c does not violate any of the faithfulness constraints. However, since candidate c is fully faithful to the underlying forms of the noun and the suffix, it includes a consonant cluster of two obstruents that differ in voicing which violates the markedness constraint AGREE[voice]. As long as the markedness constraint AGREE[voice] is ranked above the general faithfulness constraint IDENT[voice] the most faithful candidate – here candidate c – will always be less optimal than the candidate involving regressive voicing assimilation – here candidate a. The ranking established in tableau (14) is given in (15).

(15) AGREE[voice] $\gg$ IDENT[voice]

Tableau (16) shows how regressive voicing assimilation can be analyzed in word-final context. Similarly to tableau (14), the optimal candidate – candidate a – only violates the general faithfulness constraint IDENT[voice] since it is the first consonant in the consonant cluster that assimilates and not the word-final one. Candidate b, in which the word-final consonant assimilates in voicing to the one preceding it violates both the general IDENT[voice] constraint and the contextual IDENT[voice]/_# constraint as well and thus, candidate b is harmonically bound by candidate a. Note here again that the context specific IDENT[voice]/_# constraint – similarly to the context specific IDENT[voice]_[+son] in (14) – is not crucially ranked with respect to the more general IDENT[voice] constraint. In (16) I follow the convention in the literature by presenting the more specific constraint above the more general one. The most faithful candidate – candidate c – is ruled out by the high ranked markedness constraint AGREE[voice] – similarly to the most faithful candidate in tableau (14). Thus, there is still only one crucial ranking: the one given in (15).

(16)

rak + -d	AGREE[voice]	IDENT[voice]/_#	IDENT[voice]
a. ☞ rɔgd			*
b. rɔkt		*!	*
c. rɔkd	*!		

As noted earlier voicing contrast in obstruents is preserved word-finally in Hungarian. As tableaux (17) and (18) show the ranking between AGREE[voice] and the general faithfulness constraint IDENT[voice] and the presence of context specific IDENT[voice] constraints like IDENT[voice]/_# and IDENT[voice]/_[+son] do not lead to the neutralization of voicing contrast in obstruents word-finally. As tableaux (17) and (18) show candidate a in both tableaux is the optimal candidate since it is fully faithful to its underlying form and it does not violate the markedness constraint AGREE[voice] either. In contrast, candidate b in both tableaux leads to faithfulness violations because the voice feature of the word-final obstruent has changed in these candidates.

(17)

fog	AGREE[voice]	IDENT[voice]/_#	IDENT[voice]
a. ☞ fog			
b. fok		*!	*

(18)

fok	AGREE[voice]	IDENT[voice]/_#	IDENT[voice]
a. ☞ fok			
b. fog		*!	*

This concludes our brief overview of how a combination of AGREE[voice] and various IDENT [voice] constraints can account for voicing assimilation in Hungarian. The next section focuses on a different consonantal process, namely, affrication.

2.2.2 Affrication

Affrication takes place in three cases in Hungarian: (i) if a dental or palatal stop is followed by a non-affricate strident, (ii) if a dental or palatal stop is followed by an affricate or (iii) if an affricate is followed by a non-affricate strident (cf. Siptár & Törkenczy (2000), Kiefer

(2016)).[2] In what follows I review these three environments in which affrication happens one by one and present an analysis that captures all of them.

Let us start with the most straightforward case of affrication: when a dental or palatal stop is followed by a non-affricate strident. Examples for this case are provided in (19) and (20). In (19) the stem-final voiceless dental stop and the suffix initial [s] merge. In example (20) the stem-final voiced palatal stop assimilates in voicing and in place to the suffix-initial voiceless strident and then they merge and form a long voiceless coronal affricate. In examples (19) and (20) a capital O is used for the non-high suffixal vowel that is underlyingly underspecified for backness. How the quality of the vowel in such suffixes is determined is discussed in detail in 2.3.2.

(19) öt + -szOr [øt + -sOr] 'five' + MULTIPLICATIVE → ötször [øt͜sːør] 'five times'

(20) egy + -szOr [ɛɟ+ -sOr] 'one' + MULTIPLICATIVE → egyszer [ɛt͜sːɛr] 'once'

If the stem-final stop agrees in voicing and place with the suffix initial non-affricate strident, then the affrication process can formally be captured by a markedness constraint that penalizes dental or palatal stops being followed by a strident – like the one in (21) – a constraint against shortening – like the one in (22) – and a constraint against merging segments – like the Uniformity constraint first proposed by McCarthy & Prince (1995) and given in (23). This is shown for example (19) in tableau (24).

(21) $*\begin{bmatrix} \alpha \text{ ant} \\ - \text{cont} \\ - \text{son} \end{bmatrix}$ [+strident]: Assign one violation mark if a [– continuant, ± anterior] obstruent is followed by a strident.

(22) IDENT(duration): Assign one violation for every change in duration between the underlying and the surface form of a segment.

(23) UNIFORMITY: Assign one violation mark if a segment in the surface form has more than one correspondent in the underlying form.

(24)

øt +-sOr	$*\begin{bmatrix} \alpha \text{ ant} \\ - \text{cont} \\ - \text{son} \end{bmatrix}$ [+strident]	IDENT(duration)	UNIFORMITY
a. øtsør	*!		
b. øt͜sør		*!	*
c. ☞ øt͜sːør			*

As shown in tableau (24) the markedness constraint in (21) rules out the most faithful

[2] Note that some of these process are optional in slow speech. For details see Siptár & Törkenczy (2000).

candidate – candidate a – in which a coronal stop is followed by a strident. This leaves candidate b and c, which only differ in the duration of the affricate in them. In candidate b the affricate is short, which means that the duration of the voiceless stop shortened. This is ruled out by the IDENT constraint on duration. We are left with candidate c as the optimal candidate, in which the duration of the consonants stays identical and thus, it only violates UNIFORMITY that penalized the merge of the stem-final coronal stop and the strident. The crucial ranking established in tableau (24) is noted in (25).

(25) $*\begin{bmatrix}\alpha \text{ ant} \\ -\text{ cont} \\ -\text{ son}\end{bmatrix}$[+strident], IDENT(duration) $\gg$ UNIFORMITY

To account for example (20) the ranking established in tableau (24) and given in (25) is not sufficient. Since in (20) the stem-final palatal stop assimilates in voicing and place to the suffix-initial strident additional constraints are needed. To capture the voicing assimilation the constraints AGREE[voice] and IDENT[voice] from section 2.2.1 can be utilized. Similar AGREE and IDENT constraints like the ones in (26) and (27) can account for the place assimilation. In tableau (28) all of these constraints are in place to show how example (20) can be derived.

(26) AGREE(place)/$\begin{bmatrix}\alpha \text{ ant} \\ -\text{ son}\end{bmatrix}$[+strident]: Assign one violation mark for consecutive sequence of [± anterior] obstruent and [+strident] segments if they do not agree in place.

(27) IDENT(place)/_ $\left\{\begin{matrix}[+\text{ son}] \\ \#\end{matrix}\right\}$: Assign one violation mark for every change in place between the underlying and the surface form of a segment that either precedes a sonorant or is word-final.

(28)

ɛɟ+ -sOr		Agree[voice]	Ident[voice]	Agree(place)/$\begin{bmatrix}\alpha \text{ ant}\\ - \text{son}\end{bmatrix}$[+strident]	Ident(place)/_$\left\{\begin{matrix}[+ \text{son}]\\ \#\end{matrix}\right\}$	$*\begin{bmatrix}\alpha \text{ ant}\\ - \text{cont}\\ - \text{son}\end{bmatrix}$[+strident]	Ident(duration)	Uniformity
a.	ɛɟsɛr	*!				*		
b.	ɛcsɛr		*	*!		*!		
c.	ɛt͡sɛr		*				*!	*
d. ☞	ɛt͡sːɛr		*					*
e.	ɛt͡ʃɛe		*		*!		*!	*
f.	ɛt͡ʃɛr		*		*!			*
g.	ɛcʃɛr		*		*!	*!		

In tableau (28) candidate a – the most faithful candidate – is ruled out by the high ranked Agree[voice] constraint that penalizes voicing disagreement between two consecutive consonants. In all other candidates in tableau (28) there is no voicing disagreement since the voicing of one of the two candidates is changed. This means that candidates b–g all violate Ident[voice]. In candidate b the stem-final consonant assimilated in voicing to the suffix-initial strident, but not in place. Therefore, candidate b is ruled out by Agree(place). Candidates e, f and g all violate Ident(place)/_ $\left\{\begin{matrix}[+ \text{son}]\\ \#\end{matrix}\right\}$ since in these candidates it is the strident that assimilates in place to the stop and not the other way around. This leaves us with candidates c and d. What differentiates candidate c and d is the duration of the affricate. Candidate c is ruled out since it involves shortening. Thus, candidate d is chosen as the optimal candidate. The crucial ranking established in (28) is noted in (29).

(29) Agree[voice] ≫ Ident[voice], Agree(place)/$\begin{bmatrix}\alpha \text{ ant}\\ - \text{son}\end{bmatrix}$[+strident],
Ident(place)/_ $\left\{\begin{matrix}[+ \text{son}]\\ \#\end{matrix}\right\}$, $*\begin{bmatrix}\alpha \text{ ant}\\ - \text{cont}\\ - \text{son}\end{bmatrix}$[+strident], Ident(duration)
≫ Uniformity

Now that we have seen how the merge of stop-fricative sequences can be accounted for, let us turn our attention to stop-affricate sequences. Examples for the merger of stop-affricate sequences are given in (30) and (31). In example (30) the first word ends in a voiceless coronal stop, while the second word begins with a voiceless coronal affricate. These two consonants merge and surface as a long voiceless affricate in regular speech. In example (31) the first word ends in a voiced coronal stop, which assimilates in voicing and place to the voiceless palatal affricate before they merge and surface as one long voiceless palatal affricate. Examples (30) and (31) can be derived in the same way as examples (19) and (20).

(30) öt cella [øt͜sːɛlːɒ] 'five cells'

(31) szomszéd család [somseːt͜ʃːɒlaːd] 'neighbor family'

The only thing that differentiates candidates (30) and (31) is that the latter involves not only affrication, but also place and voicing assimilation. Since it has been already shown in tableau (28) how the three processes interact, I only show the derivation for example (30) below.

(32)

	øt t͜sɛlːɒ	$*\begin{bmatrix}\alpha\text{ ant}\\ -\text{cont}\\ -\text{son}\end{bmatrix}$[+strident]	IDENT(duration)	UNIFORMITY
a.	øtt͜sɛlːɒ	*!		
b.	øt͜sɛlːɒ		*!	
c. ☞	øt͜sːɛlːɒ			*

Tableau (32) shows the formal analysis for example (30). Similarly to stop-fricative sequences, in the case of stop-affricate sequences the most faithful candidate – candidate a in (32) – is ruled out by the markedness constraint against sequences of coronal stops and stridents. If there is only a single affricate in the output as in candidate b in (32), then the duration of the stop at the end of the first word is shortened, which is penalized by IDENT(duration). This leaves candidate c as the optimal candidate.

Last, but not least, let us turn our attention to affricate–fricative sequences. Examples are given in (33) and (34). In example (33) the stem-final consonant is voiceless palatal affricate, while the suffix begins with a voiceless palatal fricative. These two merge together and surface as a long voiceless palatal affricate. In example (34) the stem-final consonant is a voiceless dental affricate that is followed by the suffix-initial voiceless palatal fricative. Here the voiceless dental affricate first assimilates to the fricative following it and then the two merge together and surface as a long palatal affricate.

(33) makacs + -sÁg [mɒkɒt͜ʃ + -ʃÁg] 'stubborn' + NOMINALIZER
→ makacsság [mɒkɒt͜ʃːaːg] 'stubbornness'

(34) bohóc + -sÁg [bohoːt͜s + ʃÁg] 'clown' + NOMINALIZER
→ bohócság [bohoːt͜ʃːaːg] 'clownery'

There is one additional constraint that is needed to account for the surface form of affricate-fricative sequences. In the case of stop-fricative and affricate-fricative sequences the markedness constraint $*\begin{bmatrix}\alpha \text{ ant}\\ -\text{ cont}\\ -\text{ son}\end{bmatrix}$[+strident] ruled out the most faithful candidates. However, this markedness constraint does not apply to affricate-fricative sequences. To rule out the most faithful candidate in the case of affricate-fricative sequences I propose to use an Obligatory Contour Principle (OCP) constraint that penalizes the sequence of stridents like the one in (35).

(35) OCP[+strident]: Assign one violation mark for every pair of two consecutive stridents.

Tableau (36) shows how the correct output for example (34) can be derived utilizing the constraint in (35). Constraint (35) rules out the most faithful candidate – candidate a in tableau (36). In candidate b it is the fricative that assimilates to the affricate and not the other way around, which is penalized by the specific IDENT(place) constraint. In candidate c the duration of the consonants merged changes, which leaves candidate d as the optimal candidate.

(36)

	boho:t͡s + -ʃÁg	OCP[+strident]	IDENT(place)/_ {[+ son], #}	IDENT(duration)	UNIFORMITY
a.	boho:t͡sʃa:g	*!			
b.	boho:t͡s:a:g		*!		*
c.	boho:t͡ʃa:g			*!	*
d. ☞	boho:t͡ʃ:a:g				*

In this section we have seen that all three types of affrication can be accounted for by relying on markedness constraints penalizing certain stop-strident and strident-strident sequences, and a faithfulness constraint preserving duration and a constraint against the merger of two consonants. Additionally, AGREE and IDENT constraints are needed to also cover voicing and place assimilation processes which might precede affrication. Now that we have seen how affrication works in Hungarian, let us turn our attention to another phonological process that involves the merger of two consonants: gemination.

2.2.3 Gemination

In Hungarian if two consecutive consonants are identical underlyingly they almost always surface as one long segment (cf. Kiefer (2016)). This means that if a word ends with a consonant and it is followed by a suffix that begins with the same consonant, then gemination takes place, which leads to one long consonant at the morpheme boundary. An example for this process is given in (37). In (37) the word-final voiceless coronal stop merges with the suffix-initial voiceless coronal stop resulting in a geminate [t].

(37) barát + -tól [bɔraːt + toːl] 'friend' + ABLATIVE → baráttól [bɔraːtːoːl] 'from a friend'

There are some exceptions to the observation that two identical consecutive consonants surface as one long consonant. We can find examples for degemination in Hungarian in certain non-monomorphemic contexts. Degemination can happen if (i) the two identical consecutive consonants follow or precede another consonant, and (ii) they are in two different morphemes or words and (iii) the gemination is a result of simple concatenation without any other process – e.g. assimilation or palatalization – being involved. Whether degemination happens in these cases depends on the quality of the the third consonant. If the third consonant is an obstruent, then degemination is obligatory, if it is a nasal, then degemination is optional and if it is a liquid or a glide no degemination takes place, cf. examples (38), (39) and (40), respectively.

(38) koszt + -tól [kost + -toːl] 'board' + ABLATIVE
→ koszttól [kostoːl] 'from the board'

(39) comb + -ból [t͜somb + -boːl] 'thigh' + ELATIVE
→ combból [t͜somb(ː)oːl] 'from the thigh'

(40) szerb bor [sɛrbːor] 'Serbian wine'

Besides degemination there are only a handful of exceptions to the observation that two identical consecutive consonants surface as one long consonant. These exceptions are limited to cases in which the two identical consonants are (i) both affricates and (ii) they appear in different morphemes or words. Two examples for such cases are given in (41) and (42). In both cases the stop in both affricates is released showing that the two consonants are not merged despite being identical. Note that this only happens in slow speech. In regular fast speech gemination takes place both in example (41) and example (42).

(41) kulcs + csomó [kult͜ʃ + t͜ʃomoː] 'key' + 'node'
→ kulcscsomó [kult͜ʃt͜ʃomoː] 'a bunch of keys'

(42) Kovács Csaba [kovaːt͜ʃt͜ʃɒbɒ] 'Csaba Kovács'

Since this dissertation focuses on cases in which all segments of potential consonant clusters are in the same morpheme and thus, they are expected to surface as one long consonant if they are identical, let us turn our attention back to cases like (37) – repeated here in (43) – that fall under the generalization that two identical consecutive consonants surface as one long segment.

(43) barát + -tól [bɔraːt + toːl] ‘friend’ + ABLATIVE → baráttól [bɔraːtːoːl] ‘from a friend’

This generalization can be formally captured as an OCP effect. A possible formulation of OCP as a constraint is given in (44). What is the question here is whether the two identical consecutive segments will surface as separate segments or merge to one long segment. The latter possibility can be captured by the Uniformity constraint in (23), repeated here in (45). For completeness sake I have also included a constraint against consonant deletion, MAX(C) given in (46), since another possible way to avoid violating OCP is to delete one of the two identical consonants.

(44) OCP: Assign one violation mark for every pair of two identical consecutive segments.

(45) UNIFORMITY: Assign one violation mark if a segment in the surface form has more than one correspondent in the underlying form.

(46) MAX(C): Assign one violation mark for every consonantal segment that is present in the underlying form and has no correspondent in the surface form.

An example for how the interaction of these three constraints can capture the generalization that two identical underlyingly consecutive consonants mostly surface as one long consonant is given in tableau (47). Candidate a in tableau (47) is the most faithful candidate and as such it completely preserves the two identical consecutive consonants in the surface form which violates OCP. If we want to avoid an OCP violation, then less faithful candidates need to be considered. Candidate b in (47) does not violate OCP since it only has one consonant at the morpheme boundary. The lack of OCP violation in candidate b is the result of the deletion of one of the two identical consonants, which violates MAX(C). Another possibility to avoid an OCP violation is coalescence of the two identical consonants. Coalescence violates UNIFORMITY. However, as long as UNIFORMITY is ranked below OCP and MAX(C) candidate c – the candidate involving coalescence of the two identical consonants – surfaces as the optimal candidate. This crucial ranking is captured in (48).

(47)

bɔraːt + toːl		OCP	MAX(C)	UNIFORMITY
a.	bɔraːttoːl	*!		
b.	bɔraːtoːl		*!	
c. ☞	bɔraːtːoːl			*

(48) OCP, MAX(C) ≫ UNIFORMITY

In this section we have seen when voicing assimilation, affrication and gemination takes place in Hungarian and how we can formally capture that. Now that we are more familiar with some of the consonantal processes in the language, let us turn our attention to a process involving vowels: vowel harmony.

2.3 Vowel Harmony

Hungarian vowel harmony (HVH) has been studied extensively in a variety of different frameworks (see Vago (1975, 1976, 1978), J. T. Jensen (1978), Ringen (1978, 1980) on HVH in rule based phonology, van der Hulst (1985), Booij (1984), Clements (1976) and Ringen (1988) on HVH in autosegmental phonology, Ringen & Vago (1995, 1998) on HVH in optimality theory). More recent studies in Hungarian vowel harmony have focused on exceptionality and variation (Forró (2013), Hayes & Cziráky Londe (2006), Hayes, Zuraw, et al. (2009), Patay et al. (2020), Rebrus & Szigetvári (2016, 2021), Rebrus & Törkenczy (2016, 2017, 2021), Rebrus, Szigetvári & Törkenczy (2012, 2013, 2017, 2020, 2023), Szeredi (2016)). For a general overview of Hungarian vowel harmony see Törkenczy (2024). This section cannot possibly encompass all we know about Hungarian vowel harmony. Here, a brief description is provided of what vowel harmony is and how it generally works in Hungarian. Further references on Hungarian vowel harmony can be found in Törkenczy (2016), while van der Hulst (2011) points to additional resources on vowel harmony in general.

The distribution of Hungarian vowels is regulated by backness and roundness harmony. Vowel harmony in Hungarian is root/stem controlled. That is to say that it is the vowels in the root/stem that determine the properties of the vowel(s) in the suffixes that attach to them. Hungarian vowel harmony is always left-to-right directional, and prefixes fall outside of the scope of vowel harmony. The intervening consonants between vowels do not interact with harmony in any way: they neither block nor mitigate harmony (Törkenczy (2024)). Let us first look at some further details in backness harmony in section 2.3.1 before turning our attention to roundness harmony in section 2.3.2.

2.3.1 Backness harmony

Based on their role in backness harmony, three groups of vowels can be differentiated in Hungarian: (i) harmonic back vowels as in (49), (ii) harmonic front rounded vowels as in (50) and (iii) neutral front unrounded vowels as in (51). All back vowels are harmonic since they are always opaque to harmony and they very rarely occur together with harmonic front vowels in disharmony. Front vowels are divided between harmonic and neutral ones for a variety of reasons: (i) neutral vowels often behave in a transparent way with respect to harmony, (ii) they occur in antiharmonic roots, (iii) they occur in suffixes with only one form where they behave transparently while they are opaque whenever they appear in harmonic suffixes that have multiple different forms. For these reasons phonetically front unrounded vowels are considered phonologically neutral in Hungarian vowel harmony, while front rounded vowels are considered phonologically also to be front.

(49) Harmonic back vowels (often abbreviated as B): [u], [uː], [o], [oː], [ɔ], [aː]

(50) Harmonic front rounded vowels (often abbreviated as F): [y], [yː], [ø], [øː]

(51) Neutral front unrounded vowels (often abbreviated as N): [i], [iː], [ɛ], [eː]

In terms of backness harmony roots can be divided into three categories: (i) non-mixed roots, (ii) weakly disharmonic roots and (iii) strongly disharmonic roots. Non-mixed roots have either only harmonic back vowels or harmonic front vowels like examples (52) and (53). Weakly disharmonic stems contain back harmonic vowels and neutral front unrounded vowels as shown in example (54), while strongly disharmonic stems have harmonic back vowels and harmonic front vowels in them as in (55).

(52) asztal [ɒstɒl] 'table' — non-mixed root with back vowels

(53) öröm [ørøm] 'joy' — non-mixed root with front vowels

(54) piros [piroʃ] 'red' — weakly disharmonic root

(55) sofőr [ʃoføːr] 'driver' — strongly disharmonic root

Similarly to the roots, suffixes can also be categorized in terms of vowel harmony based on what vowel(s) they might have. There are non-harmonizing (invariant) suffixes like the terminative *-ig* /-ig/ [-ig], which always have the same vowel no matter what kind of root they attach to as shown in .

(56) a. asztal + -ig [ɒstɒl + -ig] 'table' + TERMINATIVE
→ asztalig [ɒstɒlig] '(up)to the table'
non-mixed root with back vowels + invariant suffix

b. öröm + -ig [ørøm + -ig] 'joy' + TERMINATIVE
→ örömig [ørømig] 'till joy'
non-mixed root with front vowels + invariant suffix

c. piros + -ig [piroʃ+ -ig] 'red' + TERMINATIVE
→ pirosig [piroʃig] '(up)to the red'
weakly disharmonic root + invariant suffix

d. sofőr + -ig [ʃoføːr + -ig] 'driver' + TERMINATIVE
→ sofőrig [ʃoføːrig] '(up)to the driver'
strongly disharmonic root + invariant suffix

Other suffixes can have two, three or four different vowels in them. In the case of suffixes with two different potential vowels (bivalent suffixes), one of the vowels is always back, while the other one is always front. An example for such a suffix is the dative suffix *-nak/-nek* /-nAk/ [-nɒk/-nɛk]. Since the backness of the vowel in the dative suffix depends on what stem it attaches to I use capital A in the underlying form to mark that it is a low vowel and that it can be either back or front. In the case of non-mixed roots there is only one type of vowel in the root and thus, it is straightforward what the suffixal vowel's backness feature is going to be if the vowel's quality varies with what stem it attaches to. In the case of back non-mixed stems like (57) the suffixal vowel is also back, while in the case of a front non-mixed stem like (58) the suffixal vowel is also front.

(57) asztal + -nAk [ɒstɒl + -nAk] 'table' + DATIVE → asztalnak [ɒstɒlnɒk] 'for (a) table'
non-mixed root with back vowels + suffix with two forms

(58) öröm + -nAk [ørøm + -nAk] 'joy' + DATIVE → örömnek [ørømnɛk] 'for joy'
non-mixed root with front vowels + suffix with two forms

(59) piros + -nAk [piroʃ+ -nAk] 'red' + DATIVE → pirosnak [piroʃnɒk] 'for red'
weakly disharmonic root + suffix with two forms

(60) sofőr + -nAk [ʃoføːr + -nAk] 'driver' + DATIVE → sofőrnek [ʃoføːrnɛk] 'for (a) driver'
strongly disharmonic root + suffix with two forms

When it comes to weakly and strongly disharmonic stems it is less straightforward what backness feature a vowel has in a variable suffix attached to them. There are a number of factors that play a role here like the height of neutral vowels, the number of neutral vowels, the backness feature of the final vowel etc. This means that we cannot generalize from examples (59) and (60), to all weakly and strongly disharmonic stems without further considerations. For a detailed discussion of these intricate details of Hungarian vowel harmony see Törkenczy (2024).

In the case of invariant suffixes with more than two forms, there is always at least one form with a back vowel and one with a front vowel. Additionally, the quality of the vowel in these suffixes also depends on the rounding feature of the final vowel in the stem in the case of suffixes with three forms (trivalent suffixes) and on other properties of the root in the case of suffixes with four different potential vowels (quatrian suffixes). Suffixes with three different potential vowels are discussed in section 2.3.2, while suffixes with four different forms are discussed in section 3. An overview of the distribution of invariant, bivalent and trivalent suffixes is given in table 3 in section 2.3.2.

Formally, there are at least two ways to capture that the quality of the suffixal vowel is dependent on the quality of the stem internal vowels: (i) the suffixal vowel is underspecified and it only receives a feature value for backness (and rounding) on the surface or (ii) the suffixal vowel is specified for backness (and rounding), but these features can be overwritten as a result of constraint rankings. One of the main differences between these two options is that in the case of underspecification, faithfulness of the surface form to the underlying form is not violated, whereas it clearly is if an underlying feature value α, surfaces as $-\alpha$. Another important difference between these two possible approaches is that only underspecification can capture the generalization regarding which suffixal vowels can delete, cf. section 2.4. In a framework relying on underspecification it is clear that only underspecified vowels can delete. In an approach which all suffixal vowels are underlyingly fully specified the quality of the different suffixal vowels can be derived through a variety of positional faithfulness and markedness constraints. However, in this approach it is seemingly arbitrary that only the vowels in suffixes with multiple forms can delete. For these reasons I follow Siptár & Szentgyörgyi (2013) in assuming that the suffixal vowels in suffixes with multiple forms are underlyingly underspecified, while suffixal vowels in suffixes with a unique form are fully specified underlyingly.

To formally capture vowel harmony in Optimality Theory (Prince & Smolensky (2004)) I rely on AGREE constraints such as AGREE[α back] as defined in (61).

(61) AGREE[αback]: Assign one violation mark for every pair of consecutive vowels that differ in backness.

As tableau (62) shows AGREE[αback] can distinguish between two candidates that only differ in the backness in the suffixal vowel that is underlyingly underspecified. More concretely, the tableau in (62) shows that the ellative suffix *-ból/-ből* /-bOːl/ [-boːl/-bøːl] surfaces with a back vowel after a stem with a back vowel (cf. candidate a) since that leads to no violation of AGREE[αback], while candidate b – in which the suffixal vowel is [-back] after a back stem – does violate AGREE[αback].

(62)

orsaːg + -bO$_{(+)}$l	AGREE[αback]
a. ☞ orsaːgboːl	
b. orsaːgbøːl	∗!

Note that if a suffixal vowel is fully specified underlyingly, it is more important to be faithful to the underlying vowel than to adhere to vowel harmony. This is shown in (64), where the higher ranked faithfulness constraint (IDENT defined in (63)) preserves the identity of the underlyingly fully specified terminative suffix *-ig* /-ig/ [-ig].

(63) IDENT: Assign one violation mark for every change between the underlying and surface form of a segment.

(64)

orsaːg + -ig	Ident	Agree[αback]
a. ☞ orsaːgig		*
b. orsaːgug	*!	

In tableau (64) candidate a is the fully faithful candidate, which does not adhere to vowel harmony and thus, violates Agree[αback]. However, if a candidate satisfies backness harmony, as in candidate b, then a faithfulness violation occurs since the suffixal vowel on the surface differs from its corresponding counterpart underlyingly. Now that we have seen how we can formally account for the quality of suffixal vowels in invariant and bivalent suffixes, let us turn our attention to trivalent suffixes which are sensitive to not only backness, but also roundness harmony.

2.3.2 Roundness harmony

Roundness harmony appears only in a subset of cases where backness harmony appears. This is evidenced by the fact that roundness harmony can only be seen when we look at variable suffixes with three different forms like the allative suffix *-hoz/-hez/-höz* /-hOz/ [-hoz/-hɛz/høz]. Note that a capital letter is again used in the underlying form to show that the vowel can be either front or back. Furthermore, the capital O also signals that the underlying vowel is non-high. Since suffixes with three different potential vowels always only have on form with a back vowel, it is expected and born out that this is the form that attaches to a non-mixed root with back vowel(s) as shown in example (65). However, if the root is non-mixed with front vowel(s), then there are still two options remaining for the suffixal vowel: a round – [-høz] – and an unround one – [-hɛz]. Which suffixal vowel is chosen after non-mixed roots with front vowel(s) depends on whether the final stem-internal vowel is rounded or not.

(65) asztal + -hOz [ɒstɒl + -hOz] 'table' + ALLATIVE
→ asztalhoz [ɒstɒlhoz] 'to (a) table'

(66) öreg + -hOz [ørɛg + -hOz] 'old (person)' + ALLATIVE
a. → öreghez [ørɛghɛz] 'to (an) old (person)'
b. → *öreghöz [ørɛghøz]

(67) erős + -hOz [ɛrøːʃ+ -hOz] 'strong (person)' + ALLATIVE
a. → *erőshez [ɛrøːʃhɛz]
b. → erőshöz [ɛrøːʃhøz] 'to (a) strong (person)'

Examples (66) and (67) show, respectively, that if the final stem-internal vowel is unrounded, then the suffixal vowel is also unrounded and if it is rounded then so is the suffixal vowel.

Table 3 presents a comparison of invariant, bivalent and trivalent suffixes. The surface forms of the suffixes are highlighted in magenta. The cell colors show the difference in the distribution of the different forms of the suffixes: cells with a blue background highlight that the form of invariant suffixes like the terminative *-ig* /-ig/ [-ig] never changes, cells with a green in contrast to cells with orange or yellow and red backgrounds show that there is a difference in the form of a suffix if it follows a non-mixed root with back or front vowels. Additionally, the split between yellow and red backgrounds emphasized that the surface form of trivalent suffixes after a non-mixed root with front vowels also depends on whether the final stem-internal vowel is rounded or not.

	Invariant suffix terminative /-ig/ [-ig]	**Bivalent suffix** dative /-nAk/ [-nɒk/-nɛk]	**Trivalent suffix** allative /-hOz/ [-hoz/-hɛz/-høz]
Non-mixed root with back vowels			
asztal [ɒstɒl] 'table'	asztalig [ɒstɒlig] '(up)to (a) table'	asztalnak [ɒstɒlnɒk] 'for (a) table'	asztalhoz [ɒstɒlhoz] 'to (a) table'
Non-mixed root with front vowels			
öreg [ørɛg] 'old (person)'	öregig [ørɛgig] '(up)to an old (person)'	öregnek [ørɛgnɛk] 'for an old (person)'	öreghez [ørɛghɛz] 'to an old (person)'
erős [ɛrøːʃ] 'strong (person)'	erősig [ɛrøːʃig] '(up)to a strong (person)'	erősnek [ɛrøːʃnɛk] 'for an old (person)'	erőshöz [ɛrøːʃhøz] 'to an old (person)'

Table 3: Surface forms of invariant, bivalent and trivalent suffixes

Now that we have seen how the distribution of trivalent suffixes that are impacted by roundness harmony compares to that of invariant and bivalent suffixes, which are not affected by roundness harmony, let us turn our attention back to the targets and triggers of roundness harmony. Since most back vowels – with the exception of [aː] – are round, it is not surprising that roundness harmony only targets front vowels. It is important to note, though, that roundness harmony is even more restricted than that. It only targets front non-high vowels as evidenced by the fact that there are no suffixes with three different vowels in which the vowels are all high – i.e. *-(C)U(C) /-(C)U(C)/ [-(C)u(C)/-(C)i(C)/-(C)y(C)]. Even though roundness harmony does not target front high vowels, it is triggered by front high vowels as shown in the contrast of examples (68) and (69). In example (68) the stem-internal front high unrounded vowel is followed by an unrounded vowel in the suffix, while in example (69) the stem-internal front high rounded vowel is followed by a rounded vowel in the suffix.

(68) víz + -hOz [viːz + -hOz] 'water' + ALLATIVE
   a. → vízhez [viːzhɛz] 'to (the) water'
   b. → *vízhöz [viːzhøz]

(69) ügy + -hOz [yɟ+ -hOz] 'case' + ALLATIVE
   a. → *ügyhez [yɟhɛz]
   b. → ügyhöz [yɟhøz] 'to (a) case'

While in the case of backness harmony there are some vacillating stems, there are no such stems when it comes to roundness harmony. How local (or not) backness harmony is can be debated, but there is a general consensus that roundness harmony is strictly local. Furthermore, there are no antiharmonic stems in terms of roundness harmony, although these exist in the case of backness harmony.

Roundness harmony can – similarly to backness harmony – also be formally captured by an AGREE constraint like the on in (70).

(70) AGREE[αround]: Assign one violation mark for every pair of consecutive vowels that differ in rounding.

As we have seen in section 2.3.1 AGREE[αback] is sufficient to predict the quality of a suffixal vowel if only its backness feature is undetermined underlyingly. This means that if a trivalent suffix follows a non-mixed root with back vowels, then the suffixal vowel will surface as back due to AGREE[αback] since roundness harmony does not affect back vowels. However, if a trivalent suffix follows a non-mixed root with front vowels, then AGREE[αround] is necessary to determine the roundness feature of the suffixal vowel based on the roundness feature of the final stem-internal vowel. Additionally, the fact that the suffixal vowel in trivalent suffixes is [-high, -low, -round] and that there is no [-high, -low, -round] front vowel in Standard Hungarian needs to be taken into account. To see how this can be done formally let us look at a concrete example. In tableau (71) we can see how the correct form of the allative suffix -*hoz/-hez/-höz* /-hO$_{(-)}$z/ [-hoz/-hɛz/-høz] following a non-mixed stem with front vowels with a final unrounded vowel can be derived.

(71)

meːz + -hO$_{(-)}$z		*e	Ident	Agree[αback]	Agree[αround]
a. ☞	meːzhɛz		(*)		
b.	meːzhoz		*	*	*!
c.	meːzhøz		*		*!
d.	mezhez	*!			

Hungarian has only two short mid vowels – [o] and [ø] – both of which are [+round]. This means that both possible short mid vowels – candidate b and c in (71), respectively – lead not only to an Ident violation – since they are both [+round] and the suffixal vowel is underlyingly specified as [-round] – but both candidates also violate rounding harmony since the stem vowel is unrounded. The short [e] is not part of the standard dialect, and therefore, a candidate with it as the suffixal vowel – candidate d – is ruled out by a high ranked markedness constraint – *e – which reflects the absence of this vowel in the phoneme inventory of the language. Since the only two viable short mid vowels in Standard Hungarian are [+round] there is only one way to satisfy rounding harmony in this case: to resort to the phonetically low, phonologically mid unrounded vowel [ɛ], cf. candidate a in (71). Depending on the interpretation of the last resort vowel [ɛ], we may or may not have an Ident violation here. What is meant by that is that if [ɛ] is interpreted based on its phonetical features as [+low], then candidate a violates Ident since the height of the suffixal vowel has changed between the underlying and the surface form, whereas if we take [ɛ] to be mid based on its phonological characteristics, then no Ident violation occurs. In either case, candidate a is the optimal candidate since it does not contain a segment that is not part of the vowel inventory of the dialect – cf. candidate d – neither does it violate backness and/or rounding harmony – cf. candidate b and c.

In section 2.3.1 we have seen that faithfulness is more important than backness harmony. What about the relative importance of backness harmony and rounding harmony with respect to each other? As the tableau in (72) shows it is more important to adhere to backness harmony than to rounding harmony.

(72)

køt͜ʃøg + -bA		Ident	Agree[αback]	Agree[αround]
a. ☞	køt͜ʃøgbɛ			*
b.	køt͜ʃøgbɒ		*!	
c.	køt͜ʃøgbø	*!		

Tableau (72) shows that if the illative suffix *-ba/-be* /-bA/ [-bɒ/-bɛ] is attached to a stem with a front round final vowel it will adhere to backness harmony and not to rounding harmony, cf. candidate a in (72). Candidate b represents the alternative that follows rounding harmony, but not backness harmony. This candidate is not what we find on the surface and thus, it is ruled out by AGREE[αback], which is crucially ranked above AGREE[αround]. Candidate c does not violate either backness or rounding harmony, however, it leads to an IDENT violation since the height of the suffixal vowel is changed between the underlying form – [+low] – and the surface form – [-high,-low]. Since there is no front low round vowel in the language, following both backness and rounding harmony always leads to a faithfulness violation. Therefore, to avoid a faithfulness violation only one of the harmony constraints can be fulfilled and as we can see from (62) it is going to be AGREE[αback] over AGREE[αround]. This concludes our general overview of how Hungarian vowel harmony works. The next section focuses on a different possible categorization of Hungarian suffixes.

2.4 Suffixes

Hungarian suffixes can be categorized in different ways. As we have seen in section 2.3 there are invariant suffixes – suffixes with only one form – bivalent suffixes – suffixes with two forms – trivalent suffixes – suffixes with three forms – and quatrain suffixes – suffixes with four different possible vowels. There are, of course, the more generally used categorizations based on the syntactic category of a suffix – e.g. nominalizer, verbalizer etc. – or based on the changes the suffix leads to – i.e. derivational or inflectional. In what follows, I present a classification of Hungarian suffixes based on their behavior after vowel-final and consonant-final roots: suffixes that are always consonant initial – section 2.4.1 – suffixes that are sometimes vowel-initial and sometimes consonant-initial – section 2.4.2 – and suffixes that are always vowel-initial – section 2.4.3. The importance of this classification becomes clear when looking at what suffixes trigger stem-internal vowel-zero alternations: only suffixes that are sometimes or always vowel-initial can trigger this alternation as discussed in detail in section 3.

2.4.1 Consonant initial suffixes

Strictly consonant-initial suffixes like the dative suffix *-nak/-nek* /-nAk/ [-nɒk/-nɛk] do not show any alternation no matter whether they follow a consonant-final or vowel-final root as shown in examples (73) and (74). Note, that when talking about alternations in this section we restrict our attention to the initial segment of the suffix and disregard other alternations like those due to vowel harmony (cf. section 2.3).

(73) kapu + -nAk [kɒpu + -nAk] ‘gate’ + DATIVE
→ kapunak [kɒpunɒk] ‘for (a) gate’ (V#)

(74) ország + -nAk [orsaːg + -nAk] 'country' + DATIVE
→ országnak [orsaːgnɒk] 'for (a) country' (C#)

We find strictly consonant-initial suffixes both in the nominal and in the verbal domain. Since most Hungarian monomorphemic verbs end in a consonant – with the exception of *lő* [løː] 'shoot' – we need to consider the subjunctive form of verbs to find vowel final verbforms. Examples (75) and (79) show that the possibility modal suffix *-hat/-het* /-hAt/ [-hɒt/-hɛt] attaches to a vowel-final and to a consonant-final stem without any suffix-initial alternations. Note that the lengthening of the final low vowel in example (75) is not unique to this suffix or even to verbs. This process known in the literature as final low vowel lengthening takes place whenever a stem ending in a low vowel – [ɛ] or [ɒ] – is followed by a suffix (cf. Siptár & Törkenczy (2000)).

(75) lő + -hAt [løː+ -hAt] 'shoot' + POSSIBILITY
→ lőhet [løːhɛt] 'she can shoot' (V#)

(76) főz + -hAt [føːz + -hAt] 'cooks' + POSSIBILITY
→ főzhet [føːzhɛt] 'he can cook' (C#)

In this section we have seen that consonant-initial suffixes attach to vowel- and consonant-final roots in the same unaltered form. From a theoretical point of view, this pattern can be straightforwardly derived since it is always the most faithful candidate that we find on the surface.

2.4.2 Vowel-zero alternating suffixes

There are number of suffixes – both nominal and verbal – that undergo alternations depending on whether they attach to a vowel- or a consonant-final stem. I refer to these suffixes as vowel-zero alternating suffixes. Vowel-zero alternating suffixes like the plural suffix *-k/-ak/-ok/-ek/-ök* /-(V)k/ [-k/ɒk/-ok/-ɛk/-øk] attach to vowel-final stems without a suffix-initial vowel and attach to consonant-final stems with a vowel-initial form as shown in examples (77) and (78), respectively. Since the height of the suffixal vowel in the plural suffix is not predetermined underlyingly I use a capital V as a stand in for it.

(77) kapu + -(V)k [kɒpu + -(V)k] 'gate' + PLURAL
→ kapuk [kɒpuk] 'gates' (V#)

(78) ország + -(V)k [orsaːg + -(V)k] 'country' + PLURAL
→ országok [orsaːgok] 'countries' (C#)

An example for vowel-zero alternating suffixes in the verbal domain is the 1. singular suffix

-k/-ok/-ek/-ök /-(O)k/ [-ok/-ɛk/-øk] as shown in examples (79) and (80). In example (79) the suffix surfaces without a suffixal vowel after a vowel-final stem, while in example (80) a non-high suffixal vowel appears after the consonant-final stem.

(79) főzne + -(V)k [føːznɛ+ -(V)k] 'would cook' + 1.SG
→ főznék [føːzneːk] 'I would cook' (V#)

(80) főz + -(V)k [føːz + -(V)k] 'cooks' + 1.SG. → főzök [føːzøk] 'I cook' (C#)

The suffixal vowel in vowel-zero alternating suffixes does not necessarily have to be non-high as in examples (77)–(80). Examples (81) and (82) show that the high vowel of the 1. plural possessive suffix *-unk/-ynk* /-(U)nk/ [-ŋ̊/-uŋ̊/-yŋ̊] is also subject to vowel-zero alternations. In example (81) the 1. plural possessive suffix *-unk/-ünk* /-(U)nk/ [-ŋ̊/-uŋ̊/-yŋ̊] surfaces without a vowel after a vowel-final stem, while in example (82) it surfaces with a high vowel after a consonant final stem.

(81) hajó + -(U)nk [hɒjoː+ -(U)ŋ̊] 'ship' + 1.PL.POSSESSIVE
→ hajónk [hɒjoːŋ̊] 'our ship' (V#)

(82) ország + -(U)nk [orsaːg + -(U)ŋ̊] 'country' + 1.PL.POSSESSIVE
→ országunk [orsaːguŋ̊] 'our country' (C#)

We find vowel-zero alternating suffixes with an underlyingly high vowel in the verbal domain as well. An example for such a suffix is given in (83) and (84). In example (83) the 1. plural suffix appears on the surface without an initial vowel after a vowel-final stem, while it appears with a vowel after a consonant-final stem in (84).

(83) főzne + -(U)nk [føːznɛ+ -(U)ŋ̊] 'would cook' + 1.PLURAL
→ főznénk [føːzneːŋ̊] 'we would cook' (V#)

(84) főz + -(U)nk [føːz + -(U)ŋ̊] 'cooks' + 1.PLURAL
→ főzünk [føːzyŋ̊] 'we cook' (C#)

As we have seen in the examples in this section when a vowel-zero alternating stem follows a vowel-final stem, the suffix-initial vowel is deleted to avoid hiatus. Theoretically, there are many different ways to avoid hiatus in general, e.g. vowel deletion, consonant epenthesis, diphtongization. Hungarian deploys different solutions to avoid hiatus, although in certain cases it tolerates it (cf. Siptár & Szentgyörgyi (2013)). To account for examples like (77) – repeated here in (85) – we need to capture that the insertion of a consonant or preserving hiatus is worse than vowel deletion. This can be formally done by relying on the constraints in (114)–(88).

(85) kapu + -(V)k [kɒpu + -(V)k] 'gate' + PLURAL

→ kapuk [kɒpuk] ‘gates’ (V#)

(86) *Hiatus: Assign one violation mark for every pair of two consecutive vowels.

(87) Max(V): Assign one violation mark for every underlying vowel that has no corresponding segment on the surface.

(88) Dep([+consonantal]): Assign one violation mark for every [+consonantal] surface segment that has no corresponding underlying segment.

As tableau (89) shows simply ranking the constraint against hiatus – *Hiatus – and the constraint against consonant epenthesis – Dep([+consonantal]) – over the constraint penalizing vowel deletion does not suffice. This constraint ranking can successfully rule out preserving hiatus – as in candidate c in tableau (89) – and the insertion of a consonant – as in candidate d. However, the deletion of the stem-final vowel and that of the suffix-initial vowel are considered to be equally good. This would predict that the plural form of *kapu* /kɒpu/ [kɒpu] ‘gate’ is either [kɒpuk] –candidate a in (89) – or [kɒpok] – candidate b in (89) – contrary to what we find in the language.

(89)

kɒpu + -(V)k			Dep([+consonantal])	Hiatus	Max(V)
a.	☞	kɒpuk			*
b.	☞	kɒpok			*
c.		kɒpuok		*!	
d.		kɒputok	*!		

The avoid the free variation predicted in tableau (89) it is necessary to distinguish between the deletion of stem-final vowel and that of the suffix-initial vowel. This can be done by using a Max-F constraint like Max([α back]) defined in (90).

(90) Max([α back]): Assign one violation mark for every underlying [α back] feature that has no correspondent on the surface.

Since only the stem-final vowel is defined underlyingly for backness, only the deletion of that vowel and not that of the suffix-initial vowel violates this new constraint. How this solves the problem of the incorrectly predicted free variation in tableau (89) is shown in tableau (91). In (91) we can see that Max([α back]) is violated by candidate b – the candidate in which the stem-final vowel is deleted – but not by candidate a – the candidate in which the suffix-initial vowel is deleted. This means that as long as Max([α back]) – just like *Hiatus and Dep([+consonantal]) – are ranked above Max(V), the correct outcome for vowel-final stems followed by vowel-zero alternating suffixes is predicted. The crucial ranking established in tableau (91) is noted in (92).

(91)

kɒpu + -(V)k		Max([αback])	Dep([+consonantal])	Hiatus	Max(V)
a.	☞ kɒpuk				*
b.	kɒpok	*!			*
c.	kɒpuok			*!	
d.	kɒputok		*!		

(92) MAX([α back]), *HIATUS, DEP([+consonantal]) ≫ MAX(V)

Beyond the vowel-zero alternating suffixes discussed so far in this section, there are some special cases of vowel-zero alternating suffixes which present further variation in the language. Certain vowel-zero alternating suffixes like the accusative suffix *-t* /-t/ [-t] behave only seemingly the same way as the suffixes seen so far in this section. They follow a vowel-final stem directly without an additional vowel as shown in (93), and have a vowel-initial form after a consonant-final stem as in (94).

(93) kapu + -t [kɒpu + -t] 'gate' + ACCUSATIVE
→ kaput [kɒput] 'gate-ACCUSATIVE' (V#)

(94) ország + -t [orsaːg + -t] 'country' + ACCUSATIVE
→ országot [orsaːgot] 'country-ACCUSATIVE' (C#)

Suffixes like the accusative suffix *-t* /-t/ [-t] do not always have a vowel-initial form after consonant-final stems as shown in example (95). In fact, the accusative [t] can appear without a vowel after consonant-final stems if it forms a licit word-final consonant cluster the the final consonant of the stem it follows. That is to say that there is no vowel between the accusative [t] and the final [l] of *asztalt2* in example (95) because [lt] is a well-formed word-final consonant cluster in the language. In this respect the accusative is crucially different from suffixes like the plural, which always surfaces as vowel-initial after consonant-final stems. Evidence for this is provided in examples (96) and (97), which show that even though [lk] appears word-finally monomorphemically in the language – cf. (97) – the plural suffix *-k/-ak/-ok/-ek/-ök* /-(V)k/ [-k/ɒk/-ok/-ɛk/-øk] cannot follow the l-final stem without a vowel – cf. (96). This distributional difference between the accusative and plural suffix is the reason why the plural suffix is represented with an underlying vowel, while the accusative suffix isn't.

(95) asztal + -t [ɒstɒl + -t] 'table' + ACCUSATIVE (L#)
a. → *asztalot [ɒstɒlot]
b. → asztalt [ɒstɒlt] 'table-ACCUSATIVE'

(96) asztal + -(V)k [ɒstɒl + -(V)k] 'table' + PLURAL (L#)
a. → asztalok [ɒstɒlok] 'tables'

b. → *asztalk [ɒstɒlk]

(97) halk [hɒlk] 'quiet'

The past tense suffix *-t(t)/-ot(t)/-et(t)/-öt(t)* /-(O)t(t)/ [-t(t)/-ot(t)/-ɛt(t)/-øt(t)] in the verbal domain behaves very similarly to the accusative suffix *-t* /-t/ [-t] in the nominal domain, cf. examples (98)–(100). Similarly to the accusative suffix, the past tense suffix follows vowel-final stems with a consonant-initial form – cf. (98) – it follows certain consonant-final stems with a vowel-initial form as in (99), while others with a consonant-initial form as shown in (100).

(98) lő + -(O)t(t) [løː+ -(O)t(t)] 'shoots' + PAST → lőtt [løːtː] 'shot' (V#)

(99) fog + -(O)t(t) [fog + -(O)t(t)] 'holds' + PAST → fogott [fogotː] 'held' (C#)

(100) öl + -(O)t(t) [øl + -(O)t(t)] 'kills' + PAST → ölt [ølt] 'killed' (L#)

It is important to note, though, that the distribution of vowel- and consonant-initial forms of the accusative suffix *-t* /-t/ [-t] and the past tense suffix *-t(t)/-ot(t)/-et(t)/-öt(t)* /-(O)t(t)/ [-t(t)/-ot(t)/-ɛt(t)/-øt(t)] is not identical. Even though [ʃt] is a well-formed word-final cluster that appears in the language monomorphemically – cf. (101) – only the accusative suffix can follow an ʃ-final stem in a consonant-initial form – cf. examples (102) and (103). In fact, the consonant-initial form of the past tense suffix is restricted to vowel-final stems and to consonant-final stems in which the final consonant is a sonorant with which it can form a licit word-final consonant cluster monomorphemically, while the accusative suffix is consonant-initial both after a vowel-final stem and after any final consonant – not just sonorants – that forms a licit word-final cluster with it.

(101) most [moʃt] 'now'

(102) fos + -t [foʃ+ -t] 'diarrhea' + ACCUSATIVE

a. → *fosot [foʃot]

b. → fost [foʃt] 'diarrhea-ACCUSATIVE'

(103) fos + -(O)t(t) [foʃ+ -(O)t(t)] 'have diarrhea' + PAST

a. → fosott [foʃotː] 'had diarrhea'

b. → *fost [foʃt]

So far we have seen vowel-zero alternating suffixes which have different forms depending on whether they follow a stem that ends in a vowel or a consonant and some that have different forms even depending on what consonant the stem, that they follow, ends with. There is one additional kind of vowel-zero alternating suffix, which is consonant-initial after vowel-stems and after consonant-final stems if the final consonant is preceded by a vowel and vowel-initial otherwise.[3] This kind of suffix is only found in the verbal domain. An example for such a suffix is the infinitive suffix *-ni/-ani/-eni* /-(A)ni/ [-ni/-ɒni/-ɛni]. The infinitive suffix surfaces with a consonant-initial form after vowel-final stems as shown in (104) and after stems ending in a single consonant as in (105), but it has a vowel-initial form on the surface if it follows a stem ending in a consonant clusters as shown in (106).

(104) lő + -(A)ni [løː+ -(A)ni] 'shoot' + INFINITIVE → lőni [løːni] 'to shoot' (V#)

(105) főz + -(A)ni [føːz + -(A)ni] 'cook' + INFINITIVE → főzni [føːzni] 'to cook' (VC#)

(106) mond + -(A)ni [mond + -(A)ni] 'say' + INFINITIVE
→ mondani [mondɒni] 'to say' (CC#)

2.4.3 Vowel initial suffixes

Strictly vowel-initial suffix appear in their vowel-initial form both after vowel-final and consonant-final stems. That is to say that unlike vowel-zero alternating suffixes, strictly vowel-initial suffixes never lose their initial vowel no matter what segment the stem they follow ends with. An example for such a suffix from the nominal domain is the terminative suffix *-ig* /-ig/ [-ig]. As examples (107) and (108) show, respectively, the terminative suffix surfaces in its vowel-initial form both after vowel- and consonant-final stems.

(107) kapu + -ig [kɒpu + -ig] 'gate' + TERMINATIVE
→ kapuig [kɒpujig] '(up)to (a) gate' (V#)

(108) ország + -ig [orsaːg + -ig] 'country' + TERMINATIVE
→ országig [orsaːgig] '(up)to (a) country' (C#)

Note that to avoid hiatus a glide is inserted between the stem-final and the suffix-initial vowels in example (107). However, when a strictly vowel-initial suffix with an initial non-high vowel follows a vowel-final stem hiatus is tolerated. An example for such a case arises when the causative suffix *-ért* /-eːrt/ [-eːrt] follows a vowel-final stem as shown in (109).

(109) kapu + -ért [kɒpu + -eːrt] 'gate' + CAUSATIVE
→ kapuért [kɒpueːrt] 'for (a) gate'

We also find strictly vowel-initial suffixes in the verbal domain like the nominalizer suffix *-ás/-és* /-Aːʃ/ [-aːʃ/-eːʃ]. Since this suffix cannot follow the subjunctive form of a verb, the only vowel-final verb *lő* /løː/ [løː] is used here to showcase that initial vowel of the nominalizer suffix *-ás/-és* / [-aːʃ/-eːʃ] surfaces after vowel-final stems as well, cf. example (110). Note that the v-insertion in example (110) is not tied to the suffix *-ás/-és* /-Aːʃ/

[3] Thank you to Miklós Törkenczy (p.c.) for pointing this out to me.

[-aːʃ/-eːʃ].

(110) lő + -Aːʃ[løː+ -Aːʃ] 'shoot' + NOMINALIZER → lövés [løveːʃ] 'shooting' (V#)

(111) főz + -Aːʃ[føːz + -Aːʃ] 'cook' + NOMINALIZER → főzés [føːzeːʃ] 'cooking' (C#)

Last, but not least, example (111) shows that the strictly vowel-initial nominalizer suffix *-ás/-és* /-Aːʃ/ [-aːʃ/-eːʃ] surfaces in a vowel-initial form after consonant-final stems as well.

Examples (107) and (109) – repeated here in (112) and (113) – raise the question why it is that in some case a glide is inserted whereas in other cases hiatus is tolerated. Glide insertion is only available if one of the vowels involved in a potential hiatus is [i] – a [+high, -back,-round] vowel – since that is the vowel phonetically closest to the only available glide in the language.

(112) kapu + -ig [kɒpu + -ig] 'gate' + TERMINATIVE
→ kapuig [kɒpujig] '(up)to (a) gate'

(113) kapu + -ért [kɒpu + -eːrt] 'gate' + CAUSATIVE
→ kapuért [kɒpueːrt] 'for (a) gate'

Let's see ho we can capture the distribution of glide insertion and tolerance of hiatus formally. The constraints involved in this part of the analysis are given in (114)–(118). The constraints in (114)–(118) penalize hiatus, deletion of vowel underlyingly specified for backness, consonant epenthesis, glides that are not part of the phoneme inventory of the language, and the insertion of a glide, respectively.

(114) *HIATUS: Assign one violation mark for every pair of two consecutive vowels.

(115) MAX([αback]): Assign one violation mark for every underlying [α back] feature that has no correspondent on the surface.

(116) DEP([+consonantal]): Assign one violation mark for every [+consonantal] surface segment that has no corresponding underlying segment.

(117) *w: Assign one violation mark for every [w] segment.

(118) DEP([-syllabic,-consonantal]): Assign one violation for every [-syllabic,-consonantal] surface segment that has no corresponding underlying segment.

Tableaux (119) shows how glide insertion can be derived when a truly vowel initial suffix with a high front unrounded initial vowel follows a vowel-final non-lowering stem. Candidate b in tableau (119) – the most faithful candidate – violates *HIATUS, while candidate c and d are penalized by MAX(V) for deleting one of the two vowels involved in the potential hiatus. In candidates a, e and f a segment is inserted to avoid hiatus. Candidate e is penalized because the inserted segment is not part of the phoneme inventory of the language, while candidate f violates Dep([+consonantal]) by inserting a random consonant. In contrast to candidate e and f, in candidate a a glide is inserted that is part of the phoneme inventory and moreover, it is homorganic with one of the neighboring vowels and thus, it only violates the faithfulness constraint against the epenthesis of glides. From the constraint violations in (119) we can conclude that the desired candidate emerges as the optimal as long as hiatus is ranked below the constraints penalizing vowel deletion, consonant epenthesis, glides that are not part of the language, but above the Dep([-syllabic,-consonantal]). This constraint ranking is formally captured in (120).

(119)

kɒpu + -ig			Max([αback])	Dep([+cons])	*w	*Hiatus	Dep([-syll,-cons])
a.	☞	kɒpujig					*
b.		kɒpuig				*!	
c.		kɒpug	*!				
d.		kɒpig	*!				
e.		kɒpuwig			*!		*
f.		kɒputig		*!			*

(120) Max([αback]), Dep([+cons]), *w, *Hiatus ≫ Dep([-syllabic,-consonantal])

An additional constraint is needed to capture what happens when a truly vowel initial suffix with a vowel other than [i] as its initial vowel follows a vowel-final stem ending with a vowel other than [i] to rule out glide insertion. A constraint penalizing the insertion of a non-homorganic glide before or after a vowel is given in (121).

(121) $\text{Dep}\left(\begin{bmatrix}\text{+consonantal}\\ \text{-syllabic}\\ \alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\right) / \neg \left\{\begin{matrix} - \begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix} \\ \begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix} - \end{matrix}\right\}$: Assign one violation mark for every glide on the surface that is not homorganic with a vowel preceding or following it and which has no underlying correspondent.

An example for a truly vowel initial suffix with an initial vowel that is not [i] is the causative suffix *-ért* /-eːrt/ [-eːrt]. With the causative suffix *-ért* /-eːrt/ [-eːrt] glide insertion is not expected as long as the noun it attaches to does not end with an [i]. In this case hiatus is tolerated as shown in example (113) – repeated here in (122).

(122) kapu + -ért [kɒpu + -eːrt] 'gate' + causative
→ kapuért [kɒpueːrt] 'for (a) gate'

How we can derive the toleration of hiatus with *-ért* /-eːrt/ [-eːrt] after a non-i-final stem is shown in (123). Candidates c and d, which involve deletion of one of the vowels involved in the potential hiatus can be ruled out by Max([αback]) just as in tableau (119). Again similarly to the case when an i-initial suffix attaches to a vowel-final stem (cf. (119)) candidates that involve the insertion of a random segment with a [+consonantal] feature (cf. candidate f in (123)) or the insertion of a glide that is not part of the phoneme inventory of the language (cf. candidate e in (123)) are ruled out by constraints Dep([+consonantal]) and *w, respectively. The main question with respect to non-i-initial suffixes following non-i-final stems is how we rule out glide insertion. This can be done with the faithfulness constraint penalizing non-homorganic glides as shown with candidate b in (123). That is to say that as long as the faithfulness constraint against non-homorganic glides is ranked above Hiatus, which the desired candidate – candidate a in (123) – violates, we can predict the desired outcome. This new crucial constraint ranking is given in (124).

(123)

kɒpu + -eːrt	Max([αback])	Dep([+cons])	*w	$\textsc{Dep}\left(\begin{bmatrix}+\text{consonantal}\\ \text{-syllabic}\\ \alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\right)/\neg\left\{\begin{matrix}\text{–}\begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\\ \begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\text{–}\end{matrix}\right\}$	*Hiatus	Dep([-syll,-cons])
a. ☞ kɒpueːrt					*	
b. kɒpujeːrt				*!		*
c. kɒpurt	*!					
d. kɒpeːrt	*!					
e. kɒpuweːrt			*!			*
f. kɒputeː		*!				*

(124)

$$\textsc{Dep}\left(\begin{bmatrix}+\text{consonantal}\\ \text{-syllabic}\\ \alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\right)/\neg\left\{\begin{matrix}\text{–}\begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\\ \begin{bmatrix}\alpha\text{ high}\\ \beta\text{ round}\end{bmatrix}\text{–}\end{matrix}\right\} \gg \text{*}\textsc{Hiatus}$$

If a vowel-final stem ends in [i], then a glide is always inserted when a vowel initial form of a suffix is attached. This means that the causative forms of i-final stem kocsi [kot͡ʃi] 'car' involves glide insertion (cf. (125)).

(125) kocsi + -ért [kot͡ʃi + -eːrt] 'car' + CAUSATIVE
→ kocsiért [kot͡ʃijeːrt] 'for (a) car'

Example (125) can be derived with the already established ranking similarly to the terminative form of non-i-final vowel-final stems (cf. (119)) since the faithfulness constraints against the insertion of homorganic glides is bidirectional. That is to say it does not matter whether the first or second vowel is [i] in a potential hiatus case, as long as one is a [+high,-back,-round] vowel a glide is inserted.

The distribution of consonant-initial, vowel-zero alternating and vowel-initial nominal and verbal suffixes is summarized below in tables 4 and 5, respectively. The suffixes are marked in magenta for ease of interpretation. Furthermore, in both tables the cells with blue backgrounds highlight that these suffixes always have the same consonant- or vowel-initial forms. The contrast between the green and orange cells highlights that some vowel-zero alternation suffixes have different forms based on whether they follow a vowel- or consonant-final stem. Note, that in table 5 not all forms of the verb *lő* 'she shoots' are truly vowel-final as marked by the coloring. The three way contrast in coloring – green, yellow and red – under certain suffixes signals that these suffixes are not only sensitive to whether they follow a vowel- or a consonant-final stem, but also to what the final consonant is in the case of the accusative and the past tense suffixes and to how many consonants a verb ends with in the case of the infinitive suffix.

	C-initial suffix	**Vowel-zero alternating suffixes**			**V-initial suffixes**	
	dative /-nAk/ [-nɒk/-nɛk]	plural /-(V)k/ [-k/-ɒk/-ok/-ɛk/-øk]	1.pl possessive /-(U)nk/ [-ŋ̊/-uŋ̊/-yŋ̊]	accusative /-t/ [-t]	terminative /-ig/ [-ig]	causative /-eːrt/ [-eːrt]
Vowel-final stems						
hajó [hɒjoː] ‘ship’	hajónak [hɒjoːnɒk] ‘for (a) ship’	hajók [hɒjoːk] ‘ships’	hajónk [hɒjoːŋ̊] ‘our ship’	hajót [hɒjoːt] ‘ship-ACC’	hajóig [hɒjoːjig] ‘(up)to (a) ship’	hajóért [hɒjoːeːrt] ‘for (a) ship’
Consonant-final stems						
ország [orsaːg] ‘country’	országnak [orsaːgnɒk] ‘for (a) country’	országok [orsaːgok] ‘countries’	országunk [orsaːguŋ̊] ‘our country’	országot [orsaːgot] ‘country-ACC’	országig [orsaːgig] ‘(up)to (a) country’	országért [orsaːgeːrt] ‘for (a) country’
asztal [ɒstɒl] ‘table’	asztalnak [ɒstɒlnɒk] ‘for (a) table’	asztalok [ɒstɒlok] ‘tables’	asztalunk [ɒstɒluŋ̊] ‘our table’	asztalt [ɒstɒlt] ‘table-ACC’	asztalig [ɒstɒlig] ‘(up)to a table’	asztalért [ɒstɒleːrt] ‘for (a) table’
fos [foʃ] ‘diarrhea’	fosnak [foʃnɒk] ‘for diarrhea’	fosok [foʃok] ‘diarrheas’	fosunk [foʃuŋ̊] ‘our diarrhea’	fost [foʃt] ‘diarrhea-ACC’	fosig [foʃig] ‘(up)to diarrhea’	fosért [foʃeːrt] ‘for diarrhea’

Table 4: Distribution of nominal suffixes

	C-initial suffix	**Vowel-zero alternating suffixes**				**V-initial suffix**
	possibility /-hAt/ [-hɒt/-hɛt]	first singular /-(O)k/ [-k/-ok/-ɛk/-øk]	first plural /-(U)nk/ [-ŋ̊/-uŋ̊/-yŋ̊]	past tense /-(O)t(t)/ [-t(t)/-ot(t)/-ɛt(t)/-øt(t)]	infinitive /-(A)ni/ [-ni/-ɒni/-ɛni]	nominalizer /-Aːʃ/ [-aːʃ/-eːʃ]
Vowel-final stems						
főzne [føːznɛ] 'would cook'	főzhetne [føːzhɛtnɛ] 'she could cook'	főznék [føːzneːk] 'I would cook'	főznénk [føːzneːŋ̊] 'we would cook'	főzött volna [føːzøtː volnɒ] 'she would have cooked'	NA NA NA	NA NA NA
lő [løː] 'shoot'	lőhet [løːhɛt] 'she can shoot'	lövök [løvøk] 'I shoot'	lövünk [løvyŋ̊] 'we shoot'	lőtt løːtː] 'she shot'	lőni [løːni] 'to shoot'	lövés [løveːʃ] 'shooting'
Consonant-final stems						
főz [føːz] 'cook'	főzhet [føːzhɛt] 'he can cook'	főzök [føːzøk] 'I cook'	főzünk [føːzynk] 'we cook'	főzött føːzøtː] 'he cooked'	főzni [føːzni] 'to cook'	főzés [føːzeːʃ] 'cooking'
öl [øl] 'kill'	ölhet [ølhɛt] 'she can kill'	ölök [øløk] 'I kill'	ölünk [ølynk] 'we kill'	ölt [ølt] 'she killed'	ölni [ølni] 'to kill'	ölés [løveːʃ] 'killing'
fos [foʃ] 'has diarrhea'	foshat [foʃhɒt] 'he can have diarrhea'	fosok [foʃok] 'I have diarrhea'	fosunk [foʃuŋ̊] 'we have diarrhea'	fosott [foʃotː] 'he had diarrhea'	fosni [foʃni] 'to have diarrhea'	fosás [foʃaːʃ] 'diarrhea'
mond [mond] 'say'	mondhat [mondhɒt] 'he can say'	mondok [mondok] 'I say'	mondunk [mondunk] 'we say'	mondott [mondotː] 'he said'	mondani [mondɒni] 'to say'	mondás [mondaːʃ] 'saying'

Table 5: Distribution of verbal suffixes

Chapter 3

‘Epenthetic’ stems

Hungarian has a variety of different stem-alternations. This thesis focuses on stems which are subject to vowel-zero alternations when followed by certain suffixes. These stems have been traditionally referred to as ‘epenthetic’ stems in the literature since Vago (1980). According to Vago (1980) the base form of these stems is the vowelless form and a vowel is inserted in certain cases to break up an illicit cluster. However, if we compare example (5) – an ‘epenthetic’ stem – and (2) – a CC final stem – we can see that his assumption about illicit consonant clusters is incorrect.

(1) torony + -(V)k [toroɲ+ -(V)k] ‘tower’ + PLURAL → tornyok [torɲok] ‘towers’

(2) szörny [søɾɲ] ‘monster’

Although the literature still refers to these stems a ‘epenthetic’ at least to some extent, I will refrain from referring to them as such and rather use the term vowel-zero alternating stems to avoid any confusion.

This chapter provides an overview of what stem-internal vowel-zero alternations look like and when they are triggered based on Siptár & Törkenczy (2000) and Kiefer (2018). The chapter is divided into two parts: section 3.1 introduces nominal vowel-zero alternating stems, while section 3.2 is devoted to verbal vowel-zero alternating stems.

3.1 Nominal stems

As discussed in section 2.4, certain Hungarian suffixes, like the plural suffix *-k/-ak/-ok/-ek/-ök* /-(V)k/ [-k/ɒk/-ok/-ɛk/-øk], have vowel-initial and consonant-initial forms. Generally the consonant-initial form attaches to vowel-final stems as in (3), while the vowel-initial form attaches to the consonant-final stems as in (4) without any changes to the stems in either case.

(3) kapu + -(V)k [kɒpu + -(V)k] 'gate' + PLURAL → kapuk [kɒpuk] 'gates'

(4) beteg + -(V)k [bɛtɛg + -(V)k] 'patient' + PLURAL
→ betegek [bɛtɛgɛk] 'patients'

There is a set of about 500 stems that form an exception to this observation (Siptár & Törkenczy (2000)). Here an example for an exceptional noun is given in (5). When the plural form of these consonant-final stems is formed the final stem-internal vowel is dropped.

(5) nyereg + -(V)k [ɲɛrɛg + -(V)k] 'saddle' + PLURAL → nyergek [ɲɛrgɛk] 'saddles'

Note that these stems undergo vowel-zero alternations only if they are followed by a certain suffixes, cf. examples (6) and (7). Examples (6) and (7) show, respectively, that the dative suffix *-nak/-nek* /-nAk/ [-nɒk/-nɛk] and the terminative suffix *-ig* /-ig/ [-ig] do not trigger this alternation.

(6) nyereg + -nAk [ɲɛrɛg + -nAk] 'saddle' + DATIVE → nyeregnek [ɲɛrɛgnɛk] 'for (a) saddle'

(7) nyereg + -ig [ɲɛrɛ+ -ig] 'tower' + TERMINATIVE → nyeregig [ɲɛrɛgig] 'to the tower'

The contrast between example (5) and examples (6) and (7) naturally raises the questions, which suffixes trigger stem-internal vowel-zero alternations. Among nouns consonant-initial suffixes – cf. example (6) – and strictly vowel-initial suffixes – cf. example (7) – do not trigger this alternation, while all vowel-zero alternating suffixes do – cf. (5).

Even vowel-zero alternating suffixes like the accusative suffix *-t* /-t/ [-t] that can follow certain stems without a vowel in between trigger this alternation, cf. (8) and (9). Example (8) shows that the accusative suffix *-t* /-t/ [-t] can attach to stems ending with a [ɲ] without a linking vowel. One might wonder whether the accusative suffix *-t* /-t/ [-t] can trigger vowel-zero alternations if an otherwise vowel-zero alternating stem ends in a consonant that it can attach to without a vowel. Example (9) shows that the stem-internal vowel-zero alternation is triggered even in these cases.

(8) szurony + -t [suroɲ+ -t] 'bayonet' + ACCUSATIVE
→ szuronyt [suroɲt] 'bayonet-ACC'

(9) torony + -t [toroɲ+ -t] 'tower' + ACCUSATIVE → tornyot [torɲot] 'tower-ACC'

Table 6 provides a comparison of the behavior of four different suffixes after regular and vowel-zero alternating stems. It shows that the consonant-initial dative suffix and the strictly vowel-initial terminative suffix – both highlighted in blue – never trigger this alternation. The alternation is triggered after both vowel-zero alternating suffixes – highlighted in orange

– even though their behavior after regular stems is not the same – emphasized through the contrast of green and yellow backgrounds. The suffixes are marked in magenta for ease of interpretation.

	C-initial suffix	Vowel-zero alternating suffixes		V-initial suffix
	dative /-nAk/ [-nɒk/-nɛk]	plural /-(V)k/ [-k/-ɒk/-ok/-ɛk/-øk]	accusative /-t/ [-t]	terminative /-ig/ [-ig]
Regular stems				
beteg [bɛtɛg] 'patient'	betegnek [bɛtɛgnɛk] 'for (a) patient'	betegek [bɛtɛgɛk] 'patients'	beteget [bɛtɛgɛt] 'patient-ACC'	betegig [bɛtɛgig] '(up)to the patient'
szurony [suroɲ] 'bayonet'	szuronynak [suroɲnɒk] 'for (a) bayonet'	szuronyok [suroɲok] 'bayonets'	szuronyt [suroɲt] 'bayonet-ACC'	szuronyig [suroɲig] '(up)to a bayonet'
Vowel-zero alternating stems				
nyereg [ɲɛrɛg] 'saddle'	nyeregnek [ɲɛrɛgnɛk] 'for (a) saddle'	nyergek [ɲɛrgɛk] 'saddles'	nyerget [ɲɛrgɛt] 'saddle-ACC'	nyeregig [ɲɛrɛgig] '(up)to a saddle'
torony [toroɲ] 'tower'	toronynak [toroɲnɒk] 'for (a) tower'	tornyok [torɲok] 'towers'	tornyot [torɲot] 'towerACC'	toronyig [toroɲig] '(up)to a tower'

Table 6: Vowel-zero alternations in nouns

The above generalization that a vowel-zero alternating noun appears without its alternating vowel only if a it is followed by a vowel-zero alternating suffix suggests that if any vowel-zero alternating noun and any vowel-zero alternating suffix appear consecutively in this order, then the noun surfaces without its alternating vowel. In reality what we find that there is quire a bit of variation. [1]

Most vowel-zero alternating stems do in fact lose their alternating vowel when they are followed by a(ny) vowel-zero alternating suffix. Here *álom* [aːlom] 'dream' is given as an example for such a vowel-zero alternating stem in (10) and (11). As examples (10) and (11) show *álom* [aːlom] is obligatorily subject to vowel-zero alternation both before the plural suffix and the less frequently used distributive suffix. The fact that there might be a scale behind what triggers stem-internal alternations has been noted in connection with Spanish diphthongs by Eddington (1996) and in connection with German umlaut by Trommer (2016).

[1] This section is the result of discussions with Péter Rebrus, Péter Szigetvári and Miklós Törkenczy. I am grateful for their insights on how much variation there is when it comes to vowel-zero alternations.

(10) álom + -(V)k [aːlom + -(V)k] 'dream' + PLURAL

a. → álmok [aːlmok] 'dreams'

b. → *álomok [aːlomok]

(11) álom + -(V)nként [aːlom + -(V)n̊keːnt] 'dream' + DISTRIBUTIVE

a. → álmonként [aːlmon̊keːnt] 'each dream"

b. → *álomonként [aːlomon̊keːnt]

Other stems, like the nominal stem *kapocs* [kɒpot͡ʃ] 'staple' vacillate, cf. examples (12) and (13). These stems are used both like regular stems – that is they always keep their final stem vowel – and as vowel-zero alternating stems – that is they are subject to vowel-zero alternations before a vowel-zero alternating suffix. In the case of truly vacillating stems both forms are equally accepted.

(12) kapocs+ -(V)k [kɒpot͡ʃ + -(V)k] 'staple' + PLURAL

a. → kapcsok [kɒpt͡ʃok] 'staples'

b. → kapocsok [kɒpot͡ʃok] 'staples'

(13) kapocs + -(V)nként [kɒpot͡ʃ + -(V)n̊keːnt] 'staple' + DISTRIBUTIVE

a. → kapcsonként [kɒpt͡ʃon̊keːnt]

b. → kapocsonként [kɒpot͡ʃon̊keːnt]

There are also vowel-zero alternating stems, which generally do alternate, but not always. That is, they obligatory undergo vowel-zero alternation before certain vowel-zero alternating suffixes, while only optionally undergo vowel-zero alternation before other vowel-zero alternating suffixes. Here an example is given in (14) and (15). Example (14) shows that the noun *retek* [retek] 'radish' is only acceptable without its final stem vowel if it is followed by the plural suffix. However, as seen in example (15) it is acceptable with and without its final vowel before the distributive suffix *-nként/-anként/-enként* /-(V)nként/ [-n̊eːnt/-ɒn̊eːnt/-ɛn̊eːnt].

(14) retek + -(V)k [rɛtɛk + -(V)k] 'radish' + PLURAL

a. → retkek [rɛtkɛk] 'radishes'

b. → *retekek [rɛtɛkɛk]

(15) retek + -(V)nként [rɛtɛk + -(V)n̊keːnt] 'radish' + DISTRIBUTIVE

a. → retkenként [rɛtkɛn̊keːnt] 'each tower'

b. → retekenként [rɛtɛkɛn̊keːnt] 'each radish'

Note that there are no examples for vowel-zero alternating stems that are obligatorily subject to vowel-zero alternations with the distributive suffix, but only optionally subject to it before the plural suffix. Moreover, there is generally less variation before the plural suffix than before the distributive suffix: almost all alternating stems are always subject to vowel-zero alternations before the plural suffix while not all of them are before the distributive suffix. This suggests that there might be a scale reflecting how strongly a suffix is capable of triggering vowel-zero alternations. [2] Unfortunately, it goes beyond the scope of this thesis to fully document the variation in how strongly various vowel-zero alternating suffixes trigger stem-internal vowel-zero alternations. In what follows, I simply assume that both vowel-zero alternating suffixes and stems behave uniformly.

We find further variation in the domain of nominal vowel-zero alternating stems when we take a closer look at proper names. Proper names are generally not subject to vowel-zero alternations even if they are of the right form. This can be shown with a minimal pair like (16) and (17). The form of the common noun in (16) and the proper name in (17) is identical. However, only the common noun – example (16) – is subject to vowel-zero alternation.

(16) sólyom + -t [ʃoːjom + -t] 'falcon' + ACCUSATIVE
   a. → sólymot [ʃoːjmot] 'falcon-ACC'
   b. → *sólyomot [ʃoːjomot]

(17) Sólyom + -t [ʃoːjom + -t] 'Sólyom' + ACCUSATIVE
   a. → *Sólymot [ʃoːjmot]
   b. → Sólyomot [ʃoːjomot] 'Sólyom-ACC'

There is one exception to the generalization that proper names are not subject to vowel-zero alternations , which is given in (18). The name of a town *Eger* undergoes vowel-zero alternation before the adjectivizer suffix -i [-i], but not before other suffixes like the plural possessive suffix -Unk [-Uŋ̊k] as shown in example (19). [3] Interestingly, (18) is the only nominal example that undergoes vowel-zero alternation before a non-vowel-zero alternating suffix.

(18) Eger + -i [ɛgɛr + -i] Eger + ADJECTIVIZER
   a. → egri [ɛgri] 'from Eger'
   b. → *egeri [ɛgɛri]

(19) Eger + -(U)nk [ɛgɛr + -(U)ŋ̊k] Eger + 1.PL.POSS.
   a. → *Egrünk [ɛgryŋ̊k]
   b. → Egerünk [ɛgɛryŋ̊k] 'our Eger'

When a common noun like *öböl* [øbøl] 'bay' is part of a proper name the proper name may undergo vowel-zero alternation as shown in (20).[4] In contrast if the common noun *öböl* [øbøl]

[2] Thank you to Péter Rebrus (p.c.) for pointing this out to me.
[3] Thank you to Miklós Törkenczy (p.c.) forpointing this out to me.
[4] Thank you to Péter Rebrus (p.c.) for pointing this out to me.

‘bay’ is used by itself, then it must undergo vowel-zero alternation. Whether the difference between examples (20) and (21) is entirely due to the fact that the former is a proper name or whether the length difference also plays a role is left for future research.

(20) Bengáli-öböl + -t [bɛŋgaːli øbøl + -t] ‘Bay of Bengal’ + ACCUSATIVE
 a. → Bengáli-öblöt [bɛŋgaːli øbløt] ‘Bay of Bengal-ACC’
 b. → Bengáli-öbölt [bɛŋgaːli øbølt] ‘Bay of Bengal-ACC’

(21) öböl + -t [øbøl + -t] ‘bay’ + ACCUSATIVE
 a. → öblöt [øbløt] ‘bay-ACCUSATIVE’
 b. → *öbölt [øbølt]

Now that we have seen which suffixes trigger vowel-zero alternations and how much variation there is in the nominal domain, let us turn our attention to vowel-zero alternations in the verbal domain.

3.2 Verbal stems

Hungarian verbs can be divided into two groups based on their third singular present forms: (i) the majority of the verbs have a zero morpheme for person and number marking in present tense for third singular as in example (22), while (ii) a set of verbs end in *-ik* /-ik/ [-ik] in third singular in the present tense as in example (23).

(22) nevet [nɛvɛt] ‘laughs’

(23) megjelenik [mɛgjɛlɛnik] ‘appears’

There are vowel-zero alternating verbs in both groups: verbs that end with a zero morpheme and verbs that end in *-ik* /-ik/ [-ik] in third singular in the present tense. An example for a verb in each category is given in (24) and (25).

(24) pörög + -(O)k [pørøg + -(O)k] ‘twirls’ + 1.SG → pörgök [pørgøk] ‘I twirl’

(25) ugrik + -(O)k [ugrik + -(O)k] ‘jumps + 1SG → ugrok [ugrok] ‘I jump’

Since the third singular form of vowel-zero alternating *ik*-verbs does not contain their alternating vowel, one might wonder whether they are really alternating or not. We can see in other forms of these verbs – like in the imperative form of *ugrik* [ugrik] ‘jumps’ in example (26) – that the stem does have an alternating vowel that appears in some forms but not in others.

(26) ugrik + -j [ugor + -j] ‘jumps’ + IMPERATIVE → ugorj [ugorj] ‘jump-IMPERATIVE’

There are two observations that are unique to vowel-zero alternating verbs: (i) a suffix that may or may not trigger stem-internal vowel-zero alternations depending on what suffix it is followed by and (ii) strictly vowel-initial suffixes which trigger vowel-zero alternations. Let us first look at suffix, namely the past tense suffix *-t(t)/-ot(t)/-et(t)/-öt(t)* /-(O)t(t)/ [-t(ː), -ot(ː), -ɛt(ː), -øt(ː)], that is sensitive to what suffix it is followed by when it comes trigger stem-internal vowel-zero alternations.

As discussed in section 2.4.2 the past tense suffix can be vowel- or consonant-initial after consonant final stems depending on the quality and the number of the final consonant(s). However, no matter whether it attaches to a consonant-final stem with or without an initial vowel it is followed by a zero morpheme in third singular forms as shown in examples (27) and (28).

(27) nevet + -(O)t(t) + ∅ [nɛvɛt + -(O)t(t) + ∅] 'laughs' + PAST + 3SG
→ nevetett [nɛvɛtɛtː] 'she laughed'

(28) megjelenik + (O)t(t) + ∅ [mɛgjɛlɛnik + -(O)t(t) + ∅] 'appear' + PAST + 3SG
→ megjelent [mɛgjɛlɛnt] 'appeared'

In any other person and number the past tense suffix is followed by a vowel. This is shown here on the example of the first singular suffix in (29).

(29) megjelenik + (O)t(t) + Om [mɛgjɛlɛnik + (O)t(t) + Om] 'appear' + PAST + 1SG
→ megjelentem [mɛgjɛlɛntɛm] 'I appeared'

When it comes to vowel-zero alternating verbs it can make a crucial difference whether the past tense suffix is followed by null morpheme – as in third singular – or by a vowel-initial morpheme – as in the first singular. Whether the morpheme following the past tense suffix makes a difference in terms of triggering stem-internal vowel-zero alternations depends on whether the verb is an *ik*-verb or not. Among the non-*ik* verbs we find the following two patterns: (i) it either triggers the alternation when it is followed by a null morpheme as in example (30), but it does not trigger the alternation when it is followed by a vowel-initial suffix as in (31) or (ii) it does not trigger vowel-zero alternations at all as seen in examples (32) and (33).

(30) pörög + -(O)t(t) + ∅ [pørøg + -(O)t(t) + ∅] 'twirls' + PAST + 3SG
a. → *pörögött [pørøgøtː]
b. → pörgött [pørgøtː] 'he twirled'

(31) pörög + -(O)t(t) + -(O)m [pørøg + -(O)t(t) + -(O)m] 'twirls' + PAST + 1SG
a. → pörögtem [pørøgtɛm] 'I twirled'
b. → *pörgöttem [pørgøtːɛm]

(32) söpör + -(O)t(t) + ∅ [ʃøpør + -(O)t(t) + ∅] ‘sweeps’ + PAST + 3SG
  a. → söpört [ʃøpørt] ‘he swept’
  b. → *söprött [ʃøprøtː]

(33) söpör + -(O)t(t) + -(O)m [ʃøpør + -(O)t(t) + -(O)m] ‘sweeps’ + PAST + 1SG
  a. → söpörtem [ʃøpørtɛm] ‘I swept’
  b. → *söpröttem [ʃøprøtːɛm][5]

Note that based on examples (32) and (33) one might think that the verb *söpör* [ʃøpør] ‘sweeps’ does not undergo vowel-zero alternations at all. However, if we look at example (34) we find that the verb *söpör* [ʃøpør] ‘sweeps’ is subject to vowel-zero alternation when it is followed by the first singular suffix in present tense.

(34) söpör + -(O)k [ʃøpør + -(O)k] ‘sweeps’ + 1.SG → söprök [ʃøprøk] ‘I sweep’

Now that we have seen what variation the past tense suffix introduces among non-*ik*-verbs let us look at when it triggers vowel-zero alternations among *ik*-verbs. Similarly to non-*ik*-verbs we find two different patterns among *ik*-verbs as well: (i) the past tense suffix either leads to vowel-zero alternations both when it is followed by a zero morpheme and when it is followed by a vowel-initial suffix as shown in examples (35) and (36), respectively, or (ii) it leads to vowel-zero alternation when it is followed by a zero morpheme and optionally leads to it when it is followed by a vowel-initial suffix as evidenced by examples (37) and (38), respectively.

(35) ugrik + -(O)t(t) + ∅ [ugrik + -(O)t(t) + ∅] ‘jumps’ + PAST + 3SG
  a. → *ugorott [ugorotː]
  b. → ugrott [ugrotː] ‘she jumped’

(36) ugrik + -(O)t(t) + -(O)m [ugrik + -(O)t(t) + -(O)m] ‘jumps’ + PAST + 1SG
  a. → *ugortam [ugortɒm]
  b. → ugrottam [ugrotːɒm] ‘I jumped’

(37) fürdik+ -(O)t(t) + ∅ [fyrdik + -(O)t(t) + ∅] ‘bathes’ + PAST + 3SG
  a. → *fürödött [furødøtː]
  b. → fürdött [fyrdøtː] ‘she bathed’

(38) fürdik + -(O)t(t) + -(O)m [fyrdik + -(O)t(t) + -(O)m] ‘bathes’ + PAST + 1SG
  a. → fürödtem [fyrøtːɛm] ‘I bathed’
  b. → fürdöttem [fyrdøtːɛm] ‘I bathed’

[5]Note that the form *söpröttem* [ʃøprøtːɛm] is accepted in certain dialects of Hungarian even if it is not part of standard Hungarian. For the author of this thesis this form is acceptable – although somewhat marked – while for the speakers of Educated Colloquial Hungarian it is completely unacceptable. Due to this difference in acceptance this form is included in the summary table below but only in parentheses.

Note that the phenomenon that a second suffix influences whether the first suffix triggers stem-internal vowel-zero alternations is truly unique to the verbal domain. In the nominal domain it does not matter whether a potentially vowel-initial suffix is followed by a zero morpheme like the nominative as in example (39) or by a consonant-initial suffix like the dative as in example (40) or by a truly vowel-initial suffix like the terminative as in example (41) or another vowel-zero alternating suffix like the accusative as in example (42) it always triggers stem-internal vowel-zero alternations.

(39) nyereg + -(V)k + *emptyset* [ɲɛrɛg + -(V)k + ∅ 'saddle' + PLURAL + NOMINATIVE
  a. → *nyeregek [ɲɛrɛgɛk]
  b. → nyergek [ɲɛrgɛk] 'saddles'

(40) nyereg + -(V)k + -nAk [ɲɛrɛg + -(V)k + -nAk] 'saddle' + PLURAL + DATIVE
  a. → *nyeregeknek [ɲɛrɛgɛknɛk]
  b. → nyergeknek [ɲɛrgɛknɛk] 'for the saddles'

(41) nyereg + -(V)k + -ig [ɲɛrɛg + -(V)k + -ig] 'saddle' + PLURAL + TERMINATIVE
  a. → *nyeregekig [ɲɛrɛgɛkig]
  b. → nyergekig [ɲɛrgɛkig] '(up)to the saddles'

(42) nyereg + -(V)k + -t [ɲɛrɛg + -(V) + -t] 'saddle' + PLURAL + ACCUSATIVE
  a. → *nyeregeket [ɲɛrɛgɛkɛt]
  b. → nyergeket [ɲɛrgɛkɛt]

Now that we have reviewed one of the two things unique to verbal vowel-zero alternating stems – the influence of a second suffix – let us turn our attention to the other observation that is restricted to the verbal domain of vowel-zero alternating verbs. Strictly vowel-initial suffix like the terminative *-ig* /-ig/ [-ig] do not trigger vowel-zero alternations in nominal vowel-zero alternating stems as shown in (43). However, strictly vowel-initial suffixes like the nominalizer *-ás/-és* /-Aːʃ/ [-aːʃ/-eːʃ] do reliably trigger vowel-zero alternations in verbal alternating stems as shown in examples (44) and (45).

(43) nyereg + -ig [ɲɛrɛg + -ig] 'saddle' + TERMINATIVE → [ɲɛrɛgig] '(up)to (a) saddle'

(44) söpör + -Ás [ʃøpør + Aːʃ] 'sweeps' + NOMINALIZER → söprés [ʃøpreːʃ] 'sweeping'

(45) fürdik + -Ás [fyrdik + -Aːʃ] 'bathes' + NOMINALIZER → fürdés [fyrdeːʃ] 'bathing'

The above described variation in what does and does not trigger vowel-zero alternations in verbal stems is summarized in table 7. The first three rows of table 7 shows how regular non-*ik*- and *ik*-verbs behave when followed by consonant-initial, vowel-zero alternating and vowel-initial suffixes, while the last three rows provide examples for vowel-zero alternating verbs. The cells with a blue background show that consonant-initial suffixes always have the same form and do not trigger vowel-zero alternations. The distinctions between the green and orange cells in each column show when vowel-zero alternations are triggered. Additionally, the contrast between the yellow and green cells in the same columns highlights that the plural suffix can be vowel-initial even after a consonant-final stem unlike other vowel-zero alternating suffixes like the first singular. Last, but not least the red indicates variation and shows when both stable and vowel-zero alternating forms of a verb are acceptable. The suffixes are marked in magenta for ease of interpretation. For further comparisons of vowel-zero alternating verbs with other types of verbs see Rácz, Rebrus & Törkenczy (2021).

	C-initial suffix	**Vowel-zero alternating suffixes**			**V-initial suffix**
	possibility /-hAt/ [-hɒt/-hɛt]	First Singular /-(O)k/ [-k/-ok/-ɛk/-øk]	Past tense: Third Singular /-(O)t(t)/ [-t(t)/-ot(t)/-ɛt(t)/-øt(t)]	Past tense: First Singular /-(O)t(t)Om/ [-t(t)/-ot(t)om/-ɛt(t)ɛm/-øt(t)øm]	nominalizer /-Aːʃ/ [-aːʃ/-eːʃ]
Regular verbs					
nevet [nɛvɛt] ‘laughs’	nevethet [nɛvɛthɛt] ‘she can laugh’	nevetek [nɛvɛtɛk] ‘I laugh’	nevetett [nɛvɛtɛtː] ‘she laughed’	nevettem [nɛvɛtːɛm] ‘I laughed’	nevetés [nɛvɛteːʃ] ‘laugh’
fejel [fɛjɛl] ‘head’	fejelhet [fɛjɛlhɛt] ‘he can head’	fejelek [fɛjɛlɛk] ‘I head’	fejelt [fɛjɛlt] ‘he headed’	fejeltem [fɛjɛltɛm] ‘I headed’	fejelés [fɛjɛleːʃ] ‘heading’
megjelenik [mɛgjɛlɛnik] ‘appears’	megjelenhet [mɛgjɛlɛnhɛt] ‘she can appear’	megjelenek [mɛgjɛlɛnɛk] ‘I appear’	megjelent [mɛgjɛlɛnt] ‘she appeared’	megjelentem [mɛgjɛlɛntɛm] ‘I appeared’	megjelenés [mɛgjɛlɛneːʃ] ‘appearance’
Vowel-zero alternating verbs					
söpör [ʃøpør] ‘sweeps’	söpörhet [ʃøpørhɛt] ‘he can sweep’	söprök [ʃøprøk] ‘I sweep’	söpört [ʃøpørt] ‘he swept’	söpörtem(/söpröttem) [ʃøpørtɛm/ʃøprøtːɛm] ‘I swept’	söprés [ʃøpreːʃ] ‘sweeping’
pörög [pørøg] ‘twirls’	pöröghet [pørøghɛt] ‘he can twirl’	pörgök [pørgøk] ‘I twirl’	pörgött [pørgøtː] ‘he twirled’	pörögtem [pørøgtɛm] ‘I twirled’	pörgés [pørgeːʃ] ‘twirling’
ugrik [ugrik] ‘jumps’	ugorhat [ugorhɒt] ‘she can jump’	ugrok [ugrok] ‘I jumped’	ugrott [ugrotː] ‘he jumped’	ugrottam [ugrotːɒm] ‘I jumped’	ugrás [ugraːʃ] ‘jumping’
fürdik [fyrdik] ‘bathes’	fürödhet [fyrødhɛt] ‘he can bathe’	fürdök [fyrdøk] ’I bathe’	fürdött [fyrdøtː] ‘he bathed’	fürödtem/fürdöttem [fyrøtːɛm/fyrdøtːɛm] ‘I bathed’	fürdés [fyrdeːʃ] ‘bathing’

Table 7: Vowel-zero alternations in verbs

Chapter 4

The lexicon

The goal of this chapter is to provide an overview of the patterns found in vowel-zero alternating stems and to show how these stems differ from the ones which based on their form could be alternating but are not. The data described here is collected from a monolingual dictionary of Hungarian by Bárczi & Országh (1959–1962). The full list of lexical entries in the dictionary was compiled and filtered for entries ending in -VCVC sequences. That is to say that the list was restricted to entries that end in a single consonant preceded by a vowel, which is preceded by a single consonant and another vowel. Since stem internal vowel-zero alternations only occur if the final stem-internal vowel is short (cf. Siptár & Törkenczy (2000)), the list of entries were restricted to those with a final short vowel. Finally, the list was also filtered for disyllabic and trisyllabic entries only since most vowel-zero alternating stems are taken to be of that length (cf. Siptár & Törkenczy (2000)). The final list of dictionary entries has been manually processed during which compounds and verbs with different preverbs which can also appear by themselves have been removed. Through this process two lists were compiled: (i) a list of vowel-zero alternating stems and (ii) a list of potentially vowel-zero alternating stems.

The list of vowel-zero alternating stems from Bárczi & Országh (1959–1962) – 127 nouns and 350 verbs – has been compared with the list of vowel-zero alternating forms that were used in Kiefer (2008) to establish the frequency of different possible consonant clusters in vowel-zero alternating stems – 239 nouns and 334 verbs. The two lists were combined with the exclusion of compounds – 30 of them – and verbs with preverbs – 47 of them – from the latter list. Beyond these, 91 nouns that were formed with the *-alom/-elem* [-ɒlom/-ɛlɛm] nominalizer suffix were also excluded since these all have the same characteristics and thus, they would have skewed any statistical analysis. This process yielded 489 vowel-zero alternating stems: 348 of which are verbs and 141 are nouns.

Parallel to the list of vowel-zero alternating stems, a list of potentially vowel-zero alternating stems was also created from the same list of dictionary entries. The items in this second list are identical to the list of vowel-zero alternating stems in that they are also all disyllabic or trisyllabic, they are all -VCVC final, none of them are compounds, none contain preverbs and none are recent loanwords since the set of vowel-zero alternating stems is taken to be a closed group (cf. Siptár & Törkenczy (2000)). There are three additional criteria imposed on the list of potentially alternating stems that were not implemented when compiling the list of vowel-zero alternating stems. First of all, this second list is restricted to entries in which the penultimate vowel is either short or [aː] or [eː]. The reason behind this decision is that there are very few vowel-zero alternating stems in which the penultimate vowel is long and it is not [aː] or [eː]. This is not surprising given that consonant clusters after other long vowels are generally marked in the language (cf. Siptár & Törkenczy (2000)). Second of all, dictionary entries that violate roundness or backness harmony have also been excluded from this list. This is again done in the interest of a fairer comparison of the two lists since none of the vowel-zero alternating stems violate backness or roundness harmony. Last but not least, dictionary entries in which the final vowel is short, but not [o, ɛ, ø], have also been excluded from the list of potentially vowel-zero alternating stems in the interest of a better comparison. Note, that there are in fact alternating vowels that are high or low, but these are few and far between, while they are very common among the potentially alternating stems. More precisely, one third of the potentially alternating verbs (319 out of 972) have a final short vowel that is not [o], [ø], or [ɛ], while only 1% (4 out of 349) of the vowel-zero alternating ones do. A similar discrepancy in the proportion of nouns with a final vowel other than [o], [ø], or [ɛ] in the potentially alternating and the vowel-zero alternating stems can be observed: almost half of the nouns (308 out of 638) potentially alternating stems have a final high or low vowel, while only 3% (4 out of 141) of the vowel-zero alternating nouns do. Thus, the inclusion of such entries would likely skew the comparison of the two lists. The final list of potentially alternating stems contains 981 entries: 328 nouns and 653 verbs.

If we compare the two lists we find that despite all the restrictions on vowel-zero alternating stems they form only a small portion of all possible stems of this shape. Considering the more conservative list of potentially alternating stems – the one in which the final vowel is [o], [ø], or [ɛ] – then vowel-zero alternating stems present one third of all stems of the relevant form, while if we consider the less conservative list of potentially alternating stems – the one in which the final vowel can be any short vowel – then the alternating stems present less than one quarter – 23% to be exact – of all stems of this form.

With these two lists as our database we can now look at what generalizations can be observed about the vowels and consonants in vowel-zero alternating stems and how they compare to potentially alternating stems. Section 4.1 focuses on what kind of vowels we find in vowel-zero alternating stems in more detail, while section 4.2 is devoted to the consonants in these alternating stems. Section 4.2 is further divided based on whether the cluster formed in the absence of the alternating vowel is an illicit but repairable cluster in the language (cf. section 4.2.1), a cluster generally not found in the language (cf. section 4.2.2) or a generally attested cluster (cf.# section 4.2.3). Finally, a statistical model comparing the two lists of vowel-zero alternating and potentially alternating dictionary entries is presented in section 4.3.

4.1 Observations about vowels

As noted above the final vowel in vowel-zero alternating stems is always short. It is worth noting that there is not only a length restriction on the alternating vowels, but also a height one. Most vowels that are subject to vowel-zero alternations are either front non-high vowels [ø,ɛ] or back mid vowels [o], cf. example (1). This means that in general vowel-zero alternating stems end with a -VCVC sequence where the final vowel is short and mid as shown in (2) (cf. Siptár & Törkenczy (2000)).

(1) a. ökör + -t [økør + -t] 'ox' + ACCUSATIVE → ökröt [økrøt] 'ox-ACC'
  b. nyereg + -t [ɲɛrɛg + -t] 'saddle' + ACCUSATIVE
   → nyerget [ɲɛrgɛt] 'saddle-ACC'
  c. bokor + -t [bokor + -t] 'bush' + ACCUSATIVE → bokrot [bokrot] 'bush-ACC'

(2) $\text{-VCV}_{\left(\left[\substack{\text{-high} \\ \text{-low}}\right]\right)}\ \text{C}$

There are only a handful of vowel-zero alternating stems with a final vowel that is not [o], [ɛ] or [ø]: there are four vowel-zero alternating stems in which the final vowel is [ɒ] –cf. (3) – and there are three stems with a final high vowel two of which are [u] and one is [y] – cf. (4) and (5), respectively. It is worth noting that more than half of these exceptions are oscillating: they can either behave like other vowel-zero alternating stems or like other stable stems, cf. examples (3-c), (3-d), (4-b) and (5). Note that in the verbal examples in this section different suffixes – nominalizers and adjectivizer – are used to show the alternations, while in the case of the nouns it is always the same suffix – the accusative. This is due to the fact that not every verbal suffix can attach to each verbal example, while the accusative can attach to any of the nominal examples.

(3) a. fogaz + -Aːʃ [fogɒz + -Aːʃ] 'teethes' + NOMINALIZER → fogzás [fogzaːʃ] 'teething'
  b. ajak + -t [ɒjɒk + -t] 'lip' + ACCUSATIVE → ajkat [ɒjkɒt] 'lip-ACC'
  c. kazal + -t [kɒzɒl + -t] 'stack' + ACCUSATIVE

→ kazlat [kɒzlɒt] ‘stack-ACC’
→ kazalt [kɒzɒlt] ‘stack-ACC’

d. vacak + -t [vɒt͡sɒk + -t] ‘stuff’ + ACCUSATIVE
→ vacakot [vɒt͡sɒkot] ‘stuff-ACC’
→ vackot [vɒt͡skot] ‘stuff-ACC’

(4) a. pirosul + -Oː [piroʃul + -Oː] ‘reddens’ + ADJECTIVIZER
→ pirosló [piroʃloː] ‘reddening’

b. bajusz + -t [bɒjus + -t] ‘mustache’ + ACCUSATIVE
→ bajuszt + [bɒjust] ‘mustache-ACC’
→ bajszot + [bɒjsot] ‘mustache-ACC’

(5) becsül + -(O)m [bɛt͡ʃyl + -(O)m] ‘estimates’ + 1.SG

a. → becsülöm [bɛt͡ʃyløm] ‘I estimate (it)’
b. → becslem [bɛt͡ʃlɛm] ‘I estimate (it)’

With respect to the penultimate vowel in vowel-zero alternating stems, it has been noted that it can either be a short vowel or [aː] or [eː] since consonant clusters following other long vowels are generally marked in the language (cf. Siptár & Törkenczy (2000)). In the case of vowel-zero alternating stems, an intervocalic consonant cluster is formed if they are followed by a vowel-zero alternating suffix. This is shown schematically in (6).

(6) $V_1ː C_1 V_2 C_2$ + -(V_3)C → $V_1ː C_1 C_2 V_3$C

Thus, if the consonant cluster created through stem internal vowel-zero alternations follows a long vowel other than [aː] or [eː], then the vowel-zero alternation would yield a marked sequence. Since the sequence of a long vowel other than [aː] or [eː] and a consonant cluster is generally rare in the language, it is not surprising that only 13 (out of 489) exceptions were found to this generalization in the lexicon. Most of the exceptions are verbs, with only 2 exceptions coming from nouns. There is at least one example for a -VːCVC final vowel-zero alternating stem with each possible long vowel among the 13 exceptions found: there are four exceptions with [oː] as shown in (7), one exception with [uː] given in (8), five with [iː] presented in (9), two with [øː] as shown in (10) and one with [uː] given in (11).

(7) a. ólom + -t [oːlom + -t] ‘lead’ + ACCUSATIVE → ólmot [oːlmot] ‘lead-ACC’

b. sólyom + -t [ʃoːjom + -t] ‘hawk’ + ACCUSATIVE
→ sólymot [ʃoːjmot] ‘hawk-ACC’

c. jósol + -Aːʃ[joːʃol + -Aːʃ] ‘to predict’ + NOMINALIZER
→ jóslás [joːʃlaːʃ] ‘predicting’

d. pótol + -Aːʃ[poːtol + -Aːʃ] ‘to substitute’ + NOMINALIZER
→ pótlás [poːtlaːʃ] ‘substituting’

(8) bűzöl + -Oː[byːzøl + -Oː] ‘to stink’ + ADJECTIVIZER → bűzlő [byːzløː] ‘stinking’

(9) a. címez + -A:ʃ[t͡si:mɛz + -A:ʃ] 'to address' + NOMINALIZER
→ címzés [t͡si:mze:ʃ] 'addressing'
b. díszel + -At [di:sɛl + -At] 'to decorate' + NOMINALIZER
→ díszlet [di:slɛt] 'decoration'
c. hímez + -A:ʃ[hi:mɛz + -A:ʃ] 'to embroider' + NOMINALIZER
→ hímzés [hi:mze:ʃ] 'embroidery'
d. hírel + -At [hi:rɛl + -At] 'to inform' + NOMINALIZER
→ hírlet [hi:rlɛt] 'information'
e. kínoz + -A:ʃ[ki:noz+ -A:ʃ] 'torments' + NOMINALIZER
→ kínzás [ki:nza:ʃ] 'tormenting'

(10) a. őriz + -A:ʃ[ø:riz + -A:ʃ] 'to guard' + NOMINALIZER → őrzés [ø:rze:ʃ] 'guarding'
b. őröl + -O:[ø:røl + -O:] 'to grind' + ADJECTIVIZER → őrlő [ø:rlø:] 'grinding'

(11) túloz + -A:ʃ[tu:loz + -A:ʃ] 'to exaggerate' + NOMINALIZER
→ túlzás [tu:lza:ʃ] 'exaggeration'

In contrast to vowel-zero alternating stems, there are no restrictions on the length of the penultimate vowel in stable stems since they do not yield marked sequences like V:CC in their suffixed forms. This is shown schematically in (12). Therefore, it is not surprising that we find examples with a penultimate long vowel that is not [a:] or [e:] among the potentially alternating stems as shown in example (13).

(12) V_1:$C_1V_2C_2$ + -(V_3)C → V_1:$C_1V_2C_2V_3$C

(13) a. csónak + -t [t͡ʃo:nɒk + -t] 'boat' + ACCUSATIVE
→ csónakot [t͡ʃo:nɒkot] 'boat-ACC'
b. bűvöl + -O:[by:vøl + -O:] 'bewitch' + ADJECTIVIZER
→ bűvölő [by:vølø:] 'bewitching'
c. bíbor + -t [bi:bot + -t] 'crimson' + ACCUSATIVE
→ bíbort [bi:bort] 'crimson-ACC'
d. tőzeg + -t [tø:zɛg + -t] 'peat' + ACCUSATIVE → tőzeget [tø:zɛgɛt] 'peat-ACC'
e. bútor + t [bu:tor + -t] 'furniture' + ACCUSATIVE
→ bútort [bu:tort] 'furniture-ACC'

Another interesting fact regarding the vowels in vowel-zero alternating stems has been reported by Rebrus, Szigetvári & Törkenczy (2023a). They found that the sequence of the final two vowels in vowel-zero alternating stems never violates backness or roundness harmony. That is to say there are no strongly disharmonic stems in the list of vowel-zero alternating stems. This prohibition is shown schematically in (14). Moreover, there are only 12 (out of 489) weakly disharmonic stems in terms of backness harmony in the list. In the weakly disharmonic stems the penultimate vowel is mostly [i] and only occasionally – in 2 cases – is it [e:], while the final vowel is [o]. All weakly disharmonic vowel-zero alternating stems are listed in (15) – stems with a penultimate [i] – and in (16) – stems with a penultimate [eː].

(14) *oCöC + -(V)k [oCøC + -(V)k] → oCCök [oCCøk]

(15) a. izom + -t [izom + -t] 'muscle' + ACCUSATIVE → izmot [izmot] 'muscle-ACC'
 b. cirok + -t [t͡sirok + -t] 'broomcorn' + ACCUSATIVE
 → cirkot [t͡sirkot] 'broomcorn-ACC'
 c. gyilok + -t [ɟilok + -t] 'dagger' + ACCUSATIVE → gyilkot [ɟilkot] 'dagger-ACC"
 d. nyirok + -t [ɲirok + -t] 'lymph' + ACCUSATIVE → nyirkot [ɲirkot] 'lymph-ACC"
 e. piszok + -t [pisok + -t] 'dirt' + ACCUSATIVE → piszkot [piskot] 'dirt-ACC"
 f. szirom + -t [sirom + -t] 'petal' + ACCUSATIVE→ szirmot [sirmot] 'petal-ACC'
 g. szitok + -t [sitok + -t] 'curse' + ACCUSATIVE → szitkot [sitkot] 'curse-ACC'
 h. titok + -t [titok + -t] 'secret' + ACCUSATIVE → titkot [titkot] 'secret-ACC'
 i. inog + -Ás [inog + -Aːʃ] 'wobble' + NOMINALIZER → ingás [iŋgaːʃ] 'wobbling'
 j. kínoz + -Ás [kiːnoz+ -Aːʃ] 'torments' + NOMINALIZER
 → kínzás [kiːnzaːʃ] 'tormenting'
 k. tipor + -Ás [tipor + -Aːʃ] 'trample' + NOMINALIZER
 → tiprás [tipraːʃ] 'trampling'

(16) a. céloz + -Ás [t͡seːloz + Aːʃ] 'aims' + NOMINALIZER → célzás [t͡seːlzaːʃ] 'aiming'
 b. tajtékozik + -Ás [tɒjteːkozik + -Aːʃ] 'foams' + NOMINALIZER
 → tajtékzás [tɒjteːgzaːʃ] 'foaming'

In contrast to vowel-zero alternating stems, there are quite a few – 31 (out of 328) nouns and 39 (out of 653) verbs to be more precise – weakly disharmonic stems in the list of potentially alternating dictionary entries. Here four examples for non-alternating disharmonic stems are given: two with a penultimate [i] in (17) and two with a penultimate [eː] in (18).

(17) a. szigor + -t [sigor + -t] 'rigor' + ACCUSATIVE → szigort [sigort] 'rigor-ACC'
 b. vihog + -Ás [vihog + -aːʃ] 'cackle' + NOMINALIZER → vihogás [vihogaːʃ] 'crackling'

(18) a. téboly + -t [teːboj + -t] 'craze' + ACCUSATIVE → tébolyt [teːboljt] 'craze-ACC'
 b. pocsékol + -Ás [pot͡ʃeːkol + -Aːʃ] 'waste' + NOMINALIZER → pocsékolás [pot͡ʃeːkolaːʃ] 'wasting'

As noted above Rebrus, Szigetvári & Törkenczy (2023a) pointed out none of the vowel-zero alternating stems violate roundness harmony. This means that forms ending with a sequence like [øCɛC] or [ɛCøC] cannot be vowel-zero alternating stems. These restrictions are given schematically in (19). It is worth noting here that the vowel-zero alternating stem *becsül* [bɛt͡ʃyl] 'estimate' is not a violation of roundness harmony since roundness harmony only targets front mid vowels[1]. In fact, the inflected forms of *becsül* [bɛt͡ʃyl] 'estimate', which can be formed with or without the alternating vowel, show the effect of roundness harmony in

[1] Thank you to Miklós Törkenczy (p.c.) for pointing this out to me.

that the suffixal vowel is [+round] if the [+round] alternating vowel is present and [-round] if it is absent, see (20).

(19) a. *öCeC + -(V)k [øCεC + -(V)k] → öCCök [øCCøk]
b. *eCöC + -(V)k [εCøC + -(V)k] → eCCek [εCCεk]

(20) becsül + -(V)k [bεt͡ʃyl + -(V)k]
→ becslek/ becsülök [bεt͡ʃlεk/ bεt͡ʃyløk] 'estimate-1SG'

Now that we have observed the regularities among the vowels in vowel-zero alternating stems, let us turn our attention to the consonants in these stems. In particular, let us take a closer look at what consonant clusters can be created as a result of a stem-internal vowel-zero alternation and how the distribution of consonants surrounding the alternating vowel compares to the distribution of consonants in the same positions in non-alternating stems.

4.2 Consonantal patterns

When a vowel-zero alternating suffix is attached to a vowel-zero alternating stem an intervocalic consonant cluster is formed as a result of syncope. This is shown schematically in (21), and on a concrete example in (22). Given that Hungarian has 24 consonants, theoretically there are 576 (=24×24) possible consonant clusters that could be created as a result of syncope. However, not all possible consonant clusters are phonotactically well-formed.

(21) $(C)V_1C_1V_2C_2 + \text{-}V_3C_3 \rightarrow (C)V_1C_1C_2V_3C_3$

(22) bokor + -(V)k [bokor + -(V)k] 'bush + PLURAL'
→ bokrok [bokrok] 'bushes'

Table 8 shows which of all the theoretically possible consonant clusters in Hungarian appear in vowel-zero alternating stems after syncope. Each row represents a consonant preceding the alternating vowel, while each column stands for a consonant following the alternating vowel. The numbers in parentheses refer to the number of vowel-zero alternating verbs that give rise to that cluster after syncope, while the numbers without parentheses refer to the nominal vowel-zero alternating stems. The colors mark whether a given cluster is possible intervocalically in a single morpheme in general in the language in the following way: (i) cells with a blue background are consonant clusters that we find intervocalically in a single morpheme (ii) cells with an orange background are consonant clusters that we do not find intervocalically in a single morpheme, while (iii) cells with a green background are clusters that we do not find intervocalically in a single morpheme, but unlike the clusters in orange, the ones in green can be repaired through some phonological process, e.g. assimilation, gemination etc (for the categorizations of the clusters see Siptár & Törkenczy (2000)). Table 9, which is of a similar form to table 8, shows the consonants preceding and following the potentially alternating vowel in stems that are of the right form, yet are not subject to vowel-zero alternations. The two lists described in chapter 3 serve as the basis for these two tables. Last, but not least, table 10 shows the ratio of consonant clusters in vowel-zero alternating stems compared to all stems of the right form regardless of whether they are alternating or not. That is to say, to get the ratios in each cell in table 10 the values in each cell in table 8 were used as the numerator, while the sum of values in each cell in table 8 and 9 was used as a denominator. The results are presented as percentages for ease of interpretation. Cells that are left empty signal that there is no stem of the relevant form with that pair of consonants around the (potentially) alternating vowel.

To ensure that it is clear how to interpret tables 8–10, let us look at a concrete example. Let us take stems in which the (potentially) alternating vowel is preceded by a [t] and followed by an [l] as an example. This means that we are interested in stems like the one schematically represented in (23). Looking up C_1 as [t] and C_2 as [l] in table 8 tells us that there no vowel-zero alternating nouns of this form and that there are 9 vowel-zero alternating verbs of this form. Now, let us look at the same cell in table 9. Here we learn that there 5 nouns and 37 verbs that have the shape shown in (23) and which are not subject to vowel-zero alternations. If we want to know what proportion of all stems of this form are vowel-zero alternating, then we need to look at the same cell in table 10. The cell in row [t] and column [l] in table 10 tell us that 18% of all stems of the form in (23) are subject to vowel-zero alternations.

(23) (C)VtVl

The rest of this section builds heavily on the information found in tables 8–10. The following three sections each correspond to a background color in these tables: section 4.2.1 is devoted to consonant clusters that we do not find intervocalically in a single morpheme in the language, but which can be repaired through some phonological process – these are the cells with a green background –, section 4.2.2 discusses consonant clusters that we do not find intervocalically in a single morpheme which cannot be repaired through some phonological process – these are the cells with an orange background –, while section 4.2.3 describes consonant clusters that we do find intervocalically in a single morpheme – these are the cells with a blue background.

		C₂ liquids: r	l	stops: p	t	c	k	b	d	ɟ	g	affricates: t͡s	t͡ʃ	d͡ʒ	fricatives: f	ʃ	s	v	ʒ	z	nasals: m	n	ɲ	glide: j	h
C₁ liq.	r		(24)				13		(1)		6(64)									(14)	13(1)		2		
	l				1		7				1 (24)									(5)	6				
stops	p	3(4)	1(4)										1							(1)					
	t	4(2)	(9)				6															(1)			
	c	2	1				1																		
	k	6	3(24)						(1)											(2)			1		
	b	5	3(1)																	1(3)					
	d	9(4)	1(3)																						
	ɟ	1	(1)																	1					
	g	(1)	(7)																	1(8)				4	
affr.	t͡s						5																		
	t͡ʃ		(1)				8																		
	d͡ʒ																								
fric.	f																								
	ʃ		(9)				1																		
	s		1(7)				4															2			
	v																								
	ʒ		(2)								(3)														
	z	1	1(7)								(3)										1				
nas.	m	1	(18)																	(7)					
	n		(2)								(1)									(10)					
	ɲ		(6)																	(8)					
glide	j		(5)				3				(18)						1			(4)	5				
	h	1[2]	(1)																					3	

Table 8: Consonants surrounding the alternating vowel in vowel-zero alternating stems

[2] When the consonant preceding the alternating vowel is [h] and the one following it is [r], then metathesis takes place and the cluster surfacing is [rh] and not [hr].

	C$_2$																							
	liquids		stops								affricates			fricatives						nasals			glide	
C$_1$	r	l	p	t	c	k	b	d	ɟ	g	t͡s	t͡ʃ	d͡ʒ	f	ʃ	s	v	ʒ	z	m	n	ɲ	j	h
r		1 (25)	3	2(2)		7	1	(2)		6(6)	1				10 (1)	5	1		1(35)	4		2	2	
l	2	(11)	6	3		2		(4)	1	4(2)					7	1			(19)	2	1	1	1	
p	2(1)	(11)		2		1		(2)		(14)	2	1			(2)	2			(8)	(1)		1	6(1)	
t	8	5(37)				2				9(1)					8(1)	2			(10)	3	1	2	2	
c						1																		
k	4 (1)	2(51)		2				(2)		(11)		1			6	1			(12)		2	3	2	
b	8	1(10)		1			1	(1)		(13)		1			1	1			3		2	1	5	
d	12	2(8)				1				4(2)					2				(20)	1	3			
ɟ	3	(6)		(1)				2		(4)					3				(4)		2			
g	8	1(32)		3(5)				(1)		(1)	1				3	1			(13)		4	2	4	
t͡s	2	(7)		1						(5)						1			(1)					
t͡ʃ	1	(26)		3		1				1(9)					2	1			(2)		2	2		
d͡ʒ																								
f		(3)		1						(8)						1			1(1)		1			
ʃ		1(14)		1						(1)												(1)	2	
s	1	1(26)				1	1			3(7)					1				(4)			3		
v	1(2)	2(3)		3(2)		1		1(2)		4(4)					3				(6)		1	2	3	
ʒ		(2)				1				(2)														
z		1(15)		3(2)		1				1(1)					3				(3)	1	1(1)	1		
m	7	(8)		2(1)		3				1(1)					3	1			2(14)				3	
n		(3)				2				1(2)					3	1			(11)	1				
ɲ	2	1(4)				1				1					2				(17)					
j		(6)						(2)		4(1)					2	1			1(19)					
h		1(10)								(12)											(1)		2	

Table 9: Consonants surrounding the potentially alternating vowel in stems without vowel-zero alternations

	C2																							
	liquids		stops								affricates			fricatives						nasals			glide	
	r	l	p	t	c	k	b	d	ɟ	g	t͡s	t͡ʃ	d͡ʒ	f	ʃ	s	v	ʒ	z	m	n	ɲ	j	h
r		48%	0%	0%		65%	0%	33%		85%	0%				0%	0%	0%		28%	77%		50%	0%	
l	0%	0%	0%	25%		77%		0%	0%	80%					0%	0%			20%	75%	0%	0%	0%	
p	70%	31%		0%		0%		0%		0%	0%	50%			0%	0%			11%	0%		0%	0%	
t	43%	18%				75%				0%					0%	0%			0%	0%	50%	0%	0%	
c	100%	100%				50%																		
k	54%	33%		0%				33%		0%		50%			0%	0%			14%		0%	25%	0%	
b	38%	26%		0%			0%	0%		0%		0%			0%	0%			57%		0%	0%	0%	
d	52%	29%				0%				0%					0%				0%	0%	0%			
ɟ	25%	14%		0%				0%		0%					0%				20%		0%			
g	11%	18%		0%				0%		0%	0%				0%	0%			41%		0%	0%	50%	
t͡s	0%	0%		0%		100%				0%						0%			0%					
t͡ʃ	0%	0.04%		0%		88%				0%					0%	0%			0%		0%	0%		
d͡ʒ																								
f		0%		0%						0%						0%			0%		0%			
ʃ		38%		0%		100%				0%												0%	0%	
s	0%	23%				80%	0%			0%					0%				0%		100%	0%		
v	0%	0%		0%		0%		0%		0%					0%				0%		0%	0%	0%	
ʒ		50%				0%				60%														
z	100%	33%		0%		0%				60%					0%				0%	50%	0%	0%		
m	13%	69%		0%		0%				0%					0%	0%			30%				0%	
n		40%				0%				25%					0%	0%			91%	0%				
ɲ	0%	55%				0%				0%					0%				32%					
j		45%				100%		0%		78%					0%	50%			17%	100%				
h	100%	0.08%								0%											0%		60%	

Table 10: Ratio of clusters in vowel-zero alternating stems of all stems with the same form

4.2.1 Illicit clusters with available repairs

Some of the illicit consonant clusters in the language are systematically repaired through some phonological process. Consonant clusters made up of two obstruents that differ in voicing belong to this group since they are generally repaired through regressive voicing assimilation (cf. section 2.2.1). That is, if two obstruents with different voicing were to form a consonant cluster the voicing of the second one is preserved and the first one assimilates to it in voicing. An example for this process is given in (24): here the word-final voiced stop assimilates to the suffix-initial voiceless stop.

(24) fog + -tól [fog + toːl] 'tooth' + ABLATIVE → fogtól [foktoːl] 'from the tooth'

Interestingly, when the two consonants preceding and following a potentially alternating vowel are both obstruents differing in voicing, then the need for voicing assimilation prevents the vowel from syncopating. That is to say, there are no nominal vowel-zero alternating stems in which the consonant preceding the alternating vowel, C_1, and the one following it, C_2, are both obstruents with different voicing, and there are only three verbal ones. Furthermore, among these three exceptions there are two verbs that rarely occur in forms that include the alternating vowel –*tajtékozik* [tɒjteːkozik] 'to froth' as shown in example (25-a) and *patakozik* [pɒtɒkozik]'to stream' as shown in example (25-b) – and the third verb *képez* [keːpɛz] 'form/train' has two different meanings and the form corresponding to only one of them is vowel-zero alternating, while the form corresponding to the other meaning is a stable stem, cf. (26).

(25) a. tajtékozik + -Ás [tɒjteːkozik + -aːʃ] 'froths' + NOMINALIZER
→ tajtékzás [tɒjteːgzaːʃ] 'frothing'
b. patakozik + -Oː[pɒtɒkozik + -Oː] 'streams' + ADJECTIVIZER
→ patakzó [pɒtɒgzoː] 'streaming'

(26) képez + -Ás [keːpɛz + -Aːʃ] 'form' + NOMINALIZER
→ képezés [keːpɛzeːʃ] 'forming'
→ képzés [keːbzeːʃ] 'training'

As table 9 shows stems in which the two consonants surrounding the (potentially) alternating vowel are both obstruents which disagree in voicing are not uncommon among the stems that are of the right form but are not subject to vowel-zero alternations. Note, that since the final stem-internal vowel in these stems is stable the need for voicing assimilation never arises. This is shown in the examples in (27), which would all lead to voicing assimilation if they were alternating.

(27) a. fékez -Oː[feːkɛz + -Oː] 'brake' + ADJECTIVIZER → fékező [feːkɛzøː] 'braking'

b. okoz + -Oː[okoz + -Oː] ‘cause’ + ADJECTIVIZER → okozó [okozoː] ‘causing’
c. lapoz + -Oː[lɒpoz + -Oː] ‘leaf (through)’ + ADJECTIVIZER
→ lapozó [lɒpozoː] ‘leafing’

Another group of illicit consonant clusters in Hungarian that are systematically repaired through a phonological process are geminates. Gemination similarly to voicing assimilation occurs both lexically and through suffixation as discussed in section 2.2.3. An example for gemination as a result of suffixation is given in (28).

(28) bot + -tól [bot +-toːl] ‘stick’ + ABLATIVE
→ bottól [botːoːl] ‘from the stick’

Syncope in vowel-zero alternating stems could lead to gemination if the consonant preceding the alternating vowel (C_1) and the one following it are identical (C_2). However, there are no vowel-zero alternating stems in which these two consonants would be identical.

There are 16 examples for non-alternating stems in which the potentially alternating vowel is surrounded by identical consonants. Note that since the final stem-internal vowel in these stems is stable, the need for gemination does not arise. This is shown in the two examples in (29), both of which are non-alternating stems with identical consonants before and after the final stem-internal vowel.

(29) a. nábob + -t [naːbob + -t] ‘nabob’ + ACCUSATIVE → nábobot [naːbobot] ‘nabob-ACC’
b. ölel + -Ás [ølɛl + -Aːʃ] ‘hugs’ + NOMINALIZER → ölelés [ølɛleːʃ] ‘hug’

Clusters in which a coronal obstruent is followed by a strident are also illicit in Hungarian. In these cases, an affricate is formed (for more details see section 2.2.2. Hungarian has the following four affricates: t͜ʃ, t͜s, d͜ʒ, d͜z. The voiceless affricates are generally more common in the language than the voiced ones. They can occur either lexically or as a result of suffixation. In (30) an example is given for the latter case. Here the word undergoing suffixation ends in a voiceless coronal stop while the suffix begins with a voiceless post-alveolar fricative resulting in a voiceless post-alveolar affricate.

(30) barát + -ság [bɔraːt + ʃaːg] ‘friend’ + NOMINALIZER
→ barátság [bɔraːt͜ʃːaːg] ‘friendship’

If a vowel-zero alternating stem had a coronal stop preceding its final vowel and a coronal or post-alveolar fricative with the same voicing following it, then syncope would result in a context where an affricate is formed. However, there are no vowel-zero alternating stems which if followed by a vowel-zero alternating suffix that led to syncope would yield a context for affrication.

As table 9 shows there are non-alternating stems in which the final stem-internal vowel is preceded by a coronal stop and followed by a coronal or post-alveolar fricative. That is to say these type of stems are not all together absent from the language. In (31) two examples for such stems are given. In (31-a) the final stem-internal vowel is preceded by a voiceless coronal stop and followed by a voiceless post-alveolar fricative, while in example (31-b) the final stem-internal vowel is preceded by a voiced coronal stop and is followed by a voiced coronal fricative. Since neither of the stems in (31) are subject to vowel-zero alternations, the need for affrication does not arise here.

(31) a. rétes + -t [reːtɛʃ+ -t] 'strudel' + ACCUSATIVE → rétest [reːtɛʃt] 'strudel-ACC'
b. fedez + -Ás [fɛdɛz + -Aːʃ] 'cover' + NOMINALIZER → fedezés [fɛdɛzeːʃ] 'covering'

Similarly to geminates and affricates, palatal stops can also be the result of a repair mechanism. If a coronal stop or the dental nasal stop is followed by a glide, then palatalization takes place. An example for this process is provided in (32). Here the word undergoing suffixation ends in a voiceless coronal stop while the suffix begins with a glide which together create a context for palatalization that results in a voiceless palatal stop.

(32) barát +-(j)a [bɔraːt + -(j)ɔ] 'friend' + 3SG.POSSESSIVE
→ barátja [bɔraːcɔ] 'his/her friend'

Palatal stops can be formed as a result of syncope if after vowel deletion a voiced or voiceless coronal stop or a labial nasal stop is followed by a glide. This means that palatalization could happen in vowel-zero alternating stems when they are followed by a vowel-zero alternating suffix if the consonant preceding the alternating vowel is either [t],[d] or [n], while the one following it is a glide. However, there are no vowel-zero alternating stems where C_1 is either [t], [d] or [n], while C_2 is a glide. It is important to note here that there are no non-alternating stems of the right form in which the final stem-internal vowel is preceded by either [t], [d] or [n] and it is followed by a glide.

Another phonological process to repair phonotactically illicit consonant clusters is nasal place assimilation. If a coronal nasal – [n] – is followed by a (nasal) labial stop – [p], [b], [m] – or by a palatal stop – [c], [ɟ], [ɲ] – or by a velar stop – [k], [g], then the coronal nasals place of articulation assimilates to that of the following consonant and becomes labial, palatal or velar, respectively. An example for this process is given in (33). In (33) the noun ends with a coronal nasal, [n], and it is followed by the inessive suffix, which begins with the labial stop [b]. The result of suffixation in this case is nasal place assimilation, which means that the stem-final coronal nasal surfaces as a a labial stop after suffixation.

(33) szén + -ben [seːn + -bɛn] 'coal' + INESSIVE
→ szénben [seːmbɛn] 'in the coal'

Nasal place assimilation can take place after syncope in vowel-zero alternating stems if the the consonant preceding the alternating vowel is a coronal nasal and the one following it is either a labial stop, a palatal stop or a velar stop. There is only one example for nasal place assimilation after syncope in a vowel-zero alternating stem, which is given in (34). Among the non-alternating stems there are only two verbs which would be subject to nasal place assimilation if they alternated. These two verbs are given in (35). In both of them the final stem-internal vowel is preceded by a coronal nasal and followed by a velar stop. However, no nasal place assimilation takes place in the examples in (35) since their final stem-internal vowel is stable.

(34) inog + -Ás [inog + -aːʃ] 'wobble' + NOMINALIZER → ingás [iŋgaːʃ] 'wobble'

(35) a. donog + -(O)t(t) [donog + -(O)t(ː)] 'makes a bam' + PAST TENSE
→ donogott [donogotː] 'made a bam'
b. dönög + -Ás [dønøg +-Aːʃ] 'buzzes' + NOMINALIZER
→ dönögés [dønøgeːʃ] 'buzzing'

It is interesting to note that there are no homorganic nasal-consonant clusters as a result of vowel-zero alternations either, even though these are well-formed in the language. Moreover, there is only one example among the non-alternating stems in which the final stem-internal vowel is preceded by a nasal and followed by another consonant with the same place of articulation. This example is given in (36).

(36) gonosz + -t [gonos + -t] 'mean (one)' + ACCUSATIVE → gonoszt [gonost] 'mean (one)-ACC'

Last, but not least, sibilant assimilation can also serve as a phonological repair mechanism for certain phonotactically illicit consonant clusters. If a palatal sibilant is followed by a coronal sibilant, then the palatal sibilant assimilates in place to the coronal sibilant following it and they together surface as a long coronal sibilant. Similarly, if a coronal sibilant is followed by a palatal one, then the coronal sibilant assimilates in place to the palatal sibilant following it and they together surface as a long palatal sibilant. An example for the latter case is given in (37). In this example the adjective *merész* [mɛrɛːs] 'daring' ends in a coronal sibilant [s] and it is followed by the nominalizer suffix *-ság/-ség* /-ʃAːg/ [-ʃaːg/-ʃeːg], which begins with a palatal sibilant. As example (37) shows the stem-final sibilant assimilates in place to the suffix-initial one and they surface together as a long palatal sibilant.

(37) merész + -ség [mɛreːs + -ʃeːg] ‘daring’ + NOMINALIZER
→ merészség [mɛreːʃːeːg] ‘daring’

Vowel-zero alternation could lead to sibilant assimilation if the consonant preceding the alternating vowel is a coronal/palatal sibilant and the one following it is a palatal/coronal sibilant. There are no vowel-zero alternating stems in which C_1 is a coronal/palatal sibilant and C_2 is a palatal/coronal sibilant. Comparatively, there is one stem in the list of non-alternating stems in which the final stem-internal vowel is preceded by a coronal sibilant and followed by a palatal one. This stem is given in (38). As example (38) shows the need for sibilant assimilation does not arise in this case since the final stem-internal vowel in (38) is stable.

(38) feszes + -t [fɛsɛʃ+ -t] ‘tight’ + ACCUSATIVE → feszest [fɛsɛʃt] ‘tight-ACC’

Although these non-occurrences could all be accidental gaps, I show below that this is not the case. I present a statistical model in section 4.3 that addresses the question whether the absence of consonant clusters after vowel deletion in vowel-zero alternating stems which would result in a consonantal process is an accidental gap or not. However, before discussing this statistical model let us take a look at clusters resulting from stem-internal vowel-zero alternations that are absent without any available repairs.

4.2.2 Absent clusters without available repairs

There are 141 consonant clusters out of the 576 possible ones in Hungarian that cannot be found intervocalically in a single morpheme. Out of all of the clusters that are not attested intervocalically in a single morpheme there are only three that can be the result of syncope in vowel-zero alternating stems: [cr], [ɟr], [ɲz]. An example for each of these clusters as a result of stem-internal vowel-zero alternation is given in (39).

(39) a. szatyor + -t [sɒcor + -t] ‘shopping bag’ + ACCUSATIVE → szatyrot [sɒcrot] ‘shopping bag-ACC’
b. bugyor + -t [buɟor + -t] ‘bundle’ + ACCUSATIVE → bugyrot [buɟrot] ‘bundle-ACC’
c. versenyez + -Ás [vɛrʃɛɲɛz + -Aːʃ] ‘compete’ + NOMINALIZER → versenyzés [vɛrʃɛɲzeːʃ] ‘competing’

All three of these clusters involve a palatal stop, which are generally less frequent than other stops – or other consonants at large. Moreover, all three of these clusters are found across morpheme boundaries. Given the low frequency of palatal stops in general and the fact that these clusters are phonotactically well-formed since they occur non-monomorphemically, it is likely that the fact that they are not found monomorphemically in a single morpheme is just an accidental gap.

There is one additional example where a consonant cluster that is unattested intervocalically in a single morpheme is expected after syncope: in the stem *teher* [tɛhɛr] 'burden'. However, in this example the consonant preceding the alternating vowel and the one following it undergo metathesis as shown in (40), which yields an attested cluster: [rh].

(40) teher +-(V)k [tɛhɛr +-(V)k] 'burden' + PLURAL → terhek [tɛrhɛk] 'burdens'

Interestingly, metathesis takes place whenever the consonant preceding the alternating vowel is the sonorant consonant [h]. That is if the consonant preceding the alternating vowel is [h] after syncope it will follow the consonant that originally followed the alternating vowel as in example (41).

(41) kehely +-(V)k [kɛhɛj + -(V)k] 'chalice' + PLURAL → kelyhek [kɛjhɛk] 'chalices'

With the brief discussion of absent clusters without available repairs that can result from stem-internal vowel-zero alternations, let us turn our attention to clusters that are generally attested intervocalically in a single morpheme.

4.2.3 Generally attested clusters in the language

There are many intervocalic clusters that are attested intervocalically in a single morpheme in Hungarian as evidenced by the number of cells with a blue background in tables 8–10. Here we focus our attention on two groups of consonant clusters of this kind: (i) clusters in which one of the two consonants is a labial fricative and (ii) clusters in which one of the two consonants is a liquid. If we take a closer look at the clusters that can be created as a result of syncope, we find that there are no potential consonant clusters with a labial fricative in them, see table 8. That is, if a stem is subject to vowel-zero alternation, then neither the consonant preceding its alternating vowel, nor the one following it is a labial fricative. That is to say that there are no vowel-zero alternating stems of the forms in (42).

(42) $(C)V_1fV_2C_2$, $(C)V_1vV_2C_2$, $(C)V_1C_1V_2f$, $(C)V_1C_1V_2v$

Note that labial fricatives do generally occur in intervocalic consonant clusters in the language monomorphemically. Both the voiceless and the voiced labial fricative can appear in an intervocalic cluster after certain stops, e.g. after [p], [t], [c] or [k], after liquids, after certain nasals, e.g. after [m], [ɲ] or before liquids or before a glide as shown in examples (43)–(46).

(43) nyamvadt [ɲɒmvɒtː] ‘lousy’

(44) ponyva [poɲvɒ] ‘canvas’

(45) kifli [kifli] ‘roll’

(46) cifra [cifrɒ] ‘ornamented’

Since there are a variety of different intervocalic clusters found in a single morpheme with a labial fricative in them in the language in general, it is unclear why there is no example for such clusters in vowel-zero alternating stems after syncope. Now that we have taken a closer look at clusters with a labial fricative in them, let us turn our attention to clusters involving a liquid.

When looking at the distribution of potential consonant clusters in vowel-zero alternating stems, we find that most of the possible consonant clusters that result from syncope in alternating stems include a liquid. That is, in most cases either the first or the second consonant in the consonant cluster created through vowel deletion is a liquid. We find that 70% of all vowel-zero alternating stems – 66% of nominal stems and 72% of verbal stems – has a liquid either preceding or following its alternating vowel. This means that most of the vowel-zero alternating stems are either of the schematic form in (47-a) or (47-b). An example for a vowel-zero alternating stem in which a liquid precedes the alternating vowel is given in (48-a), while one in which a liquid follows the alternating vowel is given in (48-b).

(47) a. $(C)V_1LV_2C_2$
b. $(C)V_1C_1V_2L$

(48) a. malom + (V)k [mɔlom + (V)k] ‘mill’ + PLURAL → malmok [mɔlmok] ‘mills’
b. fátyol + (V)k [faːcol + (V)k] ‘veil’ + PLURAL → fátylak [faːclɔk] ‘veils’

A few of the vowel-zero alternating verbs – 8% of them– have a liquid both preceding and following the alternating vowel like example (49). There are no vowel-zero alternating nouns of this form.

(49) bérel +-ő [beːrɛl +-øː] ‘rent’ + NOMINALIZER → bérlő [beːrløː] ‘renter’

This section concludes the description of the observations made based on the information in tables 8–10. Now that we seen the variation in the consonant clusters that can and cannot be created through stem-internal vowel-zero alternations, let us turn our attention to the comparison of the consonants in vowel-zero alternating stems to those in potentially alternating stems.

4.3 A model of the lexicon

To test whether the above observations regarding the potential consonant clusters in vowel-zero alternating stems are accidental gaps or are a result of statistically significant under attestation, a logistic regression model comparing the list of vowel-zero alternating and potentially vowel-zero alternating stems has been created. The model compares the entries in the two lists with respect to the following individual factors: (i) geminates: whether the consonant preceding the (potentially) alternating vowel and the one following it are identical and thus, would form a geminate after syncope, (ii) affricates: whether the consonant preceding the (potentially) alternating vowel and the one following it would form an affricate after syncope, (iii) voicing disagreement: the consonant preceding the (potentially) alternating vowel and the one following it are both obstruents that differ in voicing and thus, would necessitate voicing assimilation after syncope, (iv) liquid: whether one or both of the consonants preceding and following the (potentially) alternating vowel are liquids, (v) labial fricative: whether one or both of the consonants preceding and following the (potentially) alternating vowel are labial fricatives, (vi) nasal assimilation: whether the consonant preceding the (potentially) alternating vowel and the one following would lead to nasal place assimilation if they were consecutive, (vii) sibilant assimilation: whether the consonant preceding the (potentially) alternating vowel and the one following it would lead to sibilant assimilation if they were consecutive and (viii) palatalization: whether the consonant preceding the (potentially) alternating vowel and the one following it would result in palatalization if they were consecutive. All factors were sum coded except for voicing disagreement. For voicing disagreement a custom coding was used to test the effect of voicing disagreement only among obstruents.

Additionally to the above factors, the model also checked whether any of the potential interactions between the factors are significant: (i) geminates and liquids: whether the number of geminates that are also liquids significantly differ in the two lists, (ii) geminates and labial fricatives: whether the number of geminates that are also labial fricatives significantly differ in the two lists, (iii) voicing disagreement and labial fricatives: whether the number of instances where both of the relevant consonants are obstruents and they differ in voicing and at least one of them is a labial fricative is significantly different in the two lists, (iv) voicing disagreement and sibilant assimilation: whether the number of instances where both of the relevant consonants are obstruents and they differ in voicing and they would lead to sibilant assimilation if they were next to each other is significantly different in the two lists, (v) liquids and labial fricatives: whether the number of instances where one of the relevant consonants is a labial fricative and the other one is a liquid is significantly different in the two lists. The interaction between geminates and labial fricatives has been dropped by the model since there were no examples in which the consonant preceding and following the (potentially) alternating vowel are identical and both are labial fricatives.

The results of the model are presented in table 11. The model did not yield any significant results with respect to any of the factors and factor interactions.

Factor	**Coefficients**	**Standard Error**	**p values**
geminates	8.62	551.66	0.99
affricates	8.63	380.68	0.98
voicing disagreement	2.43e-8	1278.58	1
liquids	-0.24	661.09	1
labial fricatives	8.39	364.29	0.98
nasal assimilation	0.26	0.54	0.63
sibilant assimilation	8.15	1211.33	0.99
palatalization	8.15	1398.72	0.99
geminates & liquids	3.12e-3	551.66	1
voicing disagr. & labial fricatives	-0.48	409.21	0.99
voicing disagr. & sibilant ass.	-0.48	1211.33	1
liquids & labial fricatives	-0.24	364.29	0.99

Table 11: Model results

However, it is worth noting that all of the standard errors are quite large, which might mask significant results. To determine whether a factor and the interactions the factor participates in make a significant contribution to determining whether a given word is alternating or not, likelihood ratio tests were performed. Likelihood ratio tests compare two models where one model has a subset of the factors the other one has. From the results of the likelihood ratio test we can conclude whether certain factor(s) have a significant impact on how well the model fits the data or not.

Since none of the factors and factor interactions yielded significant results in the original model, in what follows, I compare the original complete model to eight other models in which an individual factor and its corresponding factor interactions have been left out to see whether any of these factors have a significant impact on determining whether a given word is alternating or not. The results of all the likelihood ratio tests are summarized in 12. The models column shows which factor and its corresponding factor interactions have been left out. The columns Chi^2 and p-value show the numerical outputs of the likelihood ratio tests. In the column degrees of freedom first the degrees of freedom of the model with all factors and interactions is presented followed by the degrees of freedom of the model it is being evaluated against. The models for which the likelihood ratio test yielded significant results received a ✓ in the final column of table 12. The significance here is based on a 99% confidence interval.

Models	**Chi**^{2}	**Degrees of freedom**	**p-value**	**Significance**
Minus liquids	54.35	13/11	1.58e-12	✓
Minus voicing disagr.	38.42	13/10	2.30e-8	✓
Minus affricates	26.65	13/12	2.44e-7	✓
Minus geminates	15.09	13/11	5.27e-4	✓
Minus labial fricatives	0	13/12	9.99e-1	×
Minus nasal ass.	0.26	13/12	6.08e-1	×
Minus palatalization	0.99	13/12	3.19e-1	×
Minus sibilant ass.	1.51	13/11	4.71e-1	×

Table 12: Likelihood ratio tests

As the results of the likelihood ratio tests in table 12 show the comparison of four different models with the original model yielded significant results. This means that including liquid and its interactions with geminates and labial fricatives makes the model more precise. Similarly, including the factor voicing disagreement and its interactions with sibilant assimilation and labial fricatives gives us a more precise model. Including the factor affricates, and the factor geminates and its interactions with liquids and labial fricatives, respectively, yields a model that is better fitted to the data. This means that these factors and factor interactions play a significant role in determining whether a given word is alternating or not.

Since the likelihood ratios tests did not yield any significant results when comparing the other models – the model without the factor labial fricatives and its interactions with voicing disagreement and liquids, the model without the factor nasal place assimilation, the model without the factor palatalization and the model without the factor sibilant assimilation – to the original model, we can conclude that they do not play a significant role in determining whether a given word is alternating or not. Note that the lack of significance regarding these factors is not that surprising if we consider how few examples of the relevant kind were found in our data set, cf. section 4.2.1.

In this section vowel-zero alternating stems have been compared to potentially vowel-zero alternating stems in the lexicon to investigate which of the above observations about the potential consonant clusters in these stems are accidental gaps and which are the result of statistically significant under attestation. Four out of the eight observed patterns are could be the result of underattestation in vowel-zero alternating stems: (i) lack of voicing contrast between the consonant preceding the alternating vowel and the one following it, (ii) lack of identical consonants preceding and following the alternating vowel, (iii) lack of potential affricates formed after syncope and (iv) the high percentage of liquids either before or after the alternating vowel. The other four observations can be accidental gaps since they do not significantly contribute to determining whether a stem is vowel-zero alternating or not.

Chapter 5

Analysis

As discussed in section 2.4 I follow Siptár & Szentgyörgyi (2013) in assuming that vowel-zero alternating suffixes have an underlyingly partially underspecified vowel in them, while vowel-initial suffixes with only one form have an underlyingly fully specified vowel. In the analysis presented here I use the plural suffix -(V)k [-(V)k] as an example for vowel-zero alternating suffixes, but everything in the analysis naturally extends to other vowel-zero alternating suffixes as well. Similarly, I use the terminative suffix -ig [-ig] as a stand in for any vowel-initial suffix that is underlyingly fully specified. Note that the focus of this chapter is restricted to vowel-zero alternating nouns. An expansion of this analysis to verbal vowel-zero alternating stems – which come with the introduction of strictly vowel-initial suffixes that trigger stem-internal vowel-zero alternations as discussed in detail in section 3.2 – is left for future research.

This chapter is divided into three parts, section 5.1 describes how underspecification in vowel-zero alternating stems but not in stable stems predicts a difference in their surface forms when followed by vowel-zero alternating suffixes. In section 5.2 I show how we can predict that voicing assimilation, gemination and affrication block syncope in vowel-zero alternating stems, while 5.3 provides an analysis for the restrictions on the vowels in vowel-zero alternating stems.

5.1 Alternating vs. non-alternating stems

One of the corner stones of the problem of vowel-zero alternating stems to be captured by any analysis is how they differ from regular non-alternating stems. Following Siptár & Szentgyörgyi (2013)'s analysis for vowel-zero alternating stems, I propose that what differentiates vowel-zero alternating stems from non-alternating stems is that their alternating vowel is underlyingly underspecified. This assumption provides the basis for a unified treatment of vowel-zero alternating suffixes and vowel-zero alternating stems in that in both cases it is the underlyingly underspecified vowels are the alternating ones. It is important to note here that underspecification is not the only option here. Either the vowel-zero alternating stems themselves or the alternating vowels in them could be lexically indexed in some other way. The analysis presented here relies on the underspecification to account for the syncope process, but it is by no means the only possible way to do so.

In this proposal there is an underlying vowel present in vowel-zero alternating stems, unlike Vago's (1980) approach in which no vowel is present underlyingly. The alternating vowel is underlyingly underspecified and it can be either deleted or extended to a full vowel. Even though the underlyingly underspecified vowel can both be deleted or extended to a full vowel, I refer to to vowel-zero alternation as syncope to emphasize the difference between the analysis presented here and Vago's (1980) proposal.

This proposal naturally raises the question how underspecified the alternating vowel is. I put forth an analysis in which the alternating vowel is underlyingly only specified for height. In particular the underlying alternating vowel has the following features: [–high, –low]. It is underlyingly specified for height since it is generally a mid vowel. It is not specified for backness or roundness, how these features are acquired is what differentiates it from regular stems. Section 5.3 provides a more in depth overview of which features can be part of an underlyingly underspecified vowel that syncopates.

With these assumptions in mind, let us now take a look at some concrete examples. The proposed underlying form for the syncopating stem torony [tor([–high,–low, –consonantal])ɲ] 'tower' contains an underlyingly underspecified vowel, see (1), while the underlying form for the stable stem szurony [suroɲ] 'bayonet' has underlyingly fully specified vowels, see (2). Furthermore, I assume that full specification is required in the output.

(1) torony + -(V)k [tor([–high,–low, –consonantal])ɲ+ -(V)k] 'tower' + PLURAL → tornyok [torɲok] 'towers'

(2) szurony + -(V)k [suroɲ+ -(V)k] 'bayonet' + PLURAL
→ szuronyok [suroɲok] 'bayonets'

Any analysis of vowel-zero alternations has to account for how different forms of syncopating and non-syncopating stems are derived: (i) the stem alone, (ii) the stem followed by a vowel-zero alternating suffix and (ii) the stem followed by a non-alternating vowel-initial suffix. First let us take a look at how the stem form of the syncopating torony [tor([–high,–low, –consonantal])ɲ] 'tower' can be derived. The definitions of the relevant constraints are given in (3)–(7).

(3) *CC/_#: Assign one violation mark for every word-final consonant cluster.

(4) DEP([α back]): Assign one violation mark for every backness feature in the surface form that is not present in the underlying form.

(5) DEP([α round]): Assign one violation mark for every roundness feature in the surface form that is not present in the underlying form.

(6) AGREE([α back]): Assign one violation mark for every pair of vowels that disagree in backness.

(7) AGREE([α round]): Assign one violation mark for every pair of vowels that disagree in roundness.

As the tableau in (8) shows the markedness constraint against word-final consonant clusters penalizes syncope in the unsuffixed form of the syncopating stem torony [tor([–high,–low, –consonantal])ɲ], cf. candidate d in (8). This means that the alternating vowel is not deleted in this case, but it is extended to a full vowel. Since the alternating vowel is underlyingly underspecified for backness and roundness there are multiple potential fully specified vowels it can be extended to, cf. candidates a–c, which all violate the DEP constraints penalizing the insertion of backness and roundness features. What differentiates candidates a, b and c from each other is whether they adhere to roundness and backness harmony. Candidate b violates backness harmony as evidenced by the violation of the constraint AGREE([α back]), while candidates c violates both backness and roundness harmony which results in a violation of the constraints AGREE([α back]) and AGREE([α round]). This means that candidate c is harmonically bound by both candidate a and b, while candidate b is harmonically bound by candidate a, which is the optimal candidate here. The crucial ranking between the markedness constraint penalizing word-final clusters and the DEP and AGREE constraints is given in (9).

(8)

tor([-high, -low])ɲ	*CC/_#	DEP([α back])	DEP([α round])	AGREE([α back])	AGREE([α round])
a. ☞ toroɲ		*	*		
b. torøɲ		*	*	*!	
c. torɛɲ		*	*	*!	*!
d. torɲ	*!				

(9) *CC/_# ≫ DEP([α back]), DEP([α round])

Tableau (10) shows that the same ranking predicts the correct outcome for non-syncopating stems. The markedness constraint penalizing word-final consonant clusters prevents vowel-deletion in general and thus, it rules out candidate b in tableau (10). This means that the fully faithful candidate – candidate a in tableau (10) – is the optimal candidate when it comes to the unsuffixed form of non-syncopating stems.

(10)

suroɲ	*CC/_#	Dep([α back])	Dep([α round])
a. ☞ suroɲ			
b. surɲ	*!		

Now that we have seen how stems of syncopating and non-syncopating nouns can be derived, let us turn to their plural forms as representative of forms where syncope may apply. Note again that I am using here the plural suffix as a stand-in for any vowel-zero alternating suffix. The vowel in the plural suffix is underlyingly underspecified. The features the vowel in the plural suffix is specified for underlyingly are [–consonantal, –high]. The reason why the vowel in the plural suffix is not specified as [–high,–low] – unlike the syncopating vowel in syncopating stems – is that it can surface not only as a mid vowel but also as a low vowel (see section 2.4).

To correctly predict the surface form of syncopating and non-syncopating stems when they are followed by a vowel-zero alternating suffix, an additional constraint is needed, which is given in (11).

(11) Max([–high]): Assign one violation mark for every [–high] feature in the underlying form that is not present in the surface form.

Tableau (12) shows how the correct surface form of a non-syncopating stem and the plural suffix can be derived. The high ranked markedness constraint against word-final consonant clusters rules out the deletion of the underlyingly underspecified vowel in the suffix, see candidate c in tableau (12). What differentiates the remaining two candidates – candidates a and b – is that in candidate b a vowel is deleted, while in candidate a no vowel deletion takes place. In terms of constraint violations it is the violation of Max([–high]) that distinguishes candidate b from candidate a. Since candidate a does not violate Max([–high]), it is harmonically bound by candidate b. Therefore, candidate a is the optimal candidate predicting the correct surface form for the plural form of a non-syncopating stem. Note that a less specific Max constraint – i.e. Max(V) – would equally be able to predict the expected output here. However, the more specific Max constraint is necessary to predict the correct form of syncopating stems in certain contexts as we will see later on.

(12)

suroɲ+ -([-high])k	*CC/_#	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ suroɲok		*	*	
b. surɲok		*	*	*!
c. suroɲk	*!			*

Tableau (13) shows that the same set of constraints from tableau (12) can predict the correct output for the plural form of syncopating stems as well as long as one additional crucial ranking is included. Similarly to the plural form of non-syncopating stems – shown in (12) – the high ranked markedness constraint penalizing word-final consonant clusters rules out the candidate in which the underlyingly underspecified vowel of the plural suffix is deleted – candidate a in (13). The two remaining candidates in tableau (13) are candidate b, in which both the stem-internal underspecified vowel and the suffixal underspecified vowel are extended to a full vowel, which leads to double violations of the Dep constraints and candidate c, in which the stem-internal underspecified vowel is deleted, while the suffixal underspecified vowel is extended to a full vowel. Since only one of the two underspecified vowels are extended to a full vowel in candidate c, it only violates each Dep constraint once. However, candidate c also violates Max[–high]) since the stem-internal underspecified vowel is deleted. Since candidate b violates both Dep constraints twice and candidate c only violates them once each, candidate b can be ruled out if the Dep constraints are ranked above Max[–high]), which is only violated by candidate c and not candidate b. That is to say that as long as the ranking in (14) holds, candidate c surfaces as the optimal candidate, which correctly predicts the output of a syncopating stem followed by a vowel-zero alternating suffix.

(13)

tor ([-high, -low]) ɲ+ -([-high])k	*CC/_#	Dep([α back])	Dep([α round])	Max[–high])
a. toroɲk	*!			*
b. toroɲok		* *!	* *!	
c. ☞ torɲok		*	*	*

(14) Dep([α back]), Dep([α round]) $\gg$ Max[–high])

The constraint ranking established so far can correctly predict the surface form of a non-syncopating stem followed by a non-alternating suffix as shown in (15). When a non-syncopating stem is followed by a non-alternating suffix, there are no underlyingly underspecified vowels. This means that neither of the two Dep constraints are violated by the potential candidates in (15). What distinguishes candidate a and b in tableau (15) is the deletion of a vowel in candidate b, which violates the Max constraint. Since candidate a does not violate any of the constraints relevant here, it is the optimal candidate and thus, the current constraint ranking correctly predicts the surface form of a non-syncopating stem followed by a non-alternating suffix.

(15)

suroɲ+ -ig	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ suroɲig			
b. surɲig			*!

However, when it comes to predicting the surface form of a syncopating stem followed by a non-alternating suffix, the current constraint ranking picks the wrong candidate to be the optimal candidate, see tableau (16). Since the actually optimal candidate – candidate a in tableau (16) – has an underlyingly underspecified vowel in it which has been extended to a full vowel it violates both DEP constraints. On the other hand, if the underlyingly underspecified vowel is deleted – as in candidate b –, then the violations of the DEP constraints are avoided and only the lower ranked MAX constraint is violated, making candidate b the optimal candidate contrary to what we find in the language. The fact that the current constraint ranking does not predict the correct output in tableau (16) naturally raises the question whether the constraints can be reranked. However, ranking MAX([-high]) above the DEP constraints is not possible as it would lead to the wrong outcome – as shown in tableau (13) – when a syncopating stem is a followed by a vowel-zero alternating suffix.

(16)

tor ([-high, -low]) ɲ+ -ig	DEP([α back])	DEP([α round])	MAX([–high])
a. ☹ toroɲig	*!	*!	
b. ☞ torɲig			*

If we want to maintain the constraint ranking established so far the only solution we are left with is relying on an additional constraint to predict the right surface form when a syncopating stem is followed by a non-alternating suffix. I propose to rely on the base-derivative identity constraint given in (17). I stipulate that this base-derivative constraint is activated whenever a non-alternating vowel-initial suffix is used. That is to say, that base-derivative contiguity is evoked by suffixes like the terminative *-ig* /-ig/ [-ig], but it is not active when suffixes like the vowel-zero alternating plural suffix is used.

(17) BD-CONTIGUITY/_[-ig]: Assign one violation mark if two segments that are adjacent in the derived form don't form a contiguous substring in the base.

If the base-derivative contiguity constraint is ranked above the DEP constraints, then the right output is predicted for syncopating stems followed by a non-vowel zero alternating vowel initial suffix, see candidate a in tableau (18). In tableau (18) BD-CONTIGUITY rules out candidate b in which the stem-internal underlyingly underspecified vowel is deleted since the vowel deletion makes underlyingly non-adjacent segments adjacent on the surface. On the other hand, if the underlyingly underspecified vowel is extended to a full vowel on the surface, then BD-CONTIGUITY is not violated. This means that the updated ranking given in (19) correctly predicts candidate a to be the optimal candidate in tableau (18).

(18)

tor ([-high, -low]) ɲ+ -ig	BD-CONTIGUITY	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ toroɲig		*	*	
b. torɲig	*!			*

(19) BD-CONTIGUITY ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

Last, but not least it is important to note that the new constraint ranking does not influence the prediction regarding non-syncopating stems followed by non-alternating suffixes as shown in tableau (20). As in tableau (18), vowel deletion results in a violation of BD-CONTIGUITY in candidate b in tableau (20). Since the other candidate in (20) – candidate a – is fully faithful to the underlying form, it does not violate BD-CONTIGUITY and it correctly surfaces as the optimal candidate.

(20)

suroɲ+ -ig	BD-CONTIGUITY	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ suroɲig				
b. surɲig	*!			*

Now that we have seen what predictions an underspecification based analysis makes for the surface form of vowel-zero alternating and stable stems with and without suffixes in general, let us turn our attention to the restriction on the segments in vowel-zero alternating stems. Section 5.2 provides an overview of the restrictions on the consonants in vowel-zero alternating stems, while section 5.3 is devoted to the constraints on the vowels in these stems.

5.2 Consonantal effects

The statistical analysis of the lexicon presented in section 4.3 has revealed four consonantal constraints on what the consonants preceding and following the alternating vowel in a vowel-zero alternating stem can look like. Three of these constraints are prohibitive in that these type of consonant combinations cannot appear in vowel-zero alternating stems, while one is supporting in nature in this type of consonant combinations improve the likelihood that a given stem is vowel-zero alternating all else being equal. The three prohibitive constraints include bans on the two consonants preceding and following the alternating vowel (i) if they are both obstruents and differ in voicing, (ii) if they are identical and (iii) if they can form an affricate when they are consecutive. What helps vowel-zero alternations in terms of the possible consonant preceding and following the alternating vowel is if one of these is a liquid.

Let us first look at the analysis of potential vowel-zero alternating stems in which the consonant preceding the alternating vowel and the one following it are both obstruents and differ in voicing. Since there are no nominal examples for this case, I use the nonce word höböt [høbøt] here as a hypothetical nominal stem of this kind. The hypothetical stem höböt [høbøt] is expected to never undergo vowel-zero alternation no matter whether the final vowel in the stem is underlyingly underspecified or whether it is fully specified underlyingly. Tableau (21) shows what the predicted surface form of the plural form of höböt [høbøt] is when its final vowel is underlyingly fully specified while tableau (23) shows what the predicted surface form of the plural form of höböt [høbøt] is when its final vowel is underlyingly partially specified. Let us first take a look at tableau (21). Tableau (21) contains the constraints introduced in section 2.2.1 to account for voicing assimilation in Hungarian in general – Agree([α voice]) and Ident([α voice]) – and the constraints introduced in the previous section to account for when underlyingly underspecified vowels are extended to a full vowel and when they are deleted – Dep and Max feature constraints. The constraints responsible for vowel deletion and the extension of an underlyingly underspecified vowel to a full vowel on the surface are ranked below the constraints used to account for voicing assimilation. This means that the constraints responsible for voicing assimilation are able to rule out any candidates in which either voicing assimilation takes place – candidate c in tableau (21) – and candidates with two consecutive obstruents that disagree in voicing – candidate a in tableau (21). This means that candidates in which no voicing disagreement arises, that is candidates in which no vowel deletion takes place – candidate a in (21) – are chosen to be the optimal candidate as long as the crucial ranking between the voicing assimilation constraints – Agree([α voice]) and Ident([α voice]) – are ranked above the constraints penalizing rounding up an underlyingly partially underspecified vowel and the ones penalizing the deletion of a vowel – Dep and Max feature constraints, respectively. This crucial ranking is noted in (22).

(21)

høbøt + -([-high])k	Agree([α voice])	Ident([α voice])	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ høbøtøk			*	*	
b. høbtøk	*!		*	*	*
c. høptøk		*!	*	*	*

(22) Agree([α voice]) ≫ Ident([α voice]) ≫ Dep([α back]), Dep([α round]) ≫ Max([–high])

In tableau (23) the same ranking as the one established in tableau (21) and noted in (22) is used to show that no matter whether the final vowel of höböt [høbøt] is underlyingly fully specified or partially underspecified, the surface form of the plural form of höböt [høbøt] is the same. As we have seen in tableau (21) the high ranked constraints penalizing voicing disagreement and change in voicing – AGREE([α voice]) and IDENT([α voice]), respectively – rule out candidates in which the final stem vowel is deleted. The same can be observed in tableau (23). Since neither AGREE([α voice]) and IDENT([α voice]) make reference to whether the underlying vowel is fully specified or partially underspecified they equally penalize candidates b and c in tableau (21) and (23). This means that candidate a in tableau (23) is the optimal candidate – just like in tableau (21) – since rounding both underlyingly partially underspecified vowels – the one in the stem and the one in the suffix – is less costly than voicing disagreement of consecutive obstruents and changing the voicing of a consonant.

(23)

høb$\left(\begin{bmatrix}\text{-high}\\ \text{-low}\end{bmatrix}\right)$t + -([-high])k	AGREE([α voice])	IDENT([α voice])	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ høbøtøk			∗ ∗	∗ ∗	
b. høbtøk	∗!		∗	∗	∗
c. høptøk		∗!	∗	∗	∗

Now that we have seen that the plural form of höböt [høbøt] is the same no matter whether the final stem-internal vowel is underlyingly fully specified or partially underspecified, let us see what the analysis predicts the plural form of the nonce word höpöt [høpøt] looks like. Unlike in höböt [høbøt], in which the obstruents preceding and following the potentially alternating vowel disagree in voicing, in höpöt [høpøt] both the obstruent before and the one after the potentially syncopating vowel are voiceless. Since the two obstruents agree in voicing, the constraints penalizing voicing disagreement – AGREE([α voice]) – and change in voicing – IDENT([α voice]) – do not play a role here even if the potentially syncopating vowel is deleted as shown in table (24). This means that what determines whether the final stem-internal vowel is deleted or not depends on the underlying form. Tableau (24) shows that if the final stem-internal vowel is underlyingly fully specified, then it is more costly to delete it – as in candidate b – than to keep it – as in candidate a.

(24)

høpøt + -([-high])k	AGREE([α voice])	IDENT([α voice])	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ høpøtøk			∗	∗	
b. høptøk			∗	∗	∗!

On the other hand, if the final stem-internal vowel is underlyingly only partially specified, then it is more costly to extended it to a full vowel – as in candidate a in tableau (24) – than to delete it – as in candidate b in tableau (24). The fact that whether vowel deletion takes place or not depends on the underlying form of the stem in a case where the potential consonant cluster after deletion is well-formed corresponds to the data we find in the language.

(25)

høp ([-high, -low]) t + -([-high])k	AGREE([α voice])	IDENT([α voice])	DEP([α back])	DEP([α round])	MAX([–high])
a. høpøtøk			∗ ∗!	∗ ∗!	
b. ☞ høptøk			∗	∗	∗

So far we have only seen how voicing assimilation interacts with stem-internal vowel-zero alternations. However, voicing assimilation is not the only consonantal process that prevents syncope in these stems. Another consonantal process that interferes with syncope is the forming of geminates when the consonant preceding and the one following the potentially alternating vowel are identical. Generally, when two identical consonants are consecutive underlyingly they surface as one long consonant. Therefore, if the consonant preceding the alternating vowel in a vowel-zero alternating stem and the one following it are identical, then after syncope the two identical consonants are expected to merge into one long consonant. However, as discussed in section 4.3 there are no vowel-zero alternating stems in which the consonant preceding the alternating vowel and the one following it are identical. This means that no matter what the underlying form of a hypothetical stem like *hötöt* [høtøt] is, the surface form of its plural form is expected to not undergo vowel-zero alternation. Formally, this can be captured if the constraints penalizing identical consecutive segments – OCP given in (26) – and the one penalizing the merger of two identical consonants – UNIFORMITY given in (27) – are ranked above the constraints penalizing extending underlyingly partially underspecified vowels to full vowels – DEP constraints – and the one penalizing vowel deletion – MAX constraint.

(26) OCP: Assign one violation mark for every pair of consecutive segments that are identical.

(27) UNIFORMITY: Assign one violation mark if a segment in the output has multiple correspondents in the input.

How the ranking of these constraints can predict the correct plural form of *hötöt* [høtøt] when the final stem-internal vowel is underlyingly fully specified is shown in tableau (28). The two candidates involving vowel deletion – candidates b and c – in tableau (28) are ruled out by the two high ranked constraints against identical consecutive consonants and against the merge of two segments – OCP and UNIFORMITY, respectively. This means that the candidate without vowel deletion – candidate a – is chosen as the optimal candidate since it only violates the lower ranked DEP constraints penalizing the insertion of vowel features for the underlyingly partially specified suffixal vowel. The crucial ranking yielding the correct surface form is noted in (29). Note that the ranking between OCP and Uniformity is based on the fact that two consecutive identical consonants generally merge into one long consonant.

(28)

høtøt + -([-high])k	OCP	Uniformity	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ høtøtøk			∗	∗	
b. høttøk	∗!		∗	∗	∗
c. høt:øk		∗!	∗	∗	∗

(29) OCP ≫ Uniformity ≫ Dep([α back]), Dep([α round]) ≫ Max([–high])

Even if the final stem-internal vowel in the hypothetical word *hötöt* [høtøt] is underlyingly only partially specified, its plural form still does not involve vowel deletion as shown in tableau (30). Similarly to tableau (28), in tableau (30) candidates a and b – the two candidates with vowel-deletion – are ruled out by the high ranked constraints against consecutive identical segments – OCP – and against the merge of segments – Uniformity. This leaves candidate a – the only candidate in which no vowel is deleted – as the optimal candidate since it only violates the lower ranked constraints against the insertion of features to extend the underlyingly underspecified vowels to a full vowels in the stem and the suffix. Tableaux (28) and (30) together show that no matter what the underlying form is of a potentially vowel-zero alternating stem with identical consonants on both sides of the alternating vowel, it surfaces as non-alternating even if it is followed by a vowel-zero alternating suffix.

(30)

høt$\left(\begin{bmatrix}\text{-high}\\ \text{-low}\end{bmatrix}\right)$t + -([-high])k	OCP	Uniformity	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ høtøtøk			∗ ∗	∗ ∗	
b. høttøk	∗!		∗	∗	∗
c. høt:øk		∗!	∗	∗	∗

The third prohibition on what consonants can surround the alternating vowel in a vowel-zero alternating stem involves affricates. If the consonant preceding the potentially alternating vowel and the one following it are expected to combine into an affricate, then that stem is not subject to vowel-zero alternations. Since there are no nominal stems of this kind, I use the hypothetical stem *hötös* [høtøʃ] below to illustrate the mechanism that ensures such stems do not alternate that no matter what the underlying form of such stems is, they do not undergo vowel-zero alternations. Similarly to the previously described cases of potential voicing assimilation and gemination after vowel-deletion, high-ranked constraints penalizing certain type of consonant clusters – here a markedness constraint against [-continuant] coronal obstruent followed by stridents, given in (31) – and a constraint against merging two segments – UNIFORMITY – can rule out candidates involving vowel deletion in the case of affrication as well. This is shown in tableau (32) where candidates b and c – the candidates involving vowel deletion – are ruled out by the phonotactic markedness constraint – $*\begin{bmatrix}\text{-son}\\ \text{+cor}\\ \text{-cont}\end{bmatrix}$[+stri] – and UNIFORMITY, respectively. This leaves us – similarly to the previous cases – with the candidate without vowel deletion – candidate a in (32) – as the optimal candidate. In candidate a the potentially alternating vowel is preserved, which means that it does not contain any illicit consonant clusters and thus, it only violates the lower ranked faithfulness constraints against inserting features to extend underlyingly partially specified vowels to full vowels. This means that as long as the constraint ranking in (33) holds, the optimal candidate for the plural form of the hypothetical stem *hötös* [høtøʃ] does not involve vowel deletion.

(31) $*\begin{bmatrix}\alpha\ \text{ant}\\ -\ \text{cont}\\ -\ \text{son}\end{bmatrix}$[+strident]: Assign one violation mark if a [– continuant, ± anterior] obstruent is followed by a strident.

(32)

høtøʃ+ -([-high])k	$*\begin{bmatrix}\alpha\ \text{ant}\\ -\ \text{cont}\\ -\ \text{son}\end{bmatrix}$[+stri]	UNIFORMITY	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ høtøʃøk			*	*	
b. høtʃøk	*!		*	*	*
c. høt͜ʃøk		*!	*	*	*

(33) $*\begin{bmatrix}\alpha\ \text{ant}\\ -\ \text{cont}\\ -\ \text{son}\end{bmatrix}$[+strident] ≫ UNIFORMITY ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

Note that the two highest ranked constraints in the ranking established in (32) – given in (33) – do not make reference to whether the final stem-internal vowel is underlyingly fully or only partially specified. This means that no matter what the underlying form of the hypothetical stem *hötös* [høtøʃ] looks like its plural form does not involve vowel deletion. The fact that the constraint ranking established in (32) makes the same prediction for the plural form of the hypothetical stem *hötös* [høtøʃ] even if its final vowel is underlyingly partially specified is shown in tableau (34). Similarly to tableau (32), in tableau (34) the two high ranked constraints against consonant clusters involving a [-continuant] coronal obstruent followed by a strident and against the merge of two underlying segments on the surface rule out the two candidates involving vowel deletion – candidates b and c. This leaves candidate a – the candidate without vowel deletion – as the optimal candidate since it only violates the lower ranked faithfulness constraints against extending the underlyingly only partially specified vowels to full vowels.

(34)

høt$\left(\begin{bmatrix}\text{-high}\\ \text{-low}\end{bmatrix}\right)$ʃ+ -([-high])k	* $\begin{bmatrix}\alpha\ \text{ant}\\ -\ \text{cont}\\ -\ \text{son}\end{bmatrix}$ [+stri]	Uniformity	Dep([α back])	Dep([α round])	Max([−high])
a. ☞ høtøʃøk			∗ ∗	∗ ∗	
b. høtʃøk	∗!		∗	∗	∗
c. høt͜ʃøk		∗!	∗	∗	∗

Last but not least, let us turn our attention to clusters with a liquid in them. As noted above, a large proportion of potentially syncopating stems in which either the consonant preceding the potentially alternating vowel or the one following it is a liquid are indeed subject to vowel-zero alternations. Note that this is not a categorical observation. That is, if one of the two consonants surrounding the potentially alternating vowel is a liquid it is not necessarily sure that the stem is syncopating. As discussed in detail in (Yun, 2016) CVL sequences are perceptually similar to CL sequences. Similarly, she also notes that rVC sequences are less different perceptually from rC sequences than stop-stop clusters are from stop-vowel-stop sequences or stop-fricative clusters are from stop-fricative sequences. However, no such observation has been made about lVC sequences and their vowel-less counterparts. Thus, the reason why potentially alternating stems with a liquid before or after the potentially alternating vowel are more likely to syncopate is potentially perceptually motivated. However, no evidence has been shown whether the perceptual argument also applies to lVC sequences which are also common among syncopating stems. In the current analysis, what predicts whether a CVL or LVC final potentially alternating stem undergoes syncope or not is entirely whether the final stem-internal vowel is underlyingly underspecified or not. As such, the high frequency of syncopating stems with a liquid preceding or following the alternating vowel is not captured in the current analysis. How the smaller perceptual differences in different clusters and their counterparts containing a vowel can be included in the current analysis is left for future research.

5.3 Impact of the vowels

Now that we have seen how different potential consonant clusters impact whether potentially syncopating stems can in fact undergo syncope, let us turn our attention to the restrictions on what vowels can be subject to syncope. To account for the restrictions of the quality of the alternating vowel I propose to extend the analysis presented so far with a series of MAX-F constraints. I show that even though underlyingly underspecified vowels can have any subset of the features a full vowel can have, only mid vowels lead to vowel-zero alternations. To see how other possible features are ruled out in underlyingly underspecified vowels that are subject to vowel-zero alternations, let us look at the different possible features individually.

We can imagine an underlyingly underspecified vowel can be specified not only as [–high, –low], but also as [+long]. As tableau (36) shows that a high-ranked MAX-F constraint, namely MAX([+long]) as defined in (35), rules out the deletion of an underlyingly underspecified vowel that is [+long]. This means that if a vowel is underlyingly partially specified but it has a [+long] feature, then it will be extended to a full vowel instead of being deleted. In tableau (36) candidate b involves the deletion of an underlyingly long vowel, which is penalized by the high ranked MAX([+long]) constraint. Since the deletion of a long vowel is ruled out by MAX([+long]), the only option left is to extend the underlyingly partially specified vowel to a full vowel as in candidate a in tableau (36). This means that the ranking in (37) ensures that an underlyingly partially specified vowel with a [+long] feature is extended to a full vowel rather than deleted.

(35) MAX([+long]): Assign one violation mark for every [+long] feature in the underlying form that is not present in the surface form.

(36)

bok $\left(\begin{bmatrix}\text{-high}\\ \text{-low}\\ \text{+long}\end{bmatrix}\right)$ r + -([-high])k	MAX([+long])	DEP([α back])	DEP([α round])	MAX([–high])
a. ☞ boko:rok		∗ ∗	∗ ∗	
b. bokrok	∗!	∗	∗	∗

(37) MAX([+long]) ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

Similarly to underlyingly partially underspecified vowels with a [+long] feature, underlyingly partially underspecified vowels with a [+low] feature also cannot be subject to vowel-zero alternations. Formally, this observation can be captured similarly to the previous one: with the use of a MAX-F constraint – here MAX([+low]) as defined in (38). How MAX[+low] can rule out vowel deletion in the case of an underlyingly partially specified vowel with a [+low] feature is shown in tableau (39). Similarly to tableau (36), in tableau (39) candidate b involves the deletion of the underlyingly partially specified vowel, which is penalized by the high ranked faithfulness constraint against the deletion of [+low] vowels – MAX([+low]). This means that candidate a is the predicted – and expected – surface form since it only violates the DEP constraints penalizing the extending of a vowel to a full vowel. The crucial ranking established in tableau (39) is given in (40). Note that there are some vowel-zero alternating stems in which the alternating is [+low]. The current proposal is categorical and as such it cannot account for these exceptions. A more fine grained proposal potentially with weighted constraints is left for future research.

(38) MAX([+low]): Assign one violation mark for every [+low] feature in the underlying form that is not present in the surface form.

(39)

bok ([-high, +low]) r + -([-high])k			MAX([+low])	DEP([α back])	DEP([α round])	MAX([–high])
a.	☞	bokɒrok		* *	* *	
b.		bokrok	*!	*	*	*

(40) MAX([+low]) ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

Another group of vowels that are generally not subject to vowel-zero alternations are high vowels. Similarly to the deletion of underlyingly underspecified vowels with a [+low] feature, the deletion of underlyingly underspecified vowels with a [+high] feature is prevented by a high ranked MAX-F constraint – in this case MAX([+high]) as defined in (41). As tableau (42) shows the high ranked MAX([+high]) constraint rules out candidate b – the candidate involving the deletion of the underlyingly partially specified vowel with the [+high] feature. This leaves candidate a as the optimal candidate since it only violates the lower ranked DEP constraints penalizing the insertion of certain features to extend the underlyingly underspecified vowel to a full vowel. That is to say that as long as the ranking in (43) holds underlyingly partially specified vowels with a [+high] feature cannot be subject to vowel-zero alternations.

(41) MAX([+high]): Assign one violation mark for every [+high] feature in the underlying form that is not present in the surface form.

(42)

bok ([+high, -low]) r + -([-high])k			MAX([+high])	DEP([α back])	DEP([α round])	MAX([–low])
a.	☞	bokurok		* *	* *	
b.		bokrok	*!	*	*	*

(43) MAX([+high]) ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

As has been noted by **rebrusetal2023**, strongly disharmonic stems also cannot be subject to vowel-zero alternations. That is if the vowels in a stem disagree in backness or rounding, then the final stem-internal vowel cannot be a vowel-zero alternating vowel. This means that if the first vowel in a stem is [-back] and the second one is specified as [+back] it cannot be subject to vowel-zero alternations even if the final stem-internal vowel is underlyingly underspecified. This can be accounted for by relying on another Max-F constraint, here Max([α back]) as defined in (44). Tableau (45) shows how a high ranked Max([α back]) constraint can account for the fact that underlyingly underspecified vowels with a Max([α back]) are not subject to vowel-zero alternations. In (45) the underlyingly underspecified vowel with a [α back] feature is deleted in candidate b and thus, candidate b violates the high ranked Max([α back]) constraint. As a result candidate a – the candidate in which the underlyingly underspecified vowel is extended to a full vowel – is chosen as the optimal candidate since it only violates the lower ranked constraints penalizing the insertion of additional features to extended the underlyingly partially specified vowel to a full vowel. That is to say that as long as the ranking in (46) holds, stems with vowels with different backness features cannot be subject to vowel-zero alternations.

(44) Max([α back]): Assign one violation mark for every [αback] feature in the underlying form that is not present in the surface form.

(45)

bøk([-high, -low, +back])r + -([-high])k	Max([α back])	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ bøkorok		* *	* *	
b. bøkrøk	*!	*	*	*

(46) Max([α back]) ≫ Dep([α back]), Dep([α round]) ≫ Max([–high])

Similarly to stems with vowels with different backness features, stems with vowels with different roundness features also cannot be subject to vowel-zero alternations. Formally, this observation can be captured in the exact same way as shown above. That is if a constraint against the deletion of roundness features like the Max([α round]) constraint – as defined in (47) – is ranked above the constraints penalizing the insertion of certain vowel features like Dep([α back]), Dep([α round]), then stems with vowels with different roundness features will not be subject to vowel-zero alternation. This process is shown in tableau (48) where the candidate involving the deletion of an underlyingly partially specified vowel containing a [± round] specification – candidate b – is ruled out by the high ranked Max([α round]) constraint. This leaves the candidate with the underlyingly underspecified vowel extended to a full vowel as the optimal candidate – candidate a in tableau (48). This means that the ranking established in (48), given in (49), ensures that stems with vowels with different roundness features cannot be subject to vowel-zero alternations.

(47) Max([α round]): Assign one violation mark for every [α round] feature in the underlying form that is not present in the surface form.

(48)

bɛk([-high -low +round])r + -([-high])k	Max([α round])	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ bɛkørøk		* *	*	
b. bɛkrɛk	*!	*	*	*

(49) Max([α round]) $\gg$ Dep([α back]), Dep([α round]) $\gg$ Max([–high])

Beyond the constraints concerning the alternating vowels in vowel-zero alternating stems, there is also a constraint on the vowel preceding the alternating vowel in these stems. The penultimate vowel in vowel-zero alternating stems cannot be long since long vowels followed by a consonant cluster are generally marked in the language. This is important since if the stem-final vowel is subject to vowel-zero alternations then the penultimate vowel is followed by two consonants when the final vowel is deleted. To formally account for this constraint on the penultimate vowels in vowel-zero alternating stems a markedness constraint against long vowels followed by multiple consonants – like the one given in (50) – can be used. Tableau (51) shows that ranking the markedness constraint in (50) above the constraints regulating the deletion of the alternating vowel in vowel-zero alternating stems ensures that stems with a penultimate long vowel do not undergo vowel-zero alternations. Candidate b in tableau (51) is the candidate with a penultimate long vowel and final vowel that is deleted, while candidate a does not involve vowel deletion. As tableau (51) shows candidate b is ruled out by the high ranked markedness constraint and candidate a is the optimal candidate since it only violates the Dep constraints penalizing the insertion of vowel features to extend the underlyingly underspecified vowel to a full vowel. That is to say that as long as the ranking in (52) holds, stems with a penultimate long vowel cannot be subject to vowel-zero alternations.

(50) *V:CC: Assign one violation mark for every long vowel followed by a consonant cluster in the surface form.

(51)

boːk([-high -low])r + -([-high])k	*V:CC	Dep([α back])	Dep([α round])	Max([–high])
a. ☞ boːkorok		* *	* *	
b. boːkrok	*!	*	*	*

(52) *V:CC ≫ DEP([α back]), DEP([α round]) ≫ MAX([–high])

Note that the markedness constraint in (50) categorically rules out stems with penultimate long vowels although there are some stems with penultimate long vowels that are subject to vowel-zero alternations. In particular, if the penultimate vowel is [aː] or [eː], then vowel-zero alternation is possible since [aː] and [eː] are generally accepted before consonant clusters in the language. One solution to implement this fact into our analysis would be to make the markedness constraint in (50) less general so that it encompasses the exceptional status of [aː] and [eː]. However, it is worth noting that [aː] and [eː] are the only two long vowels in the language without short counterparts. Since long consonants are generally shortened in the language when they are followed by a consonant cluster, the fact that [a] and [e] are not part of the phoneme inventory of the language is probably the key to the exceptional status of [aː] and [eː]. The formal implementation of the exceptional status of [aː] and [eː] with respect to the markedness constraint in (50) is left for future research.

Chapter 6

Experimental study

To investigate whether the above observations made based on the lexicon are a result of accidental gaps or a result of systematic process interactions an experimental study has been conducted. This chapter reviews the hypotheses tested (6.1) , the methodology (6.2) and the results (6.3) of the experiment.

6.1 Hypotheses

The experiment focuses on some of the above observations regarding the consonants in alternating stems. In particular, here the consonant preceding the potentially alternating vowel and the one following it have been manipulated. I refer to the consonant preceding the potentially alternating vowel as C_1 and to the one following it as C_2 based on the schematic representation of vowel-zero alternation in (1).

(1) $(C)V_1C_1V_2C_2$ + -(V_3)k → $(C)V_1C_1C_2V_3$k

The experiment addresses the five hypotheses listed below. Here eligible stem refers to a stem that is VCVC final, and in which both vowels are short mid vowels that agree in roundness and backness.

1. If C_1 and C_2 in an eligible stem are both obstruents and they disagree in voicing, then the stem does not undergo vowel zero alternation.

2. If C_1 and C_2 in an eligible stem would form an affricate if they were consecutive, then the stem does not undergo vowel zero alternation.

3. If C_1 and C_2 in an eligible stem are identical, then the stem does not undergo vowel zero alternation.

4. If either C_1 or C_2 in an eligible stem is a labial fricative, then the stem does not undergo vowel zero alternation.

5. If either C_1 or C_2 in an eligible stem is a liquid, then the stem is more likely to undergo vowel zero alternation than if neither C_1 or C_2 is a liquid.

6.2 Method

The participants in the experiment were given a forced choice task where they had to choose between two possible plural forms of the nonce words presented to them.
The experiment was created using PsychoPy version 2021.2.3 (Peirce et al. (2019)) and it was presented to participants on pavlovia.org.

6.2.1 Design

The experiment has one factor with five levels. The five levels correspond to the potential CC cluster types that would be the result of syncope. The five levels are 'voicing' – where vowel deletion would lead to voicing assimilation – 'affricate' – where vowel deletion would result in an affricate – 'geminate' – where vowel deletion would result in a geminate – 'fricative' – where the resulting CC cluster after deletion would contain a labial fricative and 'liquid' – where the resulting CC cluster after deletion would contain a liquid. The five levels correspond to the hypotheses listed in 6.1.

Items that belong to one of the first four groups – voicing, affricate, geminate and fricative – are expected to behave similarly since the consonantal processes – voicing assimilation, affrication and gemination – all categorically block syncope and since there are no examples for vowel-zero alternating stems in the lexicon, cf. section 4. That is, the grand mean of vowel retention in the items of these groups is expected to be similar. Items in the fifth group – liquid – are expected to have a lower grand mean of vowel retention than the other four groups. An overall high rate of vowel retention is expected since vowel-zero alternating stems are taken to be a closed class (cf. Siptár & Törkenczy (2000)).

A high grand mean of vowel retention in the groups 'voicing', 'affricate', 'geminate', 'fricative' and a lower grand mean of vowel retention in the 'liquid' group means that participants generalize the patterns found in the lexicon. This indicates that the difference in voicing and the potential creation of an affricate or a geminate block syncope. This also suggests that the presence of a liquid before or after the potentially alternating vowel furthers syncope. Such a result would support the observation made by Yun, 2016 that the presence or absence of a vowel before or after a liquid is perceptually less different than the presence or absence of a vowel before or after a non-liquid.

6.2.2 Participants

The questionnaire was filled out by 32 Hungarian native speakers. They did not receive any compensation for their participation in the experiment. The data of 4 participants were excluded. One of these participants was under 18 which the experiment protocol did not allow for. The three other participants did not pay enough attention to the filler items: they responded to less than 5 out of the 6 filler items correctly. Thus, the data from 28 participants were used in total. The 28 participants were between 18 and 74 years of age with a mean age of 41. All the participants grew up in Hungary.

6.2.3 Materials

During the experiment participants were presented with 46 items. In the case of each item a sentence of the form given in (2) where a nonce word appeared in the place of '... ' was presented along with a picture depicting an unknown object. To proceed to the next screen participants were asked to press the 'space' bar – this instruction appeared below the picture in each item, cf. figure 1.

(2) Ez egy ....
This a ....
'This is a ....'

Figure 1: Introduction of a nonce word

On the following screen an unfinished sentence appeared accompanied by a picture depicting multiples of the same unknown object presented on the previous screen. The unfinished sentence was of the form in (3). The plural demonstrative pronoun at the beginning of this unfinished sentence and the presence of multiples of the same object expressed the requirement for a plural form to complete the sentence. Note that the plural demonstrative pronoun was chosen instead of a numeral since numerals are followed by the singular form of nouns in Hungarian.

(3) Ezek ...
These ...
'These are ...'

Contrary to the first screen, below the picture on the second screen two buttons appeared instead of an instruction. In each button a possible plural form of the nonce word from the previous screen was presented, cf. figure 2. One of the plural forms involved syncope, while the other one did not. Which potential plural form appeared on which button was fully randomized. Participants could proceed to the next item by clicking on one of the two buttons.

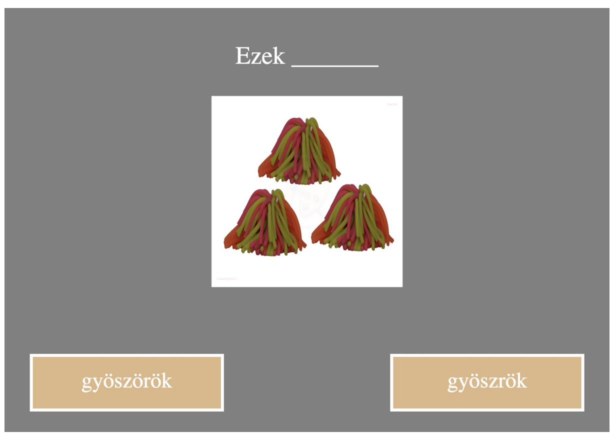

Figure 2: Forced choice between two potential plural forms

Among the 46 experimental items there were 4 introductory items that always appeared fully randomized among themselves at the beginning of the experiment. Two of the introductory items included existing syncopating nouns, while two included nonce words in which the potential consonant cluster created by syncope appears in other existing syncopating nouns.

Beyond the introductory items the experiment included 36 target items and 6 filler items. Both the target items and the filler items were fully randomized among themselves. During the experiment a filler item appeared after every 6 target items. From the 36 target items in 6 items the consonants surrounding the potentially syncopating vowel were identical – I refer to these items as the geminate group –, in 6 these two consonants were both obstruents that differed in voicing – I refer to these items as the voicing difference group –, in 6 of them one of the two consonants was a labial fricative – dubbed the labial fricative group–, in 6 the two consonants formed an affricate if syncope occurred – dubbed the affricate group while in 12 of them one of the consonants was a liquid – the liquid group. In general, target items were designed so that there is no overlap between the different groups, f.e. in the liquid group it is either the consonant preceding the potentially alternating vowel or the one following it is a liquid, but not both to avoid an overlap with the geminate group. In the end, one item in the liquid group was removed from the analysis of the data since it contains a labial fricative as the consonant preceding the potentially alternating vowel and a liquid following it and thus, this item belongs to both the labial fricative and the liquid groups.

In the labial fricative group in half of the items the first consonant was a labial fricative, while in the other half it was the second consonant. Similarly, in the liquid group in half of the items the first consonant was the liquid, while in the other half it was the second consonant. In the voicing difference group in half of the items the first consonant was voiced and the second voiceless, while in the other half it was the other way around.

In all target items the two vowels in the stem were identical and they were always mid vowels [ɛ, o, ø]. All introductory and target items were disyllabic since most vowel-zero alternating nouns are disyllabic. The experiment only included vowel-zero alternating nouns and no noun-zero alternating verbs since verbs cannot be added to present day Hungarian without a verbal suffix which introduces a final stable stem-internal vowel.

The filler items were all monosyllabic to serve as a distraction. For the same purpose they all included either a high vowel or a low back vowel [i, y, ɒ]. All vowels throughout the experiment were short. The plural forms of the filler items the participants needed to choose between were created either by using a harmonizing linking vowel or a disharmonizing one. The participants needed to chose the correct harmonic plural form to test whether they pay attention.

6.3 Results

As expected the experiment yielded a high proportion of vowel retention across all categories. Figure 3 shows the mean of each group of potential consonant clusters. The figure reveals that items in the voicing difference and the affricate groups retained the potentially alternating vowel on average more often than the items in the geminate, labial fricative and liquid groups.

A mixed effect logistic regression model with vowel retention as the dependent variable, consonant cluster type as independent variable and all of the consonant cluster types as random slopes and random intercepts by participant fails to converge. The convergence issue persists no matter how the contrasts are encoded and whether covariance between

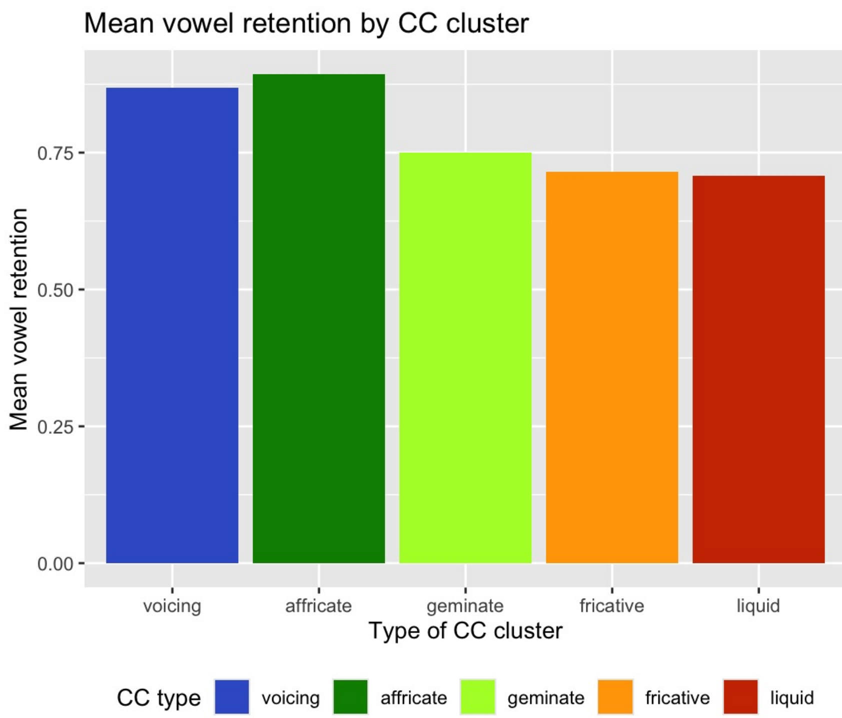

Figure 3: Grand mean of vowel retention by CC cluster

random intercept and random slopes is included or not.

Moreover, the convergence issue does not even fully go away when the different consonant cluster types are included one by one as random slopes. There are multiple potential reasons for this convergence issue: (i) there are 2 speakers who always retain the vowel, (ii) there are speakers who never delete a vowel in one or more consonant cluster type. The overall high rate of vowel retention is due to the fact that the set of vowel-zero alternating stems is a closed group and thus, it cannot be added to and to the choice of target items which are more likely to retain their final vowel than to delete it – except for the items in the liquid group. The two speakers who always retain the potentially alternating vowel can be excluded from the analysis since their results do not tell us anything about the differences between the various potential consonant clusters. Unfortunately, the exclusion of these two speakers does not resolve the convergence issues. The speakers who did not delete the vowel in any of the items in one or more consonant cluster groups cannot be excluded since their results are still informative in that they opted for vowel deletion at least in some cases.

The logistic regression model with vowel retention as the dependent variable and consonant cluster type as independent variable where the contrasts are treatment coded and liquid is taken as a base yields the following results:

```
Fixed effects:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    0.89536    0.20853   4.294 1.76e-05 ***
typeaffricate  1.36646    0.28938   4.722 2.34e-06 ***
typefricative  0.03653    0.22635   0.161    0.872
typegeminate   0.24538    0.23163   1.059    0.289
typevoicing    1.12283    0.27187   4.130 3.63e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Note that using an allFit optimizer comparison reveals that as far as the different models – with some or all random slopes and different contrasts – converge they yield very similar results. These results suggest that the proportion of vowel retention in the items in the liquid group is different from chance, while the proportion of vowel retention in the items in the voicing difference and the affricate groups are different from that in the items in the liquid group. Since the random effects have not been included in this model it is not sure whether what looks significant is truly significant for the population or only for certain participants. However, even if it is unsure whether the results hold for the whole population the model outputs indicate that at least for some of the participants these effects hold. This means that some participants find that voicing differences and the potential creation of affricates after syncope do in fact block syncope. At least some participants find that syncope is more likely if one of the two consonants preceding and following the potentially alternating vowel is a liquid than when the two consonants would undergo voicing assimilation or affrication after syncope. It is much harder to tell what influence if any potential geminates and labial fricatives have on stem internal vowel-zero alternations. There are at least two possible explanations for the behavior of potential geminates and labial fricatives: (i) they do impact vowel-zero alternations but their effect is masked by a general more important requirement against vowel deletion or (ii) potential geminates and labial fricatives do not influence vowel-zero alternations one way or another.

If we take a closer look at the results by participant, we find that there is quite a bit of variation in general and with respect to the geminate and labial fricative groups in particular, cf. figure 4. When looking at the responses to the different groups of potential consonant clusters by participant we find that there are at least 7 different groups of participants: (i) participants with an overall high proportion of vowel retention with marginal or no differences between the different potential consonant cluster types, (ii) participants who kept the potentially alternating vowel more often in every group other than in the liquid group, (iii) participants who kept the potentially alternating vowel more often in the voicing difference, affricate and geminate groups than in the labial fricative and liquid groups, (iv) participants who kept the potentially alternating vowel more often in the voicing difference and affricate groups than in the geminate, labial fricative and liquid groups, (v) participants who have kept the potentially alternating vowel in every group more often than in the geminate group, (vi) participants who particularly dislike potential affricates and (vii) participants with unique behaviors.

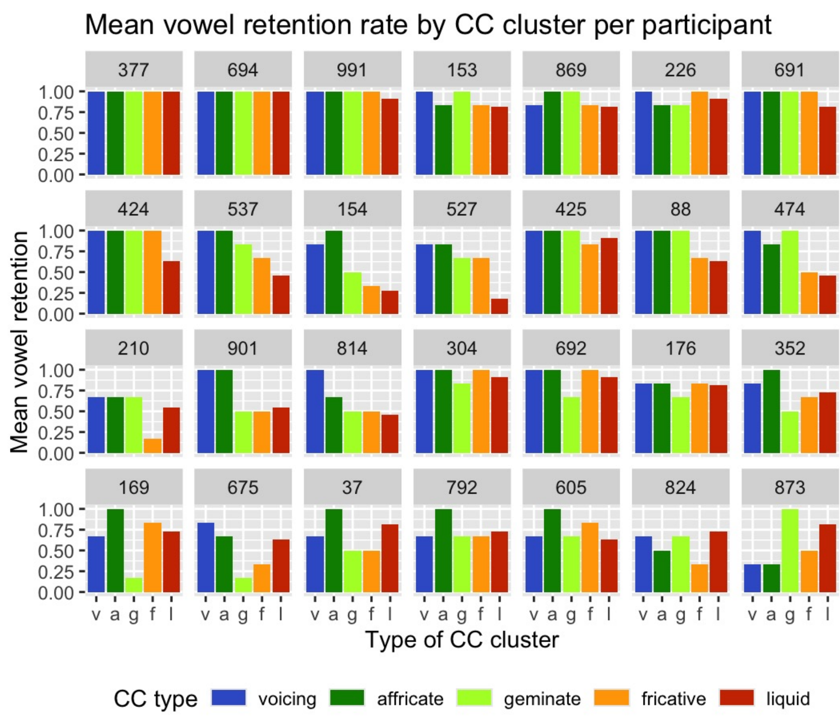

Figure 4: Mean vowel retention by participant

As noted above there are two participants – participants 377 and 694 – who did not choose the plural form without the potentially alternating vowel in any case. Furthermore, there are 3 other participants – participants 153, 869 and 226 – with overall high proportion of vowel retention with relatively small differences among the items in the different consonant cluster groups, cf. figure 5.

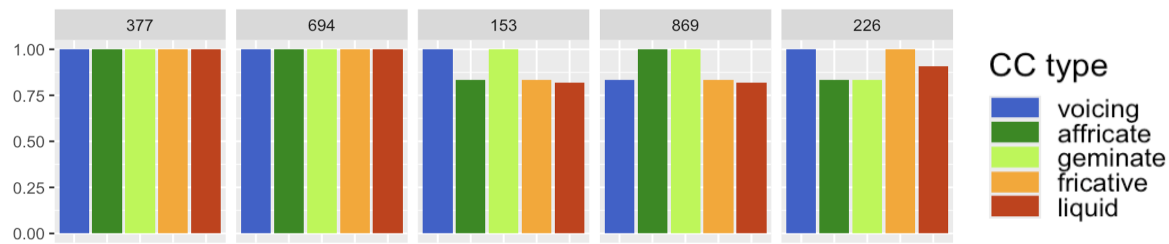

Figure 5: All consonant cluster groups are (almost) the same

There are six participants who behaved more or less as expected in that they all chose the plural form without the potentially alternating vowel more frequently for the items in the liquid group than in the case of any other items, cf. figure 6. This corresponds to our expectations since the consonantal processes voicing assimilation, affrication and gemination are expected to equally block syncope and since there are no examples for vowel-zero alternating stems with a labial fricative in them in the lexicon, cf. section 4. Note that there are some differences among the participants in this group in that some found the other four sets of items – voicing difference, affricate, geminate and labial fricative groups – equally bad like participants 991, 691 and 424, while other differentiated among these four sets of items to various degrees – cf. participants 537, 154 and 527 in figure 6.

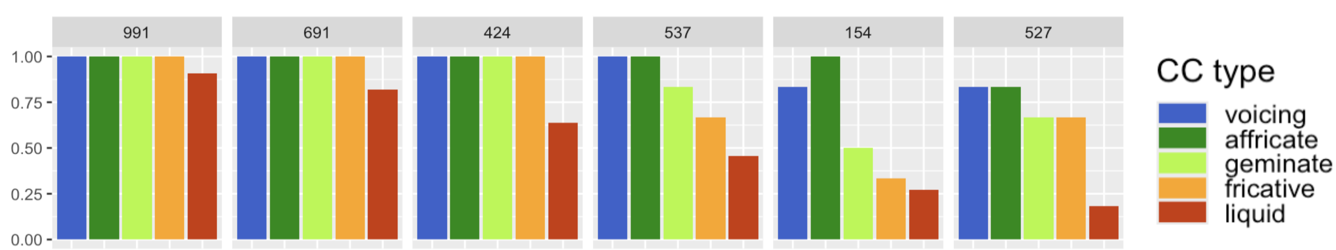

Figure 6: Items in the liquid group lose their alternating vowel more frequently

Some of the participants – in particular participants 425, 88, 474 and 210 – kept the potentially alternating vowel more often in the voicing difference, affricate and geminate groups than in the fricative and liquid groups, cf. figure 7. These 4 participants mostly agree with the participants who retained the vowels in the liquid groups the least frequently except for the items in the labial fricative group. The four participants below judged the items in the labial fricative group to retain their potentially alternating vowel either as frequently as the items in the liquid group or less frequently than them, while the previous group of participants kept the potentially alternating vowel in the items in the labial fricative groups more frequently than in the items in the liquid group.

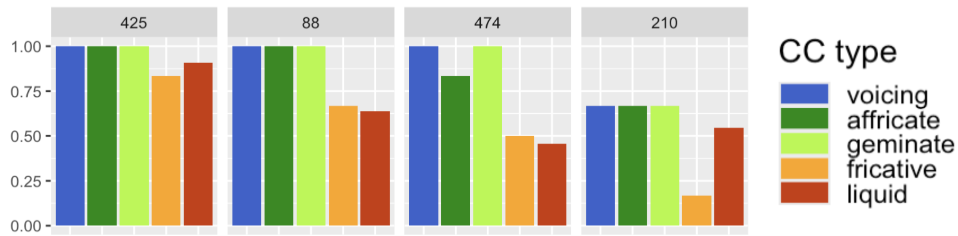

Figure 7: Items in the voicing difference, affricate and geminate groups are more likely to keep their potentially alternating vowel

There are two participants who chose the plural form with the potentially alternating vowel more frequently in the items in the voicing difference and in the affricate groups than in the items in the geminate, labial fricative and liquid groups, cf. figure 8. These two participants belong to the group of participants for whom gemination does not block syncope while voicing assimilation and affrication do.

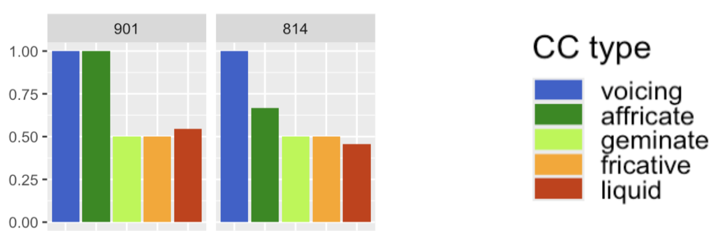

Figure 8: Items in the voicing difference and affricate groups are more likely to retain their potentially alternating vowel

Probably the most surprising results came from participants 304, 692, 176, 352, 169, 675 who have chosen the plural form without the potentially alternating vowel the most frequently in the geminate group, cf. figure 9. Participants in this group not only think that voicing assimilation and affrication block syncope, but also that the presence of a labial fricative or a liquid is more likely to block syncope than gemination.

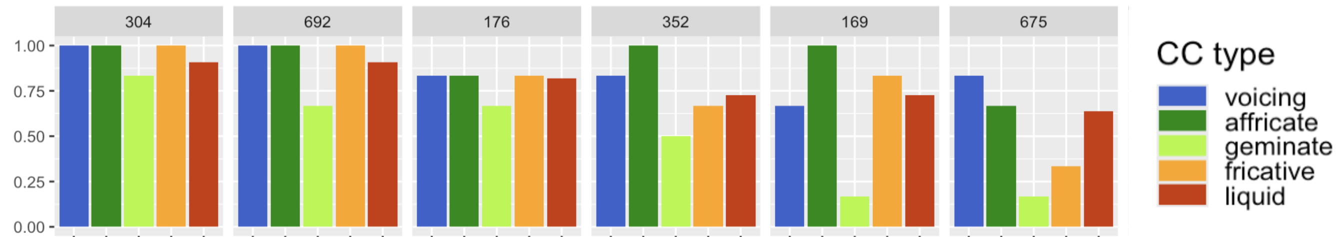

Figure 9: Items in the geminate group are the most likely to lose their potentially alternating vowel

Last, but not least, there are three participants who found that affrication has the strongest blocking effect on syncope. Participants 605, 792 and 37 chose the plural form with the potentially alternating vowel most frequently in the case of the items in the affricate group, cf. figure 10. Results from this group of participants similarly to that of the previous two groups raises the question whether there is a difference in the blocking effect of various consonantal process like voicing assimilation, affrication and gemination.

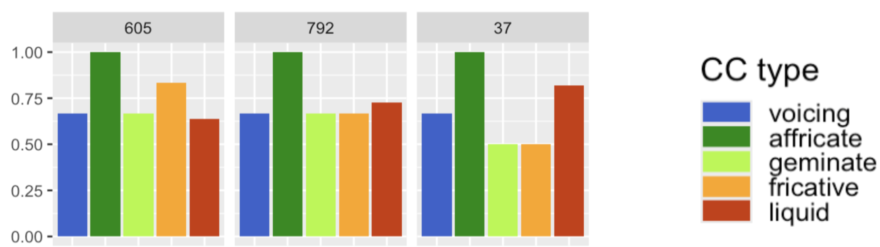

Figure 10: Items in the affricate group are the most likely to retain their potentially alternating vowel

The results from the two remaining participants are quite unique and dissimilar to the results of all the other participants, cf. figure 11. Participant 824 chose the plural form without the potentially alternating vowel more frequently in the affricate and labial fricative groups than in any other groups. The results of participant 873 are truly baffling in that they chose to retain the potentially alternating vowel in all items in the geminate group, while they chose to delete the same vowel in roughly 75% of items in the voicing difference and affricate groups. They have also retained the potentially alternating vowel at a relatively high rate in the items in the liquid group contrary to most other participants.

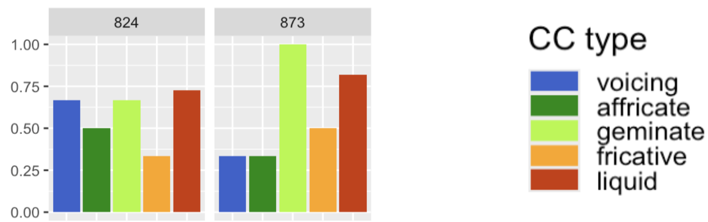

Figure 11: Outlier participants

After taking a closer look at the variation in the responses of individual participants it is perhaps less surprising that the model with all consonant cluster types as random slopes did not converge. The detailed investigation of the individual results has also shown that a lot of participants in fact chose to retain the potentially alternating vowel in all items in one or more consonant cluster groups, which has also contributed to the convergence issue.

One of the most surprising results of the experiment is the difference in judgments of the various consonant cluster groups involving consonantal processes. In particular the overall difference between voicing assimilation and affrication versus gemination draws more attention to the results in the items in the geminate group at large. Among the items in the geminate groups each item has a unique potential geminate. During item construction consonants with different features have been chosen to see whether the features of potential geminates have an impact on stem-internal vowel-zero alternations. In particular there are two items that would yield a sonorant geminate after syncope – ferer and sonon – and four items which would yield an obstruent geminate after syncope – göszösz, möböb, dotyoty, vekek. When looking at the responses to the various items in the geminate group we in fact find that potential sonorant geminates are much more likely to retain the potentially alternating vowel than potential obstruent geminates are, cf. figure 12.

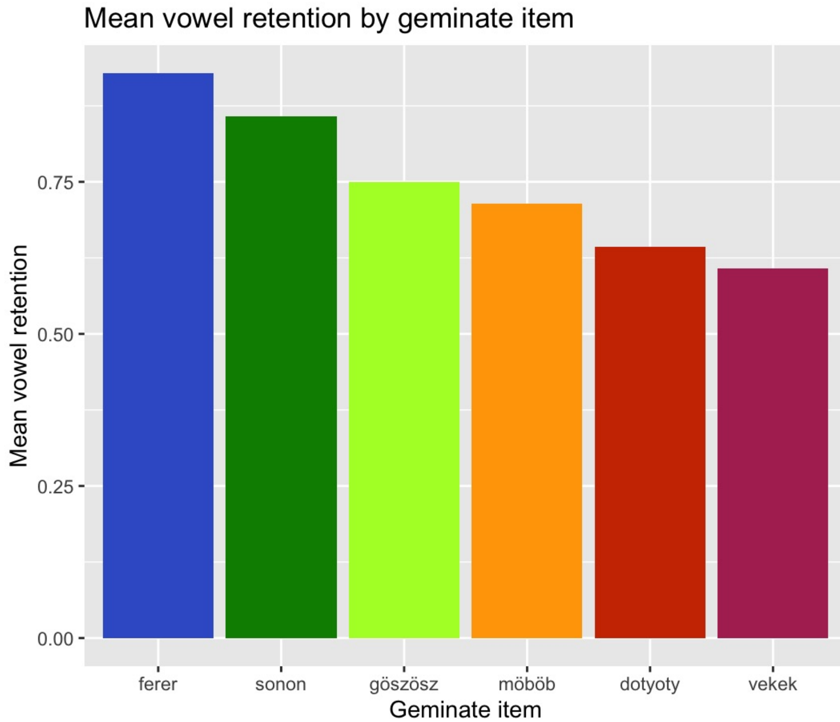

Figure 12: Mean rating of geminates

Finally it is worth noting here that no ordering effects were found in any of the consonant cluster groups. That is to say that no statistically significant difference was found whether the consonant preceding or the one following the potentially alternating vowel was voiced and the other voiceless or vice verse. Similarly, it does not make a difference whether the consonant preceding or the one following the potentially alternating vowel is a labial fricative and neither does it matter which one them is a liquid.

Chapter 7

Open questions and conclusions

This thesis has provided a detailed review of all the restrictions on the form of vowel-zero alternating stems. Based on a database containing 489 vowel-zero alternating stems previously suggested restrictions (cf. Siptár & Törkenczy (2000), Kiefer (2018))on the final two vowels of vowel-zero alternating stems have been confirmed (cf. chapter 4). Similarly, a list of restrictions on the consonants in vowel-zero alternating stems has been reviewed. Moreover, the list of vowel-zero alternating stems has been compared with a list of 981 stems with the same restrictions which do not undergo vowel-zero alternations. The statistical analysis of these two lists confirmed that there is an interaction between certain phonological process and vowel-zero alternations. In particular, it has been shown that voicing assimilation, affrication and gemination block stem-internal vowel-zero alternations. This forward looking process can easily captured on standard OT as shown in chapter 5. The forward looking nature of stem-internal vowel-zero alternations indicates that this process is not epenthesis as originally suggested by Vago (1980), but rather syncope (cf. chapter 5).

The experimental investigation presented in chapter 6 has shown that native speakers of Hungarian have strong intuitions about what nonce words can be subject to vowel-zero alternations. Although, stem-internal vowel-zero alternation is not a productive process in the language anymore, the set of such stems is not fully closed in the people do accept nonce words of this kind to varying degrees. The experiment has also reveled that Hungarian native speakers have intuitions about the interaction between voicing assimilation and affrication on the one hand and syncope on the other.

A lot of questions regarding vowel-zero alternations have been left for future research. Vowel-zero alternating stems are not the only alternating stems in Hungarian (cf. Siptár & Törkenczy (2000), Kiefer (2018)). Interestingly, there is a large overlap in the suffixes that do and do not trigger the different kind of stem alternations. It has been suggested in chapter 3 that these suffixes could be ordered on a scale based on how reliably they trigger vowel-zero alternations. It would be interesting to see if such a scale can be established for suffixes triggering vowel-zero alternations, to what extent can it be extended to triggering other stem alternation. There have been attempts in the literature (Abrusán (2005), Stiebels & Wunderlich (1990)) to present a unified analysis for some or all of these stem alternations. However, these approaches largely relied on lexical indexation and did not take variation in the trigger effects of the various suffixes into account.

Vowel-zero alternating stems come with an extensive variation both in their form and when they are triggered which has been reviewed in chapters 3 and 4. Most vowel-zero alternating vowels are mid with a few exceptions of low and high alternating vowels. The penultimate vowel in vowel-zero alternating stems is generally short or [eː] or [aː] with a few exception of ones with other long vowels. What consonants can stand before and after alternating vowels in vowel-zero alternating stems is also restricted: these two consonants cannot be both obstruents and disagree in voicing, they cannot be identical and they cannot form an affricate if they were consecutive. Furthermore, not all suffixes that trigger vowel-zero alternations reliably trigger it with all stems and certain stems oscillate between a stable and an alternating form. Additionally, strictly vowel-initial suffixes do trigger stem-internal vowel-zero alternations in the verbal domain but not in the nominal domain. The analysis in chapter 5 has focused on the majority of nominal vowel-zero alternating stems disregarding the variation in the height of the alternating vowel, the fact that not all long vowels can be penultimate vowels in vowel-zero alternating stems, the variation the verbal stems introduce and the variation oscillating stems bring with them (cf. chapter 3). To capture the extensive variation in vowel-zero alternating stems future research is necessary. Rebrus, Szigetvári & Törkenczy (2023b) presents a proposal for what governs the variation in oscillating verbal vowel-zero alternating stems.

There are some questions indirectly raised by the analysis in chapter 5. In order to capture differences between words in how the grammar applies (i.e., delete a vowel or not), there's always a question of whether to make grammar apply differently because they have different underlying representations, or make grammar apply differently by making it sensitive to which morpheme it's applying to (lexical indexation, exceptions, etc.) Here the grammar applies differently to vowel-zero alternating stems than to non-alternating stems because the final vowel of the former group of stems is always underlyingly underspecified, while lexical indexation is used to distinguish strictly vowel-initial suffixes that do not trigger vowel-zero alternations from potentially vowel-initial suffixes, which do. It is for future research to decide whether it is possible to rely on only one of these two mechanisms. The other potential issue raised by the analysis presented here is the question of how vowel-harmony is best represented formally. The current analysis relies on underspecification as the mechanism behind syncope. A direct consequence of this is that vowel harmony is represented as insertion of features and not as spreading of features. Which of these two options is preferable from the point of view of the predictions each make about vowel harmony might make underspecification less desirable to rely on to account for stem-internal vowel-zero alternations.

Another question implicitly raised by the analysis presented here – in particular by the part of the analysis focusing on the restrictions on the vowel in vowel-zero alternating stems –, is what supports the hierarchy of Max-F constraints presented in section 5.3. Generally, mid vowels are taken to be the default epenthetic vowel in Hungarian (cf. Siptár & Törkenczy (2000), Törkenczy (2024)), which might provide a basis for the ranking of Max-F constraints that penalize the deletion of certain height features. Additionally, a conflict between the ranking of Max-F constraints in the analysis presented here and those in Casali (1996) awaits future research to be resolved.

Beyond the questions raised by the analysis in chapter 5, there are some interesting questions arising from the experiment presented in chapter 6. The overall high rate of vowel retention in the experiment in chapter 6 significantly complicated the statistical analysis of the results. It would be interesting to see whether the rate of vowel deletion would increase with a more balanced set of items. That is, if most of the items would make deletion more likely than retention would that then help with the overall deletion rate and by that also the statistical analysis of the data. Two possibilities come to mind here: (i) testing items with a liquid in them against other clusters attested in vowel-zero alternating stems and/or (ii) testing a wider range of items with identical consonants to see whether there is truly a difference in the interaction of obstruent and sonorant geminates and stem-internal vowel-zero alternations.

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