The Czech mobile 'e':
an optimality theoretic approach

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To my Parents

0 Introduction

In this thesis, I identify a little discussed phonological situation, dubbed 'Homogeneity of Process, Heterogeneity of Target' (HomP-HetT) here. In HomPHetT, a single process is used to repair many different problems. This contrasts with the well-known process of 'Homogeneity of Target, Heterogeneity of Process' (HoT-HoP) (McCarthy 2002:93-4 and references cited therein).

Both models are caused by the interaction of markedness and faithfulness constraints. However, while the better known HoT-HoP is based on various faithfulness constraints working towards a single markedness goal, I show that the roles are reversed in HomP-HetT: here, multiple markedness constraints gang up in violation of a single faithfulness constraint. HomP-HetT is illustrated by Czech [ɛ] epenthesis, which is used to respond to a variety of restrictions on sonority, syllable structure and consonant cluster formation.

(1) Czech epenthetic [ɛ] in brief

(a) to provide a sufficiently sonorous syllable nucleus – **§2**

/dn/ → [dɛn] 'day' (NOM SING) cf. [dn-ɛ] (GEN SING)

/st/ → [sɛt] 'hundred' (GEN PL) cf. [st-o] (NOM SING)

/hr/ → [hɛr] 'game' (GEN PL) cf. [hr-a] (NOM SING)

(b) to provide a consonantal ending for a root – **§3**

/kl/ → [kɛl], *[kl̩] 'tusk' (NOM SING)

li/br-∅/ → li[bɛr], *li[br̩] 'pound' (GEN PL)

hu/db/ník → hu[dɛb]ník, *hu[dbɛ]ník 'musician' (NOM SING)

(c) to prevent geminate consonants in bimorphemic clusters – **§4**

/s-s/kočit → [sɛs]kočit 'to jump off'

/v-v/nitř → [vɛv]nitř 'inside'

/z z/emě → [zɛ z]emě 'from (the) land'

(d) to provide an onset ([r, l] are valid syllable nuclei) – **§5.3**

/lv/ → [lɛv]	‘lion’ (NOM SING)	cf. [lv-iː] (ADJ)
/lʒ/ → [lɛʒ]	‘lie’ (NOM SING)	cf. [lʒ-ɛ] (GEN SING)
/rt/ → [rɛt]	‘lip’ (NOM SING)	cf. [rt-uː] (GEN PL)

(e) to avoid a bad consonant cluster – **§6**

le/bk-∅/ → le[bɛk]	‘skull’ (GEN PL)	cf. le[p.k-a] (NOM SING)
hu/db-ɲ/ík → hu[dɛbɲ]ík	‘musician’	cf. hu[d.b-a] ‘music’
/t͡ʃk/at → [t͡ʃɛk]at	‘to wait’	cf. po[t͡ʃ.k]at ‘to wait for’

(f) emergence of underlying /ɛ/ – **§5.2.2**

[s-ɛhr]át	‘to play (with)’	cf. [s-hr]ábnout
o[d-ɛt͡ʃ]ist	‘to subtract’	cf. o[d-t͡ʃ]erpat
ro[z-ɛj]ít	‘to separate’	cf. ro[z-j]et

The phenomenon is known as the *pohybné* or mobile ‘e’. The first five situations show cases of epenthetic [ɛ], which are distinct from the underlying /ɛ/ which only emerges post-prefixally as in (1f). More complete data sets are provided in the sections addressing each of these particular scenarios.

The HomP-HetT approach is set within the framework of Optimality Theory (OT) and attributes these different epenthetic situations (1a-e) to epiphenomena of a larger scheme. The unitary perspective of HomP-HetT recognizes that [ɛ] epenthesis is a single process, albeit triggered by several different motives. This not only provides a clearer picture of the factors driving the phonology of Czech, but it also allows for a unified analysis. A rule-based approach can account for some of the data, but other aspects of epenthesis are beyond the empirical scope of a rule-based theory. Furthermore, such a theory lacks the ability to draw connections between these different processes, while OT naturally relates them.

The traditional analysis of this process is based on the historical development of Czech. Proto-Slavonic and its descendents (including old Czech) contained a set of vowels known as 'yers' (represented by the Cyrillic characters ъ and ь), which have a very different manifestation in modern Czech. Although the process of yer deletion represents a past change in the phonology of Czech speakers, it has no relevance to the phonology a modern Czech speaker would construct to account for the process of the mobile 'e' in its current incarnation. This statement is not only rooted in the Saussurean idea of synchronic linguistics, but evidence is found within the Czech language itself: Gregor says that some cases of mobile 'e' do not have historical grounds, but are instead based on analogy with the yer system. This implies that in the absence of direct evidence of the former yer system, new speakers created a phonology to account for the evidence they did have. This resulted in a system broader than that confined to yers alone, today known as mobile 'e'.

This paper will counter the idea that this process is solely historically based by providing a viable phonology to account for the modern manifestations of yers, including 'exceptional' cases which are not in fact historically sound. It will also show that a serialist rule-based theory does not provide an adequate representation of the process of epenthetic [ɛ].

Not only is an analysis of the process of mobile 'e' in Czech presented here, but I shows that the epenthesis of [ɛ] is a case which incorporates HoT-HoP into a larger process of HomP-HetT. In chapter 1 I will present the theory of HomP-HetT, including an introduction to the theory and formal representation of OT. The next five chapters will provide information about mobile 'e' and the different targets met by [ɛ] epenthesis: Chapter 2 addresses appropriate sonority nuclei and their relation to the sonority scale, including the response to cases without a suitable syllable nucleus. Chapter 3 deals with repair methods for onsetless syllables. Chapter 4 discusses cases where the root is compelled to have a consonant ending. Chapter 5 addresses instances in which morpheme realization comes into play. Chapter 6 introduces factors attributing to the classification of 'bad' consonant clusters, as well as their methods of repair. Chapter 7 presents alternative analyses, namely serialist and diachronic approaches, while Chapter 8 provides conclusions and a synopsis of the integration of HoT-HoP and HomP-HetT in Czech.

1 Theory

1.1 Introduction

This section presents the concept of 'Homogeneity of Process, Heterogeneity of Target' (HomP-HetT). As the expression of HomP-HetT is couched in Optimality Theory, the first section will provide an introduction to the theory and formal representation of OT. Section 1.3 will then move on to present the abstract characterization of HomP-HetT in comparison with HoT-HoP. Section 1.4 summarizes the nature of HomP-HetT and outlines the rest of this thesis.

1.2 Optimality Theory

Optimality Theory predicts that situations of HomP-HetT exist. In fact, OT's basic mechanisms make it impossible to exclude HomP-HetT.

OT is a theoretical framework which employs ranked and violable constraints computed in parallel to constrain grammatical processes. It contrasts with serialist, rule-based theories like SPE's, which employ a series of ordered rules. Accordingly, the aim of an OT analysis of any phenomenon is to determine the constraint-ranking which generates the attested outputs.

This thesis adopts the Correspondence theory of faithfulness as proposed by McCarthy & Prince (1995a). This theory posits a correspondence relationship between each member of the input and each member of the output. These outputs are constrained by faithfulness and markedness constraints. Faithfulness constraints (FAITH) urge the output to be identical to the input. Examples of faithfulness constraints are listed below:

(2) Basic faithfulness constraints (McCarthy & Prince 1995a)

MAX: Every segment in S_1 has a correspondent in S_2. ('Don't delete')

DEP: Every segment in S_2 has a correspondent in S_1. ('Don't epenthesize')

IDENT(F): Correspondent segments in S_1 and S_2 have identical values for some feature F. ('Don't change features')

While faithfulness constraints encourage the output to remain true to the input, markedness constraints evaluate the well-formedness of outputs. Some common markedness constraints are given below:

(3) Basic markedness constraints

ONSET: $*_{\sigma}[V$ ('Every syllable has an onset') (Prince & Smolensky 1993)

MORPHREAL: Every morpheme in S_1 has some correspondent in S_2 ('Every morpheme is realized overtly') (Samek-Lodovici 1993)

AGREE(F): Adjacent segments S_1S_2 must agree on some feature F. (Lombardi 1995)

Given an input, output candidates are then assessed based on how well they satisfy the constraints of a given language. The final output is the candidate which incurs minimal violation, determined by the ranking of faithfulness and markedness constraints.

The process of determining the optimal candidate is formally depicted by tableaux comparing possible outputs against a constraint ranking. The input, or underlying form, is in the upper left-hand box, while the outputs being compared are listed in the column below. The column headings reflect the constraints on the outputs, with the left-most constraint being the highest ranked. A solid line between two constraints represents a fixed ranking, while a dotted line indicates that the ranking is unknown or irrelevant. Constraint violations are marked with a '*', and fatal constraint rankings – the terminal violation preventing a form from surfacing – are marked with '*!'. Perhaps the clearest example is when two constraints are in conflict, and the optimal form, designated with '☞', is the candidate which violates the lower-ranked constraint.

(4) Constraint conflict

/input/	A	B
(a) Cand 1	*!	
☞ (b) Cand 2		*

There are also cases where one of the constraints may prove indecisive in the ranking; that is, a constraint may be violated by neither candidate or by both.

(5) *A* does not distinguish between candidates – both obey it

/input/	A	B
(a) Cand 1		*!
☞ (b) Cand 2		

(6) *A* does not distinguish between candidates – both violate it

/input/	A	B
(a) Cand 1	*	*!
☞ (b) Cand 2	*	

Finally, a ranking central to this analysis is where one constraint serves to block the effects of a lower-ranked constraint.

(7) Constraint blocking

/input/	A	B	C
(a) Cand 1	*!		*
☞ (b) Cand 2		*	

The fundamental components of OT and their formal representation have now been described. However, before moving on to the implications of HomP-HetT itself, there is another issue which should be addressed here: Richness of the Base (RoB) (Prince & Smolensky 1993). Richness of the Base is the idea that there are no constraints on inputs. Consequently, each language has mechanisms such that every possible input must map to a possible output. A practical consequence is that the absence of a feature, segment or structure in a language must follow from the constraint ranking – it is not enough to assume that the feature/segment/structure simply does not exist or can never be an input (cf. SPE). For example, the fact that [q] does not appear in British English means that an OT analysis of English must be able to transform the input /q/ into an acceptable English sound (e.g. [k], or even ∅); it is not adequate to assume that /q/ simply never appears in the input.

1.3 HomP-HetT

The concept of HomP-HetT proposed here complements the nature of Homogeneity of Target-Heterogeneity of Process: HoT-HoP predicts that several methods can be employed to achieve a single goal (McCarthy 2002:93), while HomP-HetT describes how different goals can all be reached by means of a single process. Rule-based depictions of HoT-HoP and HomP-HetT are given below in order to illustrate the two models:

(8) (a) Rule-based representation of HoT-HoP

$\alpha \rightarrow \beta$ / __ϕ

$\alpha \rightarrow \gamma$ / __χ

$\alpha \rightarrow \delta$ / __ψ

$\alpha \rightarrow \varepsilon$ / __ω

(b) Rule-based representation of HomP-HetT

$\beta \rightarrow \alpha$ / __ϕ

$\gamma \rightarrow \alpha$ / __χ

$\delta \rightarrow \alpha$ / __ψ

$\varepsilon \rightarrow \alpha$ / __ω

The theoretical characterization of HomP-HetT will be based on that of HoT-HoP in order to draw parallels and highlight contrasts between the two phenomena. The remainder of this chapter will describe both of these phenomena and the effects of their integration within the framework of OT. The advantages of OT over a serialist or diachronic model will be addressed in greater length in §7.

1.3.1 Theoretical characterization of HoT-HoP

HoT-HoP is a typological prediction unique to OT and as such has been much discussed in the literature. As in any OT process, change is triggered when a markedness constraint M_1 is higher ranked than a faithfulness constraint F_1. When faithfulness outranks markedness, then no change is effected and the input surfaces faithfully.

The exact nature of HoT-HoP is based on the interaction of a markedness constraint and two or more faithfulness constraints with a blocking constraint B_1. The blocking constraint precludes a violation of the lower-ranked faithfulness constraint F_1, allowing the higher ranked constraint F_2 to emerge.

(9) B_1, M_1 » F_2 » F_1

Thus in a generic case a violation of F_1 is optimal; it is only through the intervention of B_1 that F_2 becomes optimal. A test case serves to illustrate the interaction of constraints.

(10) MORPHREAL, ONSET » DEP » MAX

This ranking predicts that a simple violation of ONSET will result in deletion, as it is the lower-ranked faithfulness constraint: /ata/ → [ta]. However, if the input is bimorphemic then MORPHREAL can intervene to prevent deletion and epenthesis is carried out instead: /a-ta/ → [jata], *[ta].

Therefore, the key to producing a system of HoT-HoP is a highly-ranked blocking constraint which prevents violation of the lowest-ranked faithfulness constraint in a given environment. In this manner, two or more methods of repair can arise in response to the same markedness trigger.

1.3.2 Theoretical characterization of HomP-HetT

HomP-HetT is also derived from the interaction of faithfulness and markedness constraints, but in this system blocking constraints are low-ranked, preventing the emergent effects seen in HoT-HoP. Without the discrimination provided by blocking constraints, the same repair method is consistently used in multiple environments.

(11) M_1
M_2… , F_2 » F_1 » B_1 … B_n
M_n

This model predicts that the pressures of all markedness constraints will be met with a single response, a violation of F_1. This can be seen with the following example.

(12)
ONSET
*CC , DEP » MAX » MORPHREAL, MAX(root)…
NO CODA

Given this ranking, an input such as /a-s-tat/ would be completely stripped down by deletion. *[astat] because it violates ONSET, *[stat] because it violates *CC, *[tat] because it violates NO CODA: the optimal output is [ta]. Deletion can alter the input so greatly because the blocking constraints are low-ranked. In HoT-HoP, blockers allow other repair methods such as epenthesis to emerge, but in HomP-HetT they are simply out of play and one process is employed as a method of repair for multiple triggers.

1.3.3 Integration of HoT-HoP and HomP-HetT

The systems of HoT-HoP and HomP-HetT are by no means mutually exclusive; in fact, they can be combined into a single system. This is done by merging the two schemata seen above into one, with the blocking constraints forming the locus.

(13)
HomP-HetT

M_1
$M_2\ldots$, F_3 » F_2 » B_1 » F_1
M_n

HoT-HoP

This model predicts that a violation of the faithfulness constraint F_1 is optimal except where blocked by B_1. However, the next faithfulness constraint F_2 is not dominated by any blockers; therefore, once F_1 is knocked out, F_2 becomes the sole repair method to the demands of any markedness constraint. In the integrated model, any manifestation of HomP-HetT is necessarily also a case of HoT-HoP: F_2 would not be resorted to if F_1 were not already excluded by the blocker.

This integrated model is found in Czech, where deletion is the first recourse for repair, and when deletion is blocked the consistent result is epenthesis of [ɛ]. The exact interactions of constraints in Czech allowing for this integration of the systems of HoT-HoP and HomP-HetT will be described in the conclusions, §9.

1.4 Summary

This chapter outlined the fundamentals of OT, including constraint rankings as represented by tableaux and the concept of Richness of the Base. HomP-HetT was also depicted in abstract terms, showing that low-ranked blocking constraints allow one repair method to be used to satisfy multiple markedness constraints. This is in contrast with HoT-HoP, where a high-ranked blocking constraint allows the emergence of multiple solutions to the same markedness criterion.

The remainder of this thesis will explore a case in Czech integrating HomP-HetT and HoT-HoP, with each chapter addressing a different target. The case of HomP-HetT seen here is particularly striking because it is a case of 'default' epenthesis where the features of the epenthetic segment are not influenced by neighboring segments. That is, Czech not only employs epenthesis to meet several goals, but it also consistently epenthesizes the same vowel. The fact that these cases of epenthetic [ɛ] are indeed related is recognized by native speakers. The system of HomP-HetT described here is known by a single name: the *pohybné* or mobile 'e'.

2 **Sonority**

2.1 Introduction

The first case of epenthetic [ɛ] addressed in this thesis occurs when the input does not provide a suitable syllable nucleus. Thus, although deletion is the first option suggested by the constraint ranking, it is passed over because it cannot solve the problem. Only epenthesis of a segment of appropriate sonority can provide a syllable nucleus.

The syllable peak of a Czech word can be:

(a) a lexically long vowel;
(b) a lexically short vowel;[1]
(c) a diphthong [aj, au, ej, eu, oj, ou]; or
(d) a syllabic liquid [l, r].[2]

Stress always falls on the first syllable of the prosodic word (Dankovičová 1999). Prepositions are included for prosodic word purposes, as evidenced not only by the fact that they attract stress, but also because they can spur epenthesis, a process which only occurs prosodic word-internally. Any possible syllable peak can occur in initial (stressed) position, as seen below.

(14) Attested syllabic nuclei

bídák	[biːdaːk]	'villain'	bidlo	[bɪdlo]	'pole'
bérce	[beːrt͡se]	'shin'	bedna	[bɛdna]	'case'
bát se	[baːt sɛ]	'to fear'	baba	[baba]	'granny'
bóje	[boːjɛ]	'buoy'	bodák	[bodaːk]	'bayonet'
bůžek	[buːʒɛk]	'idol'	budka	[budka]	'box'
bajka	[bajka]	'fable'	pauza	[pauza]	'pause'
pejsek	[pejsɛk]	'doggie'	pneumatika	[pneumatika]	'tire'
bojovat	[bojovat]	'to fight'	bouda	[bouda]	'booth'
blbec	[bl̩bɛt͡s]	'idiot'	brloh	[br̩lox]	'den'

The fact that only vowels and liquids – the two most sonorous types of phonemes – can be syllabic peaks fully complies with the concept of the sonority scale. The inherently-ranked sonority scale denotes which types of segments are preferred as syllabic nuclei.

[1] See Appendix I for a vowel parallelogram.
[2] Some claim (Mazon 1931, among others) that the nasal /m/ can also be syllabic, as in the words *sedm* 'seven' and *osm* 'eight.' Gregor (1937) describes the same lexical items as being mono-syllabic. However, to my knowledge, these items are the only two of this type and modern speakers invariably pronounce them as disyllabic items with a vocalic syllable peak: [sɛ.dum] and [o.sum].

A simplified version of the sonority scale, adapted from Prince and Smolensky (1993), is as follows:

(15) *P(eak)/X constraint family
*P/Obstruent » *P/Nasal » *P/Liquid » *P/Vowel

The ranking of the constraints on sonority indicates that obstruents are cross-linguistically least-preferred as syllabic peaks, while at least some kind of vowel is universally accepted. The scale also entails the expectation that at a certain point in the hierarchy there is cutoff, whereby all items more sonorous than that point are suitable as syllabic nuclei, and all items less sonorous are deemed unsuitable. The data given here for Czech reflects such a cutoff point: vowels and liquids are allowed as syllabic nuclei, while less sonorous items are allowed only at syllable margins.

As far as sonority is concerned, all vocalic segments in Czech – tense and lax vowels, long and short vowels, diphthongs – make equally good syllable peaks.

The syllabic liquids [l, r] do not make length or tenseness distinctions. Although liquids are cross-linguistically less-preferred syllable nuclei than vowels as seen in the sonority scale in (15), distinctions between the two only rarely arise. Yet an example of such a case can be found in (54), where the chosen epenthetic segment is a vowel rather than a consonant and thus provides a vocalic rather than liquid nucleus. Other examples arise in the syllabification of words: *pár* /paːr/ 'pair' → [.paːr.], *[.paː.r̩.].

These insights into sonority also shed further light on the status of the phoneme /ř/, which is unique to Czech. This phoneme is an 'alveolar trill fricative' (Dankovičová 1999) and is both a phoneme in its own right and found in complementary distribution with the liquid /r/. However, the fact that this phoneme is not permitted as a syllabic nucleus while [r] and [l] are reveals that [ř] is less sonorous than the two 'true' Czech liquids. This may indicate that /ř/ is not a liquid at all or may simply be a less-sonorous liquid; there is no real way to rank the sonority of [ř] (*P/ř), except to say that it must be less sonorous than [r, l]. The phonology of /ř/ is not crucial to the discussion at hand, so it will not receive further consideration here.

2.2 HomP-HetT: Sonority as a trigger for [ɛ] epenthesis

A Czech word is determined to have an unsuitable syllable nucleus if there is no segment with a high enough sonority level (i.e. no vowel or liquid). In response to this situation, an [ɛ] is epenthesized to serve as the syllable peak. This section gives a constraint-based account of this process.

(16) [ɛ] epenthesized to provide an appropriate syllable nucleus

/ps/	→	[pɛs]	‘dog’ (NOM SING)	cf. [ps-uː] (GEN PL)
/hr/	→	[hɛr]	‘game’ (GEN PL)	cf. [hr-i] (NOM PL)
/dn/	→	[dɛn]	‘day’ (NOM SING)	cf. [dn-ɛ] (GEN SING)
/dn/	→	[dɛn]	‘gout’ (GEN PL)	cf. [dn-a] (NOM SING)
/dn/	→	[dɛn]	‘bottom’ (GEN PL)	cf. [dn-o] (NOM SING)

The sonority cutoff for Czech nuclei is between nasals and liquids. As syllable peaks of nasals and less sonorous sonority items never surface, there must be a repair operation preventing faithful outputs. The data reveals this to be epenthesis.

(17) Epenthesis of [ɛ] to provide a syllable peak

/dn/	*P/nasal	DEP
(a) [dn̩]	*!	
☞ (b) [dɛn]		*

Despite the fact that DEP » MAX, which will be attested to in later discussion, deletion is blocked because it does not solve the problem; deleting a segment does not provide an appropriate syllable nucleus.

(18) Deletion cannot provide a syllable nucleus

/dn/	*P/obstruent	*P/nasal	DEP	MAX
(a) [d̩]	*!			*
(b) [n̩]		*!		*
☞ (c) [dɛn]			*	

Therefore, an input without a liquid or a vowel – that is, an input without an appropriate syllable nucleus – is repaired by epenthesis of [ɛ]. Later analysis will show that syllabic liquids can only occur in closed syllables due to the pressures of ONSET (§5.3) and FINAL-C(root) (§3).

2.3 Summary

Any vowel or diphthong can form the syllable nucleus of a Czech word, as can a liquid [r, l]. When the input does not provide a suitable syllable nucleus, then epenthesis of [ɛ] occurs. Thus the constraint against having a low-sonority nucleus must be more powerful than that preventing epenthesis.

The other half of the relationship between the sonority scale and epenthesis is revealed through examination of a segment with the lowest possible sonority. When a liquid occurs as the nucleus of a closed syllable, it is not repaired.

(19) Liquids in closed syllables emerge faithfully

[vl̩k]	‘wolf’	[kr̩p]	‘hearth’
[pl̩ʒ]	‘snail’	[sr̩p]	‘sickle’
[bl̩b]	‘idiot’	[br̩k]	‘quill’

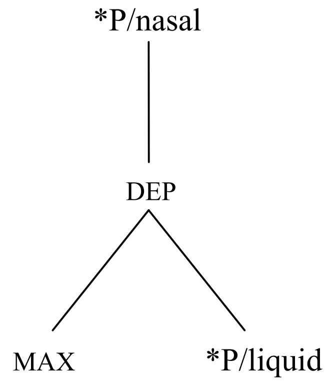
Thus, it is better for a liquid to form the nucleus than it is to epenthesize a higher sonority vowel.

(20) Liquid nuclei not repaired in closed syllables

/vlk/	DEP	*P/liquid
☞ (a) [vl̩k]		*
(b) [vlɛk]	*!	

Therefore, the observation that the Czech syllable peak sonority cutoff falls between nasals and liquids can be translated into constraints centering around DEP. The full ranking established by this section is as follows:

(21)



The next chapter will explore cases where the final segment of the input is a liquid, and therefore suitably sonorous, but [ɛ] is nonetheless epenthesized because of pressure for the root to end in a consonant.

3 FINAL-C(root)

3.1 Introduction

This chapter will look at cases where epenthesis occurs in order to provide the root with a consonantal coda. Although occurring in a closed syllable would seem to suggest a constraint such as CODA 'have a coda', this is not the case. Liquids can indeed surface faithfully in syllables without codas.

(22) Liquids in syllables without codas: word-medially

[vl̩.na]	'wool'	[pr̩.sa]	'chest'
[ml̩.ha]	'mist'	[dr̩.ʒɛt]	'to hold'
[bl̩.bɛt͡s]	'idiot'	[kr̩.tɛk]	'mole'

Equally, many surface forms emerge without codas; for example, most nominal declensional suffixes and verbal inflectional suffixes do not have codas. The following chart provides examples of words these paradigms; here, 5 items have codas while 15 surface without.

(23) Many words surface without codas

(a) Nouns – the feminine declensional paradigm

‘wool’	SING		PL	
NOM	vlna	[vl̩.n-a]	vlny	[vl̩.n-i]
GEN	vlny	[vl̩.n-i]	vln	[vl̩n.-∅]
DAT	vlně	[vl̩.ɲ-ɛ]	vlnám	[vl̩.n-aːm]
ACC	vlnu	[vl̩.n-u]	vlny	[vl̩.n-i]
VOC	vlno!	[vl̩.n-o]	vlny!	[vl̩.n-i]
LOC	vlně	[vl̩.ɲ-ɛ]	vlnách	[vl̩.n-aːx]
INSTR	vlnou	[vl̩.n-ou]	vlnami	[vl̩.n-ami]

(b) Verbs

‘to do’	SING		PL	
1	dělám	[ɟɛ.l-aːm]	děláme	[ɟɛ.l-aː.mɛ]
2	děláš	[ɟɛ.l-aːʃ]	děláte	[ɟɛ.l-aː.tɛ]
3	dělá	[ɟɛ.l-aː]	dělají	[ɟɛ.l-a.jiː]

Therefore, what emerges as the limiting factor is not the word or the syllable but the *root* that must end in a consonant. This is based on the concept of FINAL-C, after McCarthy and Prince, here tailored to be specific to roots (1993).

(24) FINAL-C(root): $*V]_{\surd}$ (‘The final segment of a root must be a (non-syllabic) consonant’)

This chapter will show the effects of FINAL-C(root) in relation to constraints on sonority and root contiguity. Section 3.2 will examine FINAL-C(root) with respect to native inputs, while §3.3 looks at a different approach for loanwords. Section 3.4 will present conclusions.

3.2 FINAL-C(root) in native words

The constraint FINAL-C(root) plays an important role in determining the output of native Czech words. This constraint can both trigger epenthesis and determine the placement of the epenthetic segment in words which undergo epenthesis on other grounds. These phenomena will be addressed in §3.2.1 and 3.2.2, respectively.

3.2.1 HomP-HetT: FINAL-C(root) as a trigger for [ɛ] epenthesis

The previous chapter showed that inputs epenthesize [ɛ] when there is not a sufficiently sonorous segment to form the syllable nucleus. However, even when there is such a segment in the input, FINAL-C(root) will still work to provide the root with a final consonant.

(25) Root-final liquids which would emerge as syllabic nuclei undergo epenthesis

/kl/ → [kɛl]	‘tusk’ (NOM SING)	cf. [kl]em (DAT SING)
li/br-∅/ → li[bɛr]	‘pound’ (GEN PL)	cf. li[br]a (NOM SING)
/hr-∅/ → [hɛr]	‘game’ (GEN PL)	cf. [hr]a (NOM SING)
/hr-n/a → [hɛrn]a	‘casino’ (NOM SING)	cf. [hr]y (NOM PL)
hu/db-∅/ → hu[dɛb]	‘music’ (GEN PL)	cf. hu[db]a (NOM SING)
hu/db-ɲ/ík → hu[dɛbɲ]ík	‘musician’ (NOM SING)	cf. hu[db]y (NOM PL)

Therefore, it is more important that the word conform to markedness conditions by ending in a consonant than it is to remain faithful to the input.

(26) Epenthesis to provide a root-final consonant

/kl/	FINAL-C(root)	DEP
(a) [kl̩]	*!	
☞ (b) [kɛl]		*

Thus, FINAL-C(root) can serve as a trigger for the epenthesis of [ɛ] when the input would otherwise emerge with a syllabic liquid in final position. This is because the pressure to end in a consonant is greater than the faithfulness constraint preventing epenthesis.

3.2.2 FINAL-C(root) as a determinant for the placement of epenthetis

The previous section showed that FINAL-C(root) can trigger epenthesis. However, this constraint also comes into play when epenthesis occurs on other grounds. In these cases, FINAL-C(root) is active in determining the placement of epenthesis. [ɛ] is inserted root-internally, despite pressure against epenthesis between segments of a root. The constraint maintaining segment continuity correspondence from the input to the output is known as CONTIG (McCarthy & Prince 1995).

(27) CONTIG: An input of adjacent segments /αβ…γ/ in S1 has a corresponding output of adjacent segments /αβ…γ/ in S2. (‘Do not separate morpheme-internal segments’)

In bimorphemic items the [ɛ] is invariably inserted between the two roots in order to maintain word contiguity.

(28) [ɛ] epenthesis respects root contiguity

[vɛ kt]erou	‘in which’	[kɛ ps]u	‘to (the) dog’
[sɛ t͡ʃ]elou	‘with (the) bee’	[vɛ tř]ídě	‘in (the) class’

CONTIG and DEP cannot be ranked with respect to one another because DEP is equally violated by both candidates.

(29) Root contiguity dictates placement of epenthetic [ɛ]

/v kt/erou	CONTIG	DEP
(a) [v kɛt]erou	*!	*
☞ (b) [vɛ kt]erou		*

This point of contiguity also gives proof that forms such as [lɛv] are indeed receiving an epenthetic [ɛ], and that not all words of the form CɛC are necessarily the same. Compare, for example, the words [lɛv] 'lion' and [lɛs] 'forest'.

In a prepositional phrase, the two behave differently:

(30) [sɛ lv-ɛm] 'with the lion' cf. [lɛv] (NOM SING)

[s lɛs-ɛm] 'with the forest' cf. [lɛs] (NOM SING)

The first example reveals that the underlying form is indeed /lv/, here preserved via CONTIG in favor of vowel epenthesis after the preposition. However, the second form has an underlying /ɛ/, and the prepositional phrase emerges completely faithfully to the input.

When epenthesis occurs in a monomorphemic word, CONTIG is undermined in order that the root may end in a consonant.

(31) Root contiguity compromised to satisfy FINAL-C

/lv/	FINAL-C(root)	CONTIG
(a) [lvɛ]	*!	
☞ (b) [lɛv]		*

Furthermore, because this version of FINAL-C is specific to the root and not to the entire word, it can also regulate prosodic word-internally: hu/db-ɲ/ík 'musician' (NOM SING) → hu[dɛbɲ]ík, *hu[dbɛɲ]ík, again violating CONTIG in favor of FINAL-C(root). The [ɛ] epenthesis here takes place on grounds of cluster well-formedness, which will be addressed in §7.

Because FINAL-C(root) is acting to create a coda in certain forms, the pressure it provides must be greater than that against having a coda.

(32) A root-final consonant can be a syllable-final consonant

/lv/	FINAL-C(root)	NO CODA
(a) [lvɛ]	*!	
☞ (b) [lɛv]		*

Therefore, there is greater pressure that the root end in a consonant than there is to maintain root contiguity or to prevent syllables from surfacing with codas [i.e. FINAL-C(root) » CONTIG, NO CODA]. However, the next section will show that root contiguity in loanwords is more important than any of these constraints.

3.3 FINAL-C(root) in loanwords

A recurring theme throughout this analysis is that Czech places high importance on input-output faithfulness in loanwords (see §5.2.7 and 6.6). This also holds true for FINAL-C(root), where this constraint is violated for the sake of loanword FAITH.

(33) Violations of FINAL-C(root) in loanwords

me[tr̩]	‘meter’	arti[kl̩]	‘article’
bun[kr̩]	‘bunker’	feny[kl̩]	‘fennel’
hypochon[dr̩]	‘hypochondriac’	deba[kl̩]	‘debacle’

This suggests the existence of a set of faithfulness constraints specific to loanwords, comparable to the foreign ‘stratum’ found in Itô and Mester’s (1995) work on Japanese (see also Ketner 2003). Any case in which loanwords seem to be exempt from normal phonological processes indicates that loanword faithfulness is ranked higher than the markedness constraints affecting the output in native words.

In this case, a constraint requiring stricter contiguity in loanwords is proposed, here referred to by the shorthand CONTIG(loan).

(34) Loanword faithfulness stronger than FINAL-C(root)

arti/kl/	CONTIG(loan)	FINAL-C(root)
☞ (a) arti[kl̩]		*
(b) arti[kɛl]	*!	

The high degree of loanword FAITH again comes into play when a loanword does not occur word finally. In (25), hu[db-a] 'music' takes on an agentive suffix to become hu[dɛb-ɲ]ík 'musician'; an [ɛ] is epenthesized root-medially to satisfy constraints on consonant cluster formation, while FINAL-C(root) influences its root-internal placement.

However, given a similar situation with a loanword, the outcome is not the same. The loanword ha[rf-a] 'harp' can take the same agentive suffix to form the word 'harpist.' Although this case also calls for epenthesis of [ɛ], it occurs after the root rather than root-medially: ha[rfɛ-ɲ]ík, *ha[rɛf-ɲ]ík. This is again due to the constraint preserving loanword contiguity at the expense of FINAL-C(root), as in (60).

3.4 Summary

The impetus that roots end in a non-syllabic consonant is undominated in native Czech words, outranking DEP, CONTIG and NO CODA. All this is not to say that no native items have a syllabic liquid in final position; however, these items are rare. Some such items are found in a small closed set of basic vocabulary.

(35) Violations of FINAL-C(root) in a closed set of basic vocabulary

bra[tr̩]	'brother'	my[sl̩]	'mind'
ce[dr̩]	'cedar'	důmy[sl̩]	'ingenuity'
ví[tr̩]	'wind'	če[tl̩]	'he read'

Because this set of native vocabulary is quite small and no longer productive, the native forms which violate FINAL-C(root) must be lexicalized.

This same phenomenon, in which a root-final syllabic liquid surfaces faithfully, can also be found in loanwords. However, this does not reflect a set of lexicalized exceptions, as this class of loanwords is still active. Instead, the contrary behavior of loanwords is caused by a loanword-specific constraint preserving root contiguity. Due to strigency relations, this constraint is necessarily higher ranked than the basic CONTIG applying to native words. In this case, where higher faithfulness is reflected, it also outweighs the markedness constraint dominating native words, FINAL-C(root).

The full ranking established by this section is as follows:

(36)

CONTIG(loan)

FINAL-C(root)

DEP CONTIG NO CODA

The next chapter will address the HomP-HetT epenthesis of [ɛ] in order to prevent complete deletion of a morpheme.

4 MORPHREAL

4.1 Introduction

This chapter examines another case of epenthetic [ɛ], this time triggered by pressure for morphological data to be overtly expressed despite markedness constraints working against it. In this way deletion is blocked if it would completely eliminate a morpheme, allowing for epenthesis to emerge. Samek-Lodovici (1993) first proposed such a constraint, calling it 'affix realization'; this paper will refer to the same phenomenon as MORPHREAL, in line with McCarthy (2002 and references therein).

(37) MORPHREAL: Every morpheme in S_1 has some correspondent in S_2 ('Every morpheme is realized overtly')

Section 4.2 will deal with cases where MORPHREAL triggers epenthesis. Section 4.3 will show that MORPHREAL is limited to one-term prefixes and prepositions to protect them from deletion, but morphemes of two or more phonemes still undergo deletion. The final section will present a summary of this chapter.

4.2 HomP-HetT: MORPHREAL as a trigger for [ɛ] epenthesis

This section will show how MORPHREAL acts to prevent deletion of morphological data, resulting in epenthesis of [ɛ]. This situation arises when the addition of a prefix or preposition results in geminate segments. Czech has a strong ban on geminates, but deletion is precluded by MORPHREAL and a member of the MAX family preventing deletion from the root.

(38) MAX(root): Every segment in $\surd_1$ has a correspondent in $\surd_2$. ('Don't delete from the root')

The epenthesis resulting from the conspiracy of MORPHREAL and MAX(root) is evident in the following data.

(39) MORPHREAL triggers epenthesis in geminate segments or those which differ only in terms of voicing

/z z/emě	→	[zɛ z]emě	'from (the) land'
/k k/atedrále	→	[kɛ k]atedrále	'to (the) cathedral'
/v v/elikosti	→	[vɛ v]elikosti	'in (the) size'
/s z/uzanou	→	[sɛ z]uzanou	'with Zuzana'
/v fr/ancii	→	[vɛ fr]ancii	'in France'
/s-sk/očit	→	[sɛsk]očit	'to jump off'
/v-vɲ/itř	→	[vɛvɲ]itř	'inside'
/z-s/ílit	→	[zɛs]ílit	'to amplify'

In order to represent the ban on geminates, the constraint *geminate is used, after Keer (1995).

(40) *geminate: *αα

This constraint is used rather than a subdivision of the Obligatory Contour Principle (OCP) (Goldsmith 1976) because dissimilation does not occur among a class or feature, but only when the two segments share both place and manner of articulation. This can only be attested to a ban on geminates, not pressure to dissimilate from a single particular feature.

Deletion of either of the offending segments is preempted: the preposition is protected by MORPHREAL, while the other half of the geminate is protected by MAX(root).

(41) Epenthesis results when both the preposition and root are preserved

/z z/emě	MORPHREAL	MAX(root)	DEP	MAX
(a) [Ø z]emě	*!			*
(b) [z Ø]emě		*!		*
☞ (c) [zɛ z]emě			*	

The fact that a violation of *geminate is repaired by epenthesis indicates that it must be the higher ranked of the two.

(42) Epenthesis used to dissimilate between geminate segments

/z z/emě	*geminate	DEP
(a) [z z]emě	*!	
☞ (b) [zɛ z]emě		*

The effects of *geminate can be seen to affect not only geminates, but also segments that differ only in voicing. The influence of AGREE(voice) compels the output forms to have the same voicing (see §6 for more on this constraint). When voicing is the only differentiating feature, then *geminate again comes into play. Deletion is still prevented through the intervention of MORPHREAL and MAX(root).

(43) Epenthesis of [ɛ] when voicing assimilation would produce a geminate

/z-s/ílit	AGREE(voice)	*geminate	DEP
(a) [zs]ílit	*!		
(b) [zz]ílit		*!	
☞ (c) [zɛs]ílit			*

Therefore, given geminate segments where one segment is a one-term morpheme and the other is a member of the root, both segments are protected from deletion by MORPHREAL and MAX(root), respectively. This allows for the emergence of HomP-HetT and epenthesis of [ɛ].

4.3 MORPHREAL and multi-term morphemes

The preceding section showed that MORPHREAL acts to prevent the deletion of morphological data. However, MORPHREAL only blocks deletion when the morpheme consists of a single segment.

The preservation of the prefix or preposition is not due to a constraint similar to MAX(root) which instead works to preserve affixes. Such a constraint would not be desirable from a typological point of view, as affixes are not positionally favored and are not privy to affix-specific FAITH (Beckman 1998). Moreover, the data does not support such an analysis:

(44) Prepositions and prefixes consisting of two or more terms undergo deletion:

be/z z/emě	→	be[∅ z]emě	‘without (the) land’
o/d d/ámy	→	o[∅ d]ámy	‘from (the) lady’
pře/s s/lunce	→	pře[∅ s]lunce	‘across the sun’
ro/z-z/uřit	→	ro[z]uřit	‘to infuriate’

po/d-d/at se → po[d]at se 'to give in'

be/z-z/ákonný → be[z]ákonný 'lawless'

Thus when the morpheme is not a single phoneme, then deletion would not completely prevent its realization and MORPHREAL does not take effect.

(45) Prefixes/prepositions consisting of two or more phonemes undergo deletion

be/z z/emě	MORPHREAL	MAX(root)	DEP	MAX
☞ (a) be[Ø z]emě				*
(b) be[z Ø]emě		*!		
(c) be[zɛ z]emě			*!	

So in the absence of a blocking constraint, deletion is carried out.

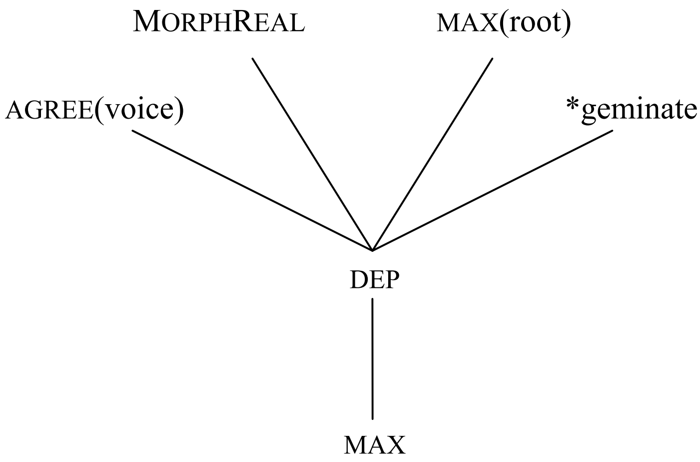
4.4 Summary

The preceding sections showed that MORPHREAL and MAX(onset) conspire to block deletion when the prefix or preposition consists of a single phoneme. Deletion of one of the geminate segments is carried out when the morpheme is not in danger of being totally eliminated; in these cases, MORPHREAL is not an issue.

Placing a prefix or preposition before an onsetless word does not raise issues of deletion and the input surfaces faithfully: be/z u/cha → be[z u]cha. Bimorphemic clusters involving non-geminate segments also surface faithfully, but only because several constraints are conspiring together and effectively block the markedness constraints triggering repair operations. This phenomenon will be discussed in §6.

The ranking established in this section is as follows:

(46)



The next chapter will explore the influence of ONSET, which is revealed to trigger HoT-HoP and subsequently HomP-HetT.

5 ONSET

5.1 Introduction

The constraint ONSET results in a case of HoT-HoP as Czech tries to avoid onsetless syllables with four different responses:

(a) Glide epenthesis eliminates onsetless non-back tense vowels [i, e, a]

(b) Deletion militates against onsetless non-back lax vowels [ɪ, ɛ]

(c) Vowel epenthesis prevents onsetless syllabic liquids [l̩, r̩]

(d) No change applies to back vowels [o, u], function words or loanwords

Once deletion is blocked, the repair method used for onsetless liquids exemplifies the case of HomP-HetT under examination in this thesis: epenthesis of [ɛ].

5.2 Repair methods for onsetless non-back vowels

The main evidence that underlyingly onsetless syllables beginning with /i, ɪ, e, ɛ, a/ are repaired is the complete lack of such items in the output. It is not possible to impose a Morpheme-Structure Condition in Optimality Theory; Richness of the Base requires that a surface-true generalization must follow from constraint ranking. In other words, there must be some process at work preventing underlyingly onsetless syllables with non-back vowels from emerging on the surface.

The chosen repair method is revealed by a phantom [ɛ], which sometimes appears post-prefixally in surface forms. In some cases it reveals an underlying /ɛ/ which is deleted in unprefixed forms, while other times the [ɛ] is epenthesized for structural reasons. The case of underlying /ɛ/ will be addressed in this chapter, while epenthetic [ɛ] will be discussed in §6 on consonant clusters.

Section 5.2.1 shows that onsetless tense vowels epenthesize an onset glide, while §5.2.2 will discuss deletion of onsetless lax vowel /ɪ, ɛ/. Section 5.3 presents another piece of the Czech case of HomP-HetT, where an [ɛ] is epenthesized to avoid an onsetless syllabic liquid. Sections 5.4, 5.5 and 5.6 will examine cases where ONSET is violated for non-back onsetless vowels /o, u/, function words and loanwords. A summary for this chapter is given in §5.7.

5.2.1 Onset glide epenthesis

There are no cases where underlying onsetless vowels /i…, e…, a…/ reveal themselves. To pursue this analysis in the interest of Richness of the Base, a hypothetical input of /iːtat/ is assumed. Although deletion is the lower-ranked repair operation, this process is blocked by MAX(root).

(47) Epenthesis of an onset glide

/iːt/at	MAX(root)	DEP	MAX
(a) [t]at	*!		*
☞ (b) [jiːt]at		*	

Furthermore, given that ONSET compels this epenthesis, it must be higher ranked than the constraint preventing it.

(48) ONSET compels onset glide epenthesis

/iːt/at	ONSET	DEP
(a) [iːt]at	*!	
☞ (b) [jiː]tat		*

Although an onset glide is not the only possible epenthetic segment, it is a relatively intuitive choice. An onset glide is often seen as a copy of the vowel, where the features of the vowel simply spread onto the onset margin, manifesting themselves in consonantal form: In OT terms, an onset glide supports a lot of AGREE constraints. Further proof that an onset glide is the best epenthetic segment given an onsetless vowel will be given in §5.4.

5.2.2 Deletion of underlying /ɛ/

The previous section showed that onsetless vowels can be repaired by epenthesizing an onset glide. However, this section will present evidence for a case in which the vowel is deleted instead. This is found in the form of cases of underlying /ɛ/, examples of which are given here:

(49) Underlying [ɛ] revealed in prefixed environments

[s-ɛhr]át	‘to play (with)’	cf. [s-hr]ábnout
o[d-ɛt͡ʃ]ist	‘to subtract’	cf. o[d-t͡ʃ]erpat
[z-ɛvr]ubný	‘detailed’	cf. [z-vr]átit
[v-ɛj]ít	‘to enter’	cf. [v-j]et
cf. roz<u>ej</u>ít	‘to separate’	cf. ro<u>zj</u>et
cf. o<u>dej</u>ít	‘to go away’	cf. o<u>dj</u>et
cf. <u>sej</u>ít	‘to come down’	cf. <u>sj</u>et
cf. o<u>bej</u>ít	‘to go around’	cf. o<u>bj</u>et

This [ɛ] is not epenthetic. Each of the potential onset clusters is accepted, as evidenced by the attested forms in the righthand column. Therefore, the consonant cluster itself gives no grounds for epenthesis. The possibility that the [ɛ] could be due to prosodic reasons does not bear out either: the [ɛ] equally faithfully appears in items of varying prosodic structure, as in *sejít* and *obejít*. Thus, neither a bad onset cluster nor a prosodic condition could possibly trigger epenthesis in this case. If the underlying form were /s-hr/át, for example, there is no condition that could prevent it from surfacing faithfully. Thus word pairs such as [hr]át – [sɛhr]át are not undergoing insertion of [ɛ] after the prefix as there is no phonological motivation for such epenthesis; rather, it is the unprefixed form in which the initial /ɛ/ has been deleted.

The preceding section found that deletion is blocked by MAX(root), so onsetless vowels epenthesize an onset glide. However, the evidence here shows that onsetless /ɛ/ is deleted. There must be a second blocking constraint preventing deletion and allowing a violation of MAX(root) to emerge as the optimal output. I propose that this constraint blocking is caused by the lack of an appropriate epenthetic segment, similar to the process for back vowels to be examined in §5.4.

As mentioned above, an onset glide is a natural choice as an epenthetic segment because it satisfies many AGREE constraints (Lombardi 1995). However, these very constraints are what prevent onset glide epenthesis before [ɛ]: one of the features which the vowel and the onset glide must agree on is that of tenseness. Glides are tense features, while the vowels [ɪ, ɛ] are not.

(50) Glide epenthesis blocked by AGREE(tense)

/ɛh/rát	AGREE(tense)	MAX(root)	DEP
(a) [jɛh]rát	*!		*
☞ (b) [h]rát		*	

As above, this process is spurred by ONSET, indicating that it must outrank MAX(root).

(51) ONSET not blocked by MAX(root)

/ɛh/rát	ONSET	MAX(root)	DEP
(a) [ɛh]rát	*!		*
☞ (b) [h]rát		*	

It is assumed that the other non-back lax vowel /ɪ/ would also be deleted in the same manner, but as with the tense vowels /i, e, a/ there are no instances in which such an underlying form is revealed.

Therefore underlying /ɛ/ is deleted when it would occur as the first segment of a syllable ([hraːt]) and only emerges when a consonant-final prefix can provide it with an onset ([sɛhraːt]). Scheer proposes that this same phenomenon emerges when the root has an underlying form of √C∅CV (2001a). However, this analysis is unnecessarily complicated as it is couched in the historical process of yer deletion (see §7.2). Instead of a null segment ∅ (cf. the yers Ь, Ъ in 7.2) alternatively being deleted or transformed into [ɛ], it is simpler to assume that underlyingly there is nothing, and that [ɛ] is epenthesized for the reasons presented in this thesis.

5.2.3 Summary

The last two sections showed that the onsetless non-back vowels have two strategies for satisfying ONSET: tense vowels epenthesize an onset glide, while lax vowels simply delete.

However, there are no instances in which underlying forms of the onsetless non-back vowels /i, ɪ, e, a/ emerge due to phonological conditioning; only [ɛ] emerges post-prefixally as in [hr]át – [sɛhr]át. There are two different processes which could account for this, but the data give no insight into which of them is accurate. In the interest of simplicity, the possible solutions are illustrated with the nonsense examples /s-iːtat/ and /s-ɪtat/:

(a) There are no native Czech words with underlying onsetless /i, ɪ, e, a/; if such a word did exist (RoB), it would emerge faithfully:

/iːtat/ → [jiːtat] /s-iːtat/ → [siːtat]

/ɪtat/ → [tat] /s-ɪtat/ → [sɪtat]

(b) There are indeed native Czech words with underlying onsetless /i, ɪ, e, a/, but the processes by which onsetless non-back vowels are repaired and the addition of the prefix /s/ are bound by O(utput)-O(utput) FAITH (Benua 1997); the repaired form becomes the new base and O-O FAITH requires the final output to be faithful to it. /ɛ/ would have to be excluded from any such O-O FAITH constraints:

/iːtat/ → [jiːtat] /s-iːtat/ → ([s-jiːtat] →) [sjiːtat]

/ɛtat/ → [tat] /s-ɛtat/ → ([s-tat] →) [stat]

Thus, as there are no clear underlying forms with /i..., ɪ..., e..., a.../, there is no way to ascertain which process prevents their faithful emergence. We only know that they do not emerge, and the ranking established elsewhere independently (i.e. ONSET, AGREE(tense) » MAX(root) » DEP » MAX) implies that tense vowels epenthesize onset glides, while lax vowels are deleted.

The analysis shown above applies in the same manner to onsetless diphthongs beginning with a non-back vowel /aj, au, ej, eu/.

5.3 HomP-HetT: Onsetless liquids as a trigger for epenthesis

Just as with the non-back vowels seen in §5.2, there are no instances of the syllabic liquids [l̩, r̩] as the initial segment of a word. Again, this indicates that a repair operation is being triggered by high-ranking ONSET. Deletion is once again blocked by MAX(root) as above, leaving epenthesis as the optimal option. The phantom vowel [ɛ] is inserted after the liquid, forming the syllable nucleus.

(52) Underlying liquid-initial segments repaired with epenthetic [ɛ]

/lv/ → [lɛv]	'lion' (NOM SING)	cf. [lv-iː] (ADJ)
/lʒ/ → [lɛʒ]	'lie' (NOM SING)	cf. [lʒ-ɛ] (GEN SING)
/rt/ → [rɛt]	'lip' (NOM SING)	cf. [rt-uː] (GEN PL)
/rt͡ʃ/ → [ř̝ɛt͡ʃ][3]	'speech' (NOM SING)	cf. [rt͡ʃ]ení 'saying'

The pressure of ONSET prevents the faithful emergence of an onsetless word.

(53) ONSET compels vowel epenthesis

/lv/	ONSET	DEP
(a) [l̩v]	*!	
☞ (b) [lɛv]		*

It is notable that the chosen epenthetic segment is [ɛ] (see §8 for more on markedness). The fact that the epenthesized segment is a vowel (which then becomes the syllable nucleus) rather than a consonant (which would force [l] to become the syllable nucleus) reflects the sonority hierarchy effected through Prince and Smolensky's nuclear sonority constraints seen in §2:

(54) Vowel epenthesis, not consonant epenthesis

/lv/	*P/liquid	*P/vowel
(a) [pl̩v]	*!	
☞ (b) [lɛv]		*

Therefore, due to the pressure of ONSET, an underlying form which would otherwise emerge with an onsetless syllabic liquid is repaired. As MAX(root) blocks deletion, epenthesis is instead carried out.

5.4 FAITH in back vowels

Sections 5.2 – 5.3 show that ONSET is a fairly high-ranked constraint in Czech, outranking both MAX and DEP and triggering repair operations in some onsetless syllables. However, this section reveals that ONSET is not an undominated constraint; when a back vowel /o, u/ occurs syllable-initially, it is not repaired and emerges faithfully on the surface as [o, u]. This occurs because both MAX and DEP are blocked, so a faithful output incurs the least violation.

(55) Onsetless back vowels surface faithfully

[u]cho	'ear'	[uː]cta	'respect'
[uː]d	'limb'	[u]hel	'coal'
[o]bčan	'citizen'	[ou]ško	'eye' (DIM)
[o]voce	'fruit'	[oj]	'shaft'

Deletion is already blocked to some extent by MAX(root), but this does not block the influence of ONSET (see §5.2.2). Therefore must be some constraint ÷ encouraging greater faithfulness in back vowels alone which can block the effects of ONSET. To this end, I propose the following member of the MAX family of constraints.

(56) MAX(back): 'Don't delete back vowels.'[4]

This subdivision of MAX leads to the following analysis regarding the current question of onsetless back vowels:

(57) Onsetless back vowels not deleted

/ux/o	MAX(back)	ONSET	MAX
(a) [x]o	*!		*
☞ (b) [ux]o		*	

[3] The palatalization of /r/ to [ř] will not be addressed here.

Epenthesis is in turn blocked by the lack of an appropriate epenthetic segment, as in §5.2.2. The most likely subject for epenthesis would be an onset glide, which is formed by spreading the vowel's features onto the onset. In this case, feature spread would result in the back rounded glide [w]; however, the phonemic inventory of Czech does not include this phoneme, indicating a strong ban against it.

(58) Onsetless back vowels do not epenthesize an onset glide

/u/xo	*w	ONSET	DEP
(a) [wu]xo	*!		*
☞ (b) [u]xo		*	

Still, a violation of DEP could result in the possible epenthesis of a segment other than an onset glide. Nevertheless, such epenthesis is also prevented. This is due to the markedness constraint family AGREE: an onset glide is effectively a copy of the vowel, or in other words, it satisfies many AGREE constraints.

My use of AGREE(back/round/approximate) does not imply that these three constraints are conjoined into one, but serves merely to illustrate that if just one of these three separate constraints outranks ONSET, then that suffices to preserve onsetless back vowels [o, u].

(59) Onsetless back vowels do not epenthesize a consonantal onset

/u/xo	AGREE(b/r/a)	ONSET	DEP
(a) [vu]xo	*!		*
☞ (b) [u]xo		*	

The analysis that Czech attempts to repair an onsetless vocalic segment with an onset glide can be seen in some Czech dialects. In these dialects the labiodental glide /ʋ/ is epenthesized before [o, u]. This phenomenon is represented by the same ranking as above, MAX(back/round) » ONSET » DEP » MAX. The problem of the lack of [w] is

[4] The vowels /i ɪ e ɛ a/ differ from /o u/ in both backness and roundness; the proposed constraint could

circumvented by the implementation of a labio-dental glide, which satisfies AGREE(back/round) but not AGREE(approximant): /na.o.pak/ 'on the contrary' → [na.ʋo.pak]. However, this glide epenthesis is not accepted in the Standard dialect.

Thus (in Standard dialect) two repair methods are blocked: deletion is prevented by a MAX(F) constraint protecting back vowels, while epenthesis cannot occur due to the lack of [w]. As epenthesis of a non-glide segment is not pursued, ONSET must be outranked by a member of the AGREE family which compels the epenthesized segment to be a glide. The analysis applies equally to onsetless diphthongs beginning with a back vowel /oj, ou/.

The next two sections will examine other cases which appear to be exceptions to the established ranking, but are then reduced to epiphenomena of constraints specific to lexical class.

5.5 Function words as exceptions

Section 5.2 discusses the near lack of native Czech lexical items beginning with the non-back vowels [i, ɪ, e, ɛ, a] and attributes this to two repair methods, epenthesis and deletion. However, this is only a *near* lack; Řešetka's dictionary, for one, contains 15 native Czech items that indeed retain onsetless /i, a/ in their surface forms (2001).[5] Closer examination of these 15 items reveals that they all belong to the same lexical class, function words.

(60) Onsetless function words

[a]le	'but'	[i]	'and'
[a]by	'so that'	[a]	'and'
[a]ž	'up to, until'	[i]nu	'well'

Function words often behave differently from other parts of speech (Selkirk 1995). This indicates that a different set of regulations applies to them; or in OT terms, an

---

equally well be MAX(back) or MAX(round).

independently rankable subset of constraints specific to function words must also exist, blocking the effects of ONSET.

To this end, a member of the ANCHOR family of constraints is proposed (McCarthy & Prince 1995b):

(61) ANCHOR-L(fxn, PrWd): The element standing at the left edge of the function word also stands at the left edge of the prosodic word.

If ANCHOR-L(fxn) outranks ONSET, then both the impetus to delete an onsetless non-back vowel and to epenthesize an onset glide are blocked, resulting in a higher degree of faith in function words.

(62) Preservation of onsetless non-back vowels in function words

/al/e	ANCHOR-L(fxn)	ONSET	DEP	MAX
(a) [l]e	*!			*
(b) [jal]e	*!		*	
☞ (c) [al]e		*		

Thus the contrary behavior of function words does not represent two different processes or phonologies. The integration of function word specific constraints provides for the emergence of surface forms unlike those in other areas lexical items. The next section addresses a similar process, this time applied to loanwords.

5.6 Loanwords as exceptions

Unlike native words, loanwords do not undergo deletion or epenthesis in order to satisfy ONSET.

(63) Onsetless loanwords

[a]kvárium	'aquarium'	[au]kce	'auction'
[eː]ra	'era'	[ɛ]vropa	'Europe'

[5] There are no native items beginning with [e]. If there were, I would expect them to be function words and to behave the same way as /i a/.

[i]kona ‘icon’ [i]nzulín ‘insulin’

This suggests the existence of a set of faithfulness constraints specific to loanwords, comparable to the foreign ‘stratum’ found in Itô and Mester’s (1995) work on Japanese (also see Ketner 2003). Any case in which loanwords seem to be exempt from normal phonological processes indicates that loanword faithfulness is ranked higher than the markedness constraints affecting native words.

The fact that loanwords beginning with a non-back vowel do not delete or epenthesize onset glides is attributable to an ANCHOR constraint, like that for function words seen in §5.2.6.

(64) ANCHOR-L(loan, PrWd): The element standing at the left edge of the loanword also stands at the left edge of the prosodic word.

The effect of ANCHOR-L(loan) can be seen in the following tableau:

(65) Preservation of onsetless non-back vowels in loanwords

/ak/várium	ANCHOR-L(loan)	ONSET	DEP	MAX
(a) [k]várium	*!			*
(b) [jak]várium	*!		*	
☞ (c) [ak]várium		*		

Therefore the constraint that allows onsetless non-back vowels in loanwords, ANCHOR-L(loan), is very closely related to that which provides for the same phenomenon in function words. The high degree of preservation in loans is repeated in other areas in this analysis (see §3.3 and 6.6).

5.7 Summary

The preceding sections showed a case of HoT-HoP triggered by ONSET. Both epenthesis and deletion repair syllables with onsetless non-back vowels. Roots beginning with back vowels, function words and loanwords were not repaired, indicating that constraints specific to these three groups can block the effects of ONSET itself.

The ranking established in this chapter is as follows:

(66)

ANCHOR-L(fxn) ANCHOR-L(loan)

MAX(back) AGREE(back/rnd/approx) *w

ONSET, AGREE(tense)

MAX(root)

DEP

MAX

The next chapter moves on to analyze constraints on the formation of consonant clusters and how epenthetic [ɛ] works to satisfy them.

6 Consonant clusters

6.1 Introduction

This chapter addresses the structure of consonant clusters and the repair methods employed to prevent the output of bad clusters. Another case of HoT-HoP is revealed, making room for the emergence of our case of HomP-HetT, epenthetic [ɛ].

Czech onset and coda clusters have quite different inventories, but the distribution of native monomorphemic clusters is generally restricted by four criteria.

(a) Obstruent cluster constituents agree on the feature [±VOICE]

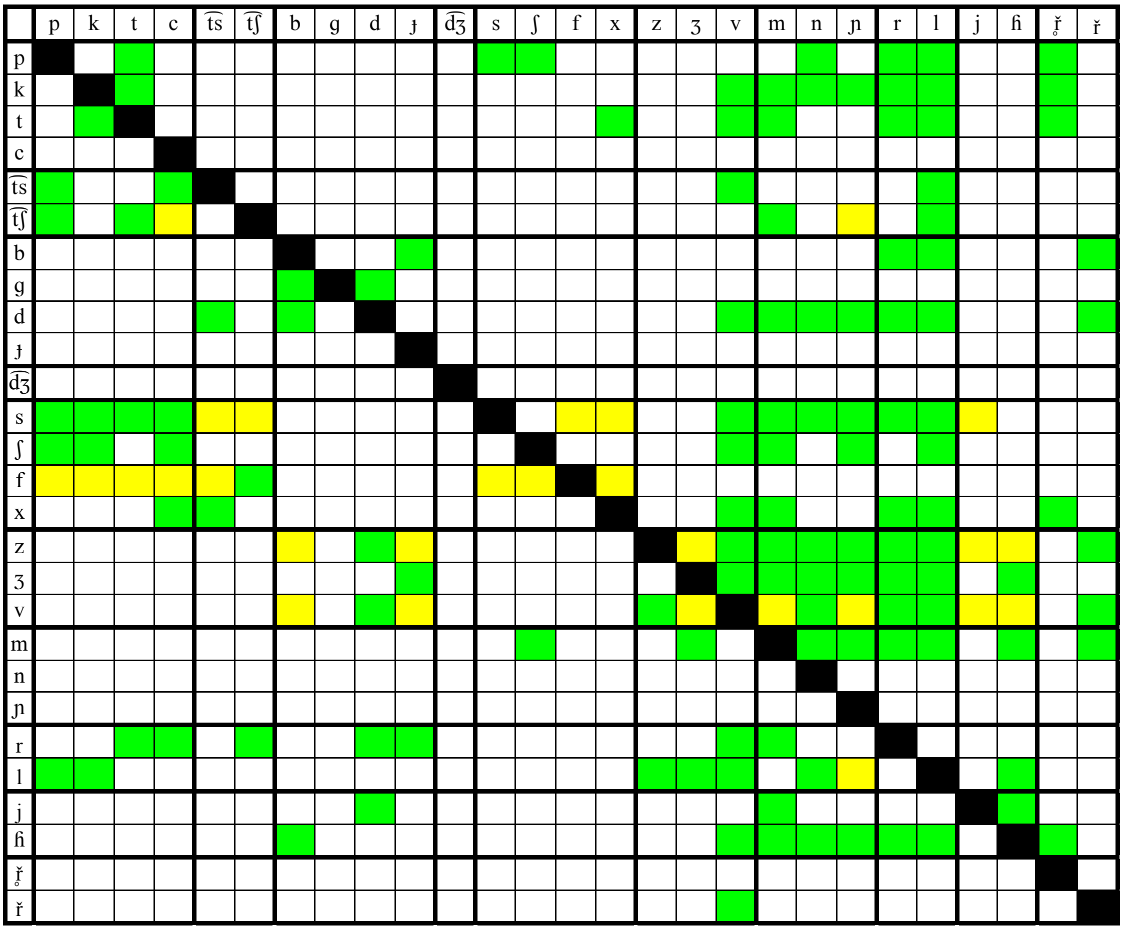
(b) Cluster constituents have different places of articulation

(c) Cluster constituents have different manners of articulation [6]

(d) One constituent must be coronal[7]

The first guideline can be represented by the constraint AGREE(voice). The next two are members of the Obligatory Contour Principle (OCP) family of constraints: OCP(place) and OCP(manner) respectively (Goldsmith 1976). The final constraint can be represented by *{KP}{KP} (= *{dors,lab}{dors,lab}; 'K' stands for a dorsal phoneme while 'P' stands for a labial) (de Lacy 2003).

The following chart gives a representation of which two-term onset clusters are allowed in Czech. The green squares signify native monomorphemic (and in some cases, also bimorphemic) onset clusters, while the yellow squares stand for native clusters which are exclusively bimorphemic. Onsets which are found only in loanwords or onomatopoeias are relatively few and not included in the chart.



(67) Two-term onset clusters

[6] Exceptions are the cluster [tk, kt, pt, dn].

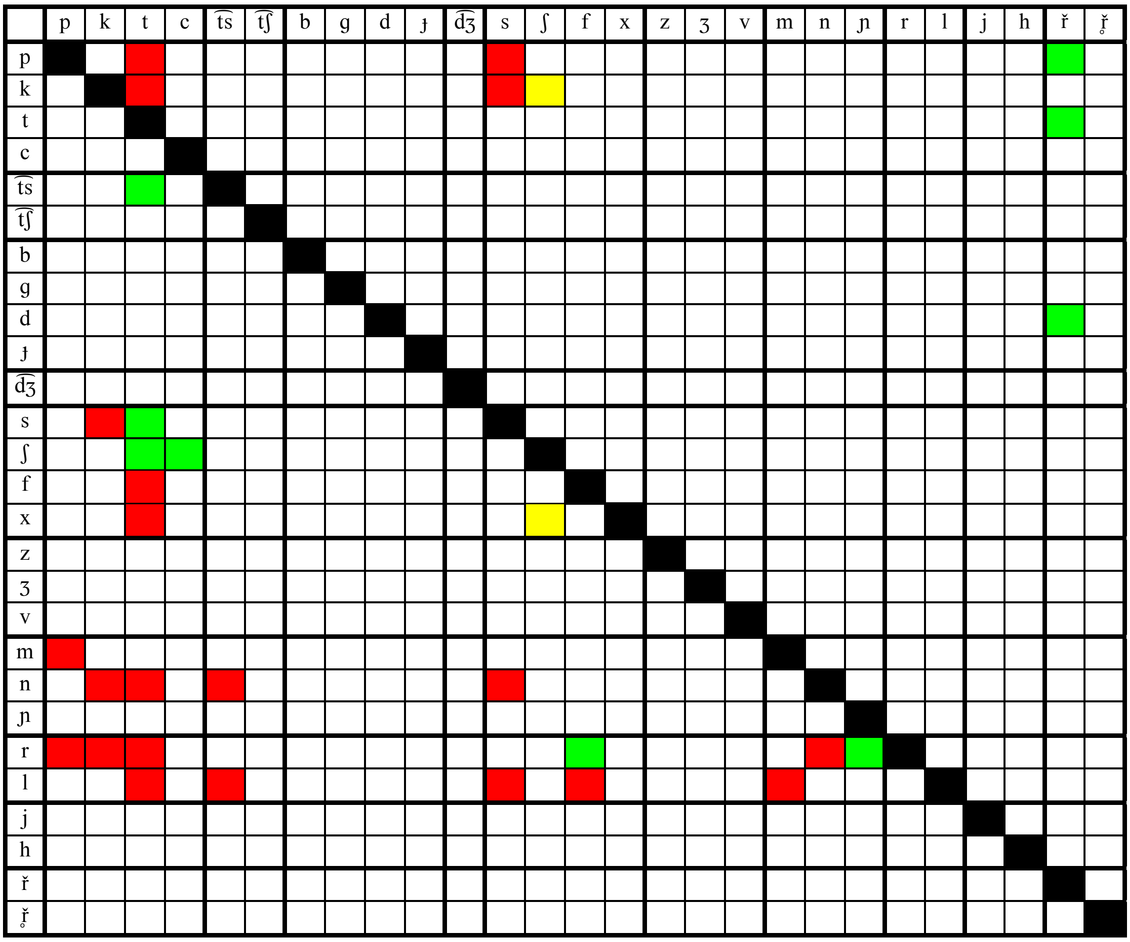
[7] Exceptions are [km, jm, ɦb, ɦv, ɦm].

Figure (67) Biphonemic onset clusters. The y-axis represents the first segment of the cluster, while the x-axis represents the second. Green squares stand for monomorphemic (and potentially bimorphemic) clusters, while yellow squares represent exclusively bimorphemic clusters.

Coda clusters represent a much smaller class: only eleven monomorphemic native clusters are found in Czech, each consisting of only two phonemes.[8] Because of the small inventory, there must be many constraints working as limiting factors, but the four listed above are the most important.

Czech obstruent codas are also subject to blanket devoicing. However, as there is no accepted account of coda devoicing and to attempt to provide one would change the focus of this paper, this process is not accounted for in the constraint-based system. The color scheme is the same as for figure (67), with the addition of loanwords in red.

(68) Two-term coda clusters



[8] Excluding onomatopoeias such as *prásk* 'bang' and *bims* 'bam'.

Figure (68). Biphonemic coda clusters. The y-axis represents the first segment of the cluster, while the x-axis represents the second. Green squares stand for monomorphemic clusters, while yellow squares represent exclusively bimorphemic clusters and red squares stand for exclusively loanword clusters.

As stated above, onset and coda clusters are governed by four guidelines. AGREE(voice) (69a) is satisfied by voicing assimilation. As deletion in monomorphemic words is blocked by MAX(root), epenthesis of [ɛ] emerges as the only repair operation for (69b-d). When epenthesis is blocked, then the input surfaces faithfully.

(69) Markedness violations in consonant clusters

(a) (i) Repairs triggered by AGREE(voice)

/v-p/adnout →	[fp]adnout	'to fall'
/s-b/alit →	[zb]alit	'to roll up'
/v-k/us →	[fk]us	'taste'

(ii) No surface violations of AGREE(voice) in obstruent clusters

(b) (i) Repairs triggered by OCP(manner)

/t͡ʃk/at →	[t͡ʃɛk]at 'to wait'	cf. po[t͡ʃk]at 'to wait for'
lá/tk-∅/ →	lá[tɛk] 'matter' (GEN PL)	cf. la[tk]a (NOM SING)
hu/db-∅/ →	hu[dɛb] 'music' (GEN PL)	cf. hu[db]a (NOM SING)

(ii) Surface violations of OCP(manner)

/s-x/ovat →	[sx]ovat	'to hide'
/z-ʒ/enštilý →	[zʒ]enštilý	'effeminate'
jeji/xʒ/ →	jeji[xʃ]	'whose' (+coda devoicing)

(c) (i) Repairs triggered by OCP(place)

be/dn-∅/ →	be[dɛn] 'case' (GEN PL)	cf. be[dn]a (NOM SING)
pa/nn-∅/ →	pa[nɛn] 'maiden' (GEN PL)	cf. pa[n]y (NOM PL)
ku/tn-∅/ →	ku[tɛn] 'frock' (GEN PL)	cf. ku[tn]a (NOM SING)

(ii) Surface violations of OCP(place)

/v-b/rzku →	[vb]rzku	'presently'
/k x/alupě →	[k x]alupě	'to the cottage'

/v-p/adnout → [fp]adnout ‘to fall’ (+voicing agreement)

(d) (i) Repairs triggered by *{KP}{KP}

di/vk-∅/ → di[vɛk] ‘girl’ (GEN PL) cf. di[fk]a (NOM SING)

ja/mk-∅/ → ja[mɛk] ‘socket’ (GEN PL) cf. ja[mk]y (NOM PL)

le/bk-∅/ → le[bɛk] ‘skull’ (GEN PL) cf. le[pk]y (NOM SING)

(ii) Surface violations of *{KP}{KP}

/v-k/us → [fk]us ‘taste’ (+voicing agreement)

/k p/očítaču → [k p]očítaču ‘to (the) computer’

/v-b/rzku → [vb]rzku ‘presently’

The examples in part (i) in the sections above may give the impression that the process of epenthesis is automatic given a genitive plural (null inflected) root. However, epenthesis only occurs when a bad coda cluster would otherwise result. For example, mě/st-∅/ ‘city’ → mě[st], *mě[sɛt], since […st] is an acceptable coda cluster.

Many of the examples show that deletion of the segments of a coda cluster is somehow blocked. As codas are never preserved through positional faithfulness constraints (Beckman 1998), this is attributable to the member of the MAX family preventing deletion from the root, MAX(root) (see §4.2).

Each of the observations (69a-d) above will now be addressed individually to provide constraint-based insight into the phenomena. However, (b-d) are shown to behave in the same fashion as one another and so their analysis will be abbreviated. Section 6.6 will address coda clusters in loanwords, which are given greater range than native items. The same phenomena is not prevalent in onset clusters for two reasons: first, their inventory is much bigger so very few clusters are exclusive to loanwords; and second, onset clusters are not exposed to the same pressures as codas (for example, the null suffix of the genitive plural) and do not provide the same accessible evidence of loanword-specific constraints.

Each section will give guidelines for cluster formation, but does not attempt to provide a complete account, as that is not within the scope of this analysis.

This chapter will only address data from two-term clusters. Longer clusters are relatively rare and their analysis is very involved, again threatening to blow this account of HomP-HetT off course. Therefore, in the interests of simplicity and clarity, complex clusters will be omitted.

6.2 AGREE(voice)

Since all obstruent clusters agree on the feature of voicing, the pressure compelling this conformity must be stronger than the pressures of FAITH to the underlying segment. This is best illustrated with a bimorphemic cluster, where the voicing of the underlying segments of the cluster are known:

(70) Voicing assimilation in clusters

/s-b/alit	AGREE(voice)	IDENT(voice)
(a) [sb]alit	*!	
☞ (b) [zb]alit		*

However, §4 has already shown AGREE(voice) to outrank both MAX and DEP. The fact that neither of these options is pursued points to a blocker, here one of the ANCHOR family of constraints.

(71) ANCHOR-L(root, PrWd): The element standing at the edge of the root also stands at the edge of the prosodic word.

This ANCHORing constraint serves to block both deletion and epenthesis. Therefore output (c), which only violates the low-ranked IDENT constraint, is optimal.

(72) ANCHOR-L(root) blocks repair operations

/sb/alit	AGREE(voice)	ANCHOR-L	DEP	MAX
(a) [s]alit		*!		*
(b) [sɛb]alit		*!	*	
☞ (c) [zb]alit				

AGREE(voice) only applies to obstruent clusters (Lombardi 1995), so an onset such as /sm/ is not subject to this constraint: /sm/ích 'smile' → [sm]ích. Voicing assimilation in Czech is almost exclusively regressive, although the contrary behavior of /ř/ and /v/ will be the subject of future research.

Voicing assimilation in coda clusters cannot be distinguished due to the influence of coda devoicing.

6.3 OCP(manner)

The effects of the constraint OCP(manner) can be best seen in the data for monomorphemic clusters, where it is completely unviolated. Deletion is again blocked by MAX(root), allowing for the emergence of epenthetic [ɛ]. In order to provide a suitable example in an onset cluster, an affricate and a stop will be said to have the same manner of articulation for the purposes of OCP(manner).

(73) Epenthesis in clusters violating OCP(manner)

/t͡ʃk/at	OCP(manner)	MAX(root)	DEP	MAX
(a) [t͡ʃk]at	*!			
(b) [t͡ʃ]at / [k]at		*!		*
☞ (c) [t͡ʃɛk]at			*	

Thus, the response to a violation of the markedness constraint OCP(manner) in monomorphemic clusters is epenthesis. The analysis given here also holds true for coda clusters: le/bk-∅/ → le[bɛk]. However, in bimorphemic (yellow above) clusters it becomes clear OCP(manner) is not undominated. In this case, MORPHREAL prevents deletion of the prefix.

(74) MORPHREAL prevents deletion of the prefix

/sx/ovat	MORPHREAL	OCP(manner)	MAX
(a) [x]ovat	*!		*
☞ (b) [sx]ovat		*	

Meanwhile, ANCHOR-L(root, PrWd) blocks both epenthesis and deletion to the root.

(75) Blocking allows faithful outputs in bimorphemic clusters

/sx/ovat	ANCHOR-L	OCP(manner)	DEP	MAX
(a) [s]ovat	*!			*
(b) [sɛx]ovat	*!		*	
☞ (c) [sx]ovat		*		

The fact that epenthesis of [ɛ] is not prevented in geminate clusters despite ANCHOR-L(root, PrWd) indicates that the ban on geminates is the more powerful constraint.

(76) *geminate blocks ALIGN-L(root, PrWd)

/z z/emě	*geminate	ANCHOR-L	OCP(manner)	DEP
(a) [z z]emě	*!		*	
☞ (b) [zɛ z]emě		*		*

Thus blocking allows for faithful surfacing of (non-geminate) violations of OCP(manner) in bimorphemic onset clusters. A similar phenomenon is observed for coda clusters, where deletion is again blocked by MAX(root) and MORPHREAL. However, this time epenthesis is prevented by FINAL-C(root) (see §3).

(77) FINAL-C(root) blocks epenthesis

jeji/xʒ/	FINAL-C(root)	OCP(manner)	DEP
(a) jeji[xɛʃ]	*!		*
☞ (b) jeji[xʃ]		*	

The final two constraints, OCP(place) and *{KP}{KP} will be shown to act in the same way as OCP(manner), so the next two sections will make reference to the analysis given here.

Thus deletion is consistently blocked by MAX(root) while MORPHREAL also comes into play in bimorphemic words. Epenthesis is prevented in bimorphemic words by ANCHOR-L(root, PrWd) in onset clusters and by FINAL-C(root) in coda clusters.

6.4 OCP(place)

OCP(place) acts in much the same way as OCP(manner): the constraint is unviolated in monomorphemic clusters, while violations occur in bimorphemic clusters. The interactions of constraints is identical to that seen above, where MORPHREAL and MAX(root) block deletion so epenthesis is the chosen method of repair for monomorphemic clusters. There is no transparent example with an onset cluster, but the fact this constraint is not violated in onset consonant clusters serves as testament enough. In a coda cluster: pa/nn-∅/ → pa[nɛn] (GEN PL), cf. [pani] (NOM PL)

In bimorphemic clusters, epenthesis is blocked by ALIGN-L(root, PrWd) in onsets and by FINAL-C(root) in codas as above. In an onset cluster: /v-b/rzku → [vb]rzku. There is no clear example with a coda cluster, but there is no condition to assume a bimorphemic coda cluster would not behave like its OCP(manner) counterpart in §6.3.

A full analysis will not be presented here because it is identical to that in 6.3, with OCP(place) instead of OCP(manner).

6.5 *{KP}{KP}

*{KP}{KP} behaves the same as the two versions of the OCP above (see §6.3 for a full analysis). There are no examples of epenthesis to prevent an output in violation of this constraint in monomorphemic clusters, but they must be considered due to Richness of the Base. Given that MAX(root) » MAX » DEP, epenthesis is assumed to prevent faithful emergence of clusters without a coronal segment in monomorphemic words. Bimorphemic clusters are attested, and they emerge faithfully since ALIGN-L(root) and FINAL-C(root) block epenthesis: /v-b/rzku → [vb]rzku; jeji/xʒ/ → jeji[xʃ] (/ʒ/ → [ʃ] due to coda devoicing).

6.6 Loanword coda clusters

The previous constraints all apply to native words. However, loanwords have already been shown to behave contrary to native words (§ 3.3, 5.6), and again this holds true. The inventory of attested coda clusters in loanwords (red above) is over twice that of native words. The additions are of three types:

(a) filling gaps left in native coda clusters;
(b) the introduction of clusters composed of stop + stop and stop + voiceless coronal; and
(c) more combinations involving nasals and liquids.

Again, this reflects the greater range given to loanwords in Czech due to a higher degree of preservation in loanwords. This faithfulness will be represented with the constraint CONTIG(loan) ('don't separate morpheme-internal segments of a loanword').

(78) Preservation of loanword coda clusters

fa/kt/	CONTIG(loan)	OCP(manner)	IDENT(manner)
☞ (a) fa[kt]		*	
(b) fa[kɛt]	*!		*

This same loanword-specific ranking holds true for the markedness constraints OCP(place) and *{KP}{KP} as well: ku/lt/ 'cult' → ku[lt] and ke/mp/ 'camp(y)' → ke[mp].

However, these codas are only acceptable in loanwords where they are protected by loan FAITH. If such a coda were found in the input of a native word, it would be repaired with an epenthetic [ɛ] (as in the preceding sections 6.3-6.5). Below, the coda cluster /…tk/ in violation of OCP(manner) is repaired; compare this to the accepted loanword fa[kt] 'fact', which also violates OCP(manner) but is preserved via the process seen in (78).

(79) Non-native clusters acceptable in loanwords not acceptable in native words

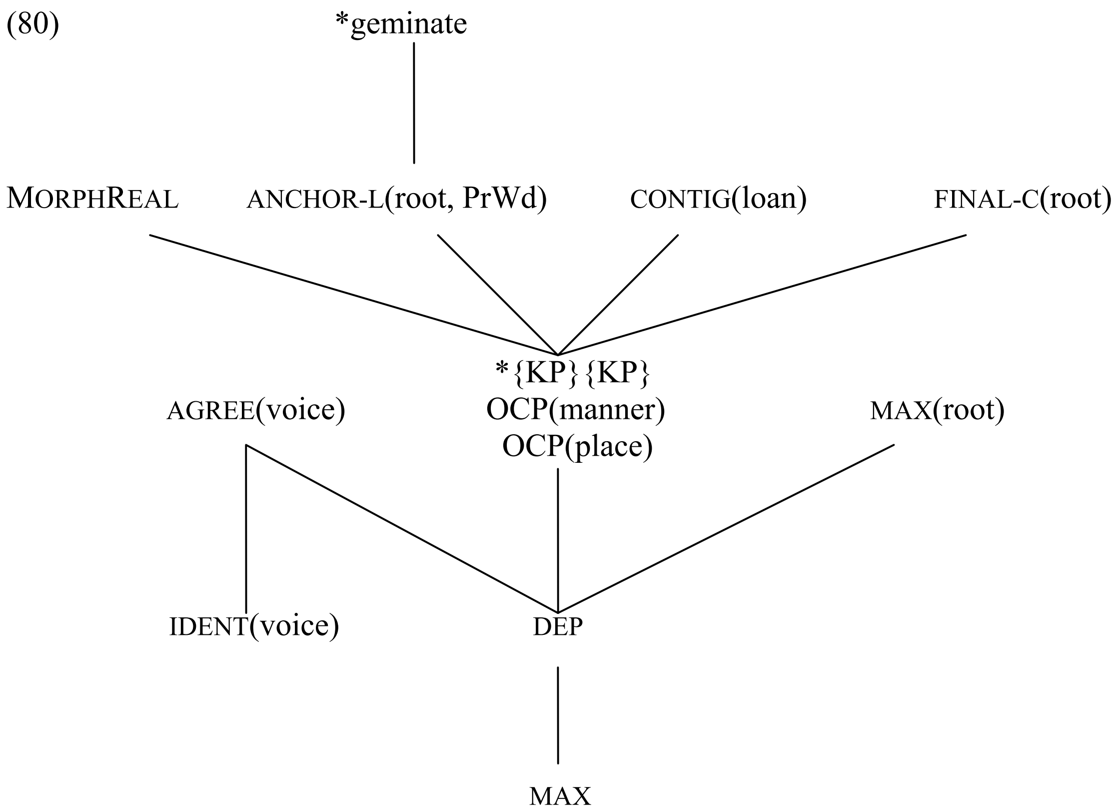
lá/tk-Ø/	OCP(manner)	DEP
(a) lá[tk]	*!	
☞ (b) lá[tɛk]		*

6.7 Summary

This chapter showed that four main constraints govern the outputs of onset and coda clusters, although loanwords are granted greater leeway. Deletion is consistently blocked in clusters due to the conspiratorial effects of MAX(root) and MORPHREAL. Epenthesis breaks up bad monomorphemic clusters, while bimorphemic clusters in violation of the markedness constraints surface faithfully.

This is the ranking established in this chapter.

(80)



The next section will give analyses of the process of mobile ‘e’ in other theoretical frameworks and compare them with the OT analysis offered here.

7 Other analyses

7.1 Rule-based theories

A rule-based approach to the system of mobile ‘e’ can work to some extent. However, such an analysis soon runs into snags caused by issues of locality. Moreover, such an approach fails to grasp the motives driving the observed phenomena and does not have the ability to unify obviously related phenomena into a single process.

Certain aspects of the analysis provided in this thesis can be successfully described with a rule-based model. For example, the data from §5 (‘ONSET’) can be reduced to the following rules:

(81) *Three unrelated rules?*

∅	→	j / #___{i,e,a}	/iː/tat	→	[jiː]tat
{ɪ, ɛ}	→	∅ / #__	/ɛh/rát	→	[h]rát
∅	→	ɛ / #[liquid]____C	/lv/	→	[lɛv]

Although a rule-based theory can account for the data in this case, it fails to capture the relationship between the rules: these three processes are all related in that they conspire to produce a syllable onset. Within OT, this is simply an example of HoT-HoP, attributable to the ranking ONSET » DEP » MAX, where blocking constraints provide for the emergence of different methods of repair (see §5 for a full analysis).

Just as a rule-based approach fails to characterize the unified nature of HoT-HoP, the same is true for HomP-HetT.

(82) Examples of a single process used in different environments

∅	→	ɛ / #[liquid]____C	/lv/	→	[lɛv]
∅	→	ɛ / C____[liquid]#	čí/sl/	→	čí[sɛl]
∅	→	ɛ / #C_i+____C_i	/z z/emě	→	[zɛ z]emě
…					
∅	→	ɛ / C____C#	hu/db-ɲ/í	→	hu[dɛbɲ]í

Again, this list of rules does not capture the relationship between them, namely that [ɛ] epenthesis is a single process that is triggered by many different conditions (HomP-HetT).

The advantage of OT is therefore clear: it eliminates the conspiratorial nature of rules (Kisseberth 1970). OT allows the relationship between the rules – i.e. the single repair process employed by all – to be expressed formally.

(83) 'The output orientation of OT is closely linked to another property of the theory, the decoupling of the operational side of a process from the conditions that trigger or block the operation. Taken together, these properties lead to a basic typological claim of OT, which I have been calling homogeneity of target/heterogeneity of process.' McCarthy (1995:93)

This decoupling also allows for another typological process: HomP-HetT. Neither HoT-HoP nor HomP-HetT can be accurately characterized by a rule-based theory because each rule is independent of all others, with its application determined by the input alone. The output-driven model of OT allows for parallels to be drawn between outputs. Outputs and inputs are related through faithfulness correspondence, but the two are not bound to one another to the exclusion of all other linguistic data.

Nor is a rule-based theory capable of accounting for all the data presented in this analysis. There are certain phenomena which cannot be formally explained due to locality. Locality is a principle of rule-based theory which says that a rule can only relate to adjacent elements (Kenstowicz 1994:343). Several rules must thus be discarded for ill-formedness due to a non-local reference.

(84) Non-local references

∅	→	ɛ / #C_i+____ C_i	/z z/emě	→	[zɛ z]emě
∅	→	ɛ / C____C#	hu/db-ɲ/í	→	hu[dɛbɲ]í
∅	→	ɛ / #C____C#	/dn/	→	[dɛn]

Each of these rules exhibits a non-local effect where a non-adjacent segment – here, a distant word boundary – is required for a faithful representation. For instance, the word boundary is crucial in ∅ → ε / #C_i+____ C_i, for it is not the case that all bimorphemic geminates are broken up by [ε] epenthesis: C_i → ∅ / C_i+____C_i as in be/z z/emě → be[∅ z]emě. It is only due to a (non-local) word boundary that epenthesis occurs. Moreover, these two separate rules on geminate clusters completely miss the point: the main goal of both processes is preventing a geminate, and deletion can be blocked in favor of epenthesis to allow overt realization of the morpheme.

The final drawback of a rule-based approach deals with clarity of representation. As an example, the inventory of coda clusters is very limited in Czech, and bad clusters are repaired with epenthesis (see §6). To represent this fact many rules are needed, growing successively specific.

(85) Rule-based analysis of epenthesis to repair bad coda clusters

∅	→	ε / [stop]____C#	lá/tk/	→	lá[tɛk]
∅	→	ε / [nasal]____C#	la/nk/	→	la[nɛk]
…					
∅	→	ε / l____C#	pa/lm/	→	pa[lɛm]
…					
∅	→	ε / s____[nasal]	pi/sm/	→	pi[sɛm]
∅	→	ε / s____[liquid]	čí/sl/	→	čí[sɛl]
…					
∅	→	ε / s____k	vrá/sk/	→	vrá[sɛk]

Ignoring the fact that each of these rules is already faulty due to a non-local effect, it is clear that an analysis such as this quickly grows out of hand – and the data above are only a portion of that governing native clusters, not to mention the different rules provided for loanwords. Additionally, the rules above fail to recognize their commonality, that each one is a manifestation of the same process. OT can provide simple constraints on cluster formation (in Czech, AGREE(voice), OCP(place), OCP(manner), *{KP}{KP}) and indicate through the constraint ranking that epenthesis of [ε] is the method of repair for any bad consonant cluster (see §6 for a full analysis). Not only is the OT approach more elegant, but it can also provide insight into the formal relationship between the phenomena.

This section showed that an OT analysis of Czech mobile ‘e’ is superior for two important reasons. First, it can formally account for all of the data, while a rule-based theory stumbles over non-local effects. Second, OT provides a unified model of analysis and formal representation, recognizing that a single target can trigger different methods of repair (HoT-HoP) and that a single process can serve to many different ends (HomP-HetT).

7.2 Yers and Havlík’s law

Traditionally, the analysis of Czech mobile ‘e’ has been explained not in synchronic terms, but by historical accounts. While historical accounts can describe and sometimes explain past phonological changes, once a change is completed the motivating processes are no longer relative to a modern speaker. This follows directly from the Saussurean opposition of synchrony and diachrony:

(86)‘The first thing that strikes us when we study the facts of language is that their succession in time does not exist insofar as the speaker is concerned. He is confronted with a state. That is why the linguist who wishes to understand a state must discard all knowledge of everything that produced it and ignore diachrony. He can enter the mind of speakers only by completely suppressing the past. The intervention of history can only falsify his judgment.’

(Saussure 1974, *Cours* 81)

History can clarify the origins of the modern-day system, but it does not give insight into the phonology constructed by a modern speaker ignorant of the language spoken before his or her lifetime.

The historical account is based on the system of ‘yer’ vowels, also known as ‘ultra short vowels’ or *neurčité vokály* (‘indefinite vowels’) (Komárek 1962). These vowels had both ‘soft’ (palatalizing) and ‘hard’ forms, represented with ĭ and ŭ or ь and ъ, respectively. This report will use the Cyrillic characters in the Slavicist tradition.

Yers were originally found word-finally in every token of the language, but with time the weak yers were reduced and then deleted from Czech (Shevelov 1964, Ch. 29). This shift, characterized by the Havlík(-Gebauer) rule, probably occurred some time in the 10th century. This rule specifies that single yers were completely deleted from Czech: [rokъ̲], [sluʒь̲ba] = [rok], [sluʒba]. However, if more than one yer was found in a given Old Czech word, the yers were deleted from every odd syllable, counting from the end (Gregor 1937). Today the vowel [ɛ] is the reflex for the remaining strong yers, irrespective of whether they were originally ь or ъ.

(87) Havlík's law

(a) šь̲vь̲cь̲ (OCz) > švec (MoCz) [ʃvɛt͡s] 'cobbler'
3 2 1

(b) dь̲nь̲sь̲ > dnes [dnɛs] 'today
3 2 1

(c) vь̲sь̲ > ves [vɛs] 'village'
2 1

(d) sъ̲nъ̲ > sen [sɛn] 'dream'
2 1

However, not all modern cases of epenthetic [ɛ] have their roots in this historical process. Cases of analogy, or what Short calls 'the Czech tendency to adjust forms in favour of morphemic consistency [sic]' (1993), indicate that Havlík's rule soon evolved into a new phonology.

(88) Mobile 'e' based on 'analogy'; not historically attested

[ka:zn̩] (OCz) > [ka:zɛɲ] (MoCz)	'discipline'	cf. (67c, d)
[vɛsl̩] > [vɛsɛl]	'happiness'	cf. (67c, d)
[zbɛru] > [sɛbɛru]	'I carry'	cf. *sebrat* 'to carry'

Once the 'weak' yers were made completely obsolete through consistent deletion, new speakers had no historical form for comparison to which they could attribute the mobile 'e'. Instead they constructed a different phonology explaining the appearance of the ghost vowel, much like the one I have presented in the preceding sections. Because this phonology was not historically-based, but evidence-based, it provided fertile ground for correcting the 'mistakes' found in forms which historically had had no yers.

7.3 No analysis

Another possible analysis is that the synchronic situation is 'unpredictable' (Scheer 2001b). However, the preceding chapters have hopefully proven this statement inaccurate. [ɛ] epenthesis patterns itself in controlled, predictable environments salient throughout the language.

The process of mobile 'e' is still active in the phonology of a native speaker. Informants consistently decline cases of mobile 'e' in the manner predicted by this analysis. This cannot be a case of wide-spread lexicalization, either, because nonsense words were declined in the predicted patterns as well.

Subjects were given short written situations introducing a phonotactically plausible nonsense word. Then another declension of the word was elicited by a fill-in-the-blank where subjects were free to write what they felt to be the 'correct' answer.

(89) Example sentences testing the application of mobile 'e' in nonsense words – case markings added here for clarity

a. 'I have a friend named 'Távek' (NOM SING). I can see him over there. I see ___________.' (eliciting GEN SING)

b. 'There is a new candy called 'batko' (NOM SING). I went to the store yesterday, and now I have a lot of ____________.' (eliciting GEN PL)

The subjects completed all tasks 'successfully', providing the answers (a) *Távka* and (b) *batek*. The experiment was very small scale, consisting of 6 elicitations like the samples above with responses from two informants. It was a simple, informal test to see if native speakers declined mobile 'e' as predicted by this analysis.

The results show that epenthesis cannot be random. Native speakers must have some kind of phonology in their heads, allowing them to predictably apply [ɛ] epenthesis in the appropriate environments.

8 Conclusions

This thesis showed that the nature of HoT-HoP, where a single target is realized by different means, is effectively complemented by a system in which different goals are all met by the same process, dubbed here HomP-HetT. The empirical difference between the two is the ranking of blocking constraints. HoT-HoP has higher ranked blockers which discriminate between two or more faithfulness constraints allowing for the emergence of different repair processes. HomP-HetT has lower ranked blocking constraints such that a given violation of FAITH is never blocked and so only one repair operation is used in response to several markedness violations.

These two systems can also be integrated into one, using the blocking constraint(s) as a pivot point. In this integrated model, the lower ranked faithfulness constraint can be blocked, allowing for the emergence of other repair operations (HoT-HoP). However, no other blocking constraints have dominance over the higher ranked faithfulness constraint; when the lower ranked F_1 is blocked, then the higher ranked F_2 becomes the only repair operation serving to meet multiple targets (HomP-HetT). Therefore in the integrated model, a case of HomP-HetT is also necessarily a case of HoT-HoP in the first instance.

A case study of the integration of HoT-HoP and HomP-HetT can be found in the Czech process of mobile or epenthetic [ɛ]. The model integrating the two is reproduced here for clarity.

(90) *HomP-HetT*

M_1
$M_2\ldots$, F_3 » F_2 » B_1 » F_1
M_n

HoT-HoP

A particularly clear example of this case in Czech can be found in the case of geminate clusters (see §4). The constraints at work here fit into the schema thus:

(91) *HomP-HetT*

*geminate, IDENT(place) » DEP » MORPHREAL » MAX

HoT-HoP

Because deletion is the first course of repair in Czech, any case in which [ɛ] is epenthesized entails a case of HoP-HoT. Deletion (F_1) is carried out in cases where it is not blocked: be/z z/emě → be[∅ z]emě. But when F_1 is blocked, then epenthesis(F_2) emerges, giving us our case of HoT-HoP: /z z/emě → [zɛ z]emě. Because this epenthesis of [ɛ] is used as a repair method to meet many targets, this is our case of HomP-HetT.

Only one markedness constraint, *geminate, is included here because HomP-HetT and HoT-HoP are being examined in a single environment. However, any other markedness constraint spurring epenthesis of [ɛ] – *P/nasal+, FINAL-C(root), ONSET, AGREE(voice), OCP(place), OCP(manner), *{KP}{KP} – joins *geminate at the far lefthand side as one of the targets met by epenthetic [ɛ]. See the respective sections one these constraints for more information on their role in HomP-HetT.

Looking at the complete ranking for this analysis (see Appendix III), we see that MORPHREAL(B_1) actually outranks DEP(F_2). This is in slight contrast with the schema for HomP-HetT given in (90). However, it does not matter where the blocker ranks in respect to DEP(F_2), so long as MORPHREAL(B_1) serves to block MAX(F_1).

Epenthetic [ɛ] is a case of default epenthesis because the quality of the epenthetic segment is not influenced by adjacent segments. As epenthetic segments have no input, there are no faithfulness constraints influencing the output form (McCarthy & Prince 1994). Therefore, markedness constraints alone have sway over the quality of the epenthetic segment. In such a situation, the typical epenthetic vowel is either the least marked vowel, with the highest sonority – here, [a] – or the most marked vowel, with the lowest sonority – here, [i] (de Lacy 2002). Because of the vowel markedness hierarchy a > i > e, epenthetic [ɛ] can only emerge through combined effects preventing outputs of the two markedness extremes. To delve too deeply into this subject would take the discussion too far from the point here, but the process is explained in greater depth in de Lacy (2002, Ch 4).

Strictly speaking, [ɛ] is not the only epenthetic segment. For historical reasons, the epenthetic vowel after the preposition *k* /k/ before a labial onset is [u]. However, this process is no longer active and to my knowledge only occurs in two lexicalized forms: /k pr/ospěchu 'to the benefit (of)' → [ku pr]ospěchu and /k př/íkladu 'for example' → [ku př]íkladu (today usually avoided for the form *například.*) Other non-lexicalized forms take the epenthetic segment [ɛ]: /k pr/odavačce → [kɛ pr]odavačce.

Further directions of research include greater explanation of the processes behind consonant cluster formation, as well as motives behind the varying levels of acceptability for onset and coda clusters.

Basic experiments were run to explore the level to which the phonology of mobile 'e' was active: Were the variations lexicalized, or could they be expanded to include 'correct' derivations of nonsense words? To this end, native speakers indeed inflected words in a style consistent with the analysis presented here, and it would be interesting to explore this system of 'improvisation' with nonsense words in greater depth.

Other research, only tangential to this analysis, includes voicing directionality with particular respect to the phonemes /v/ and /ř/.

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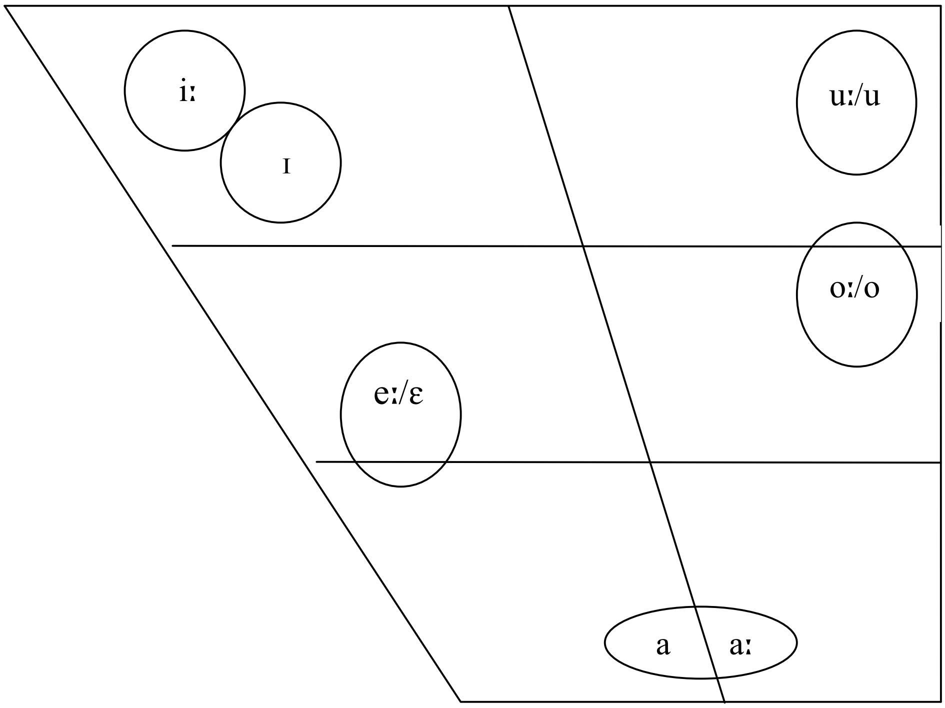
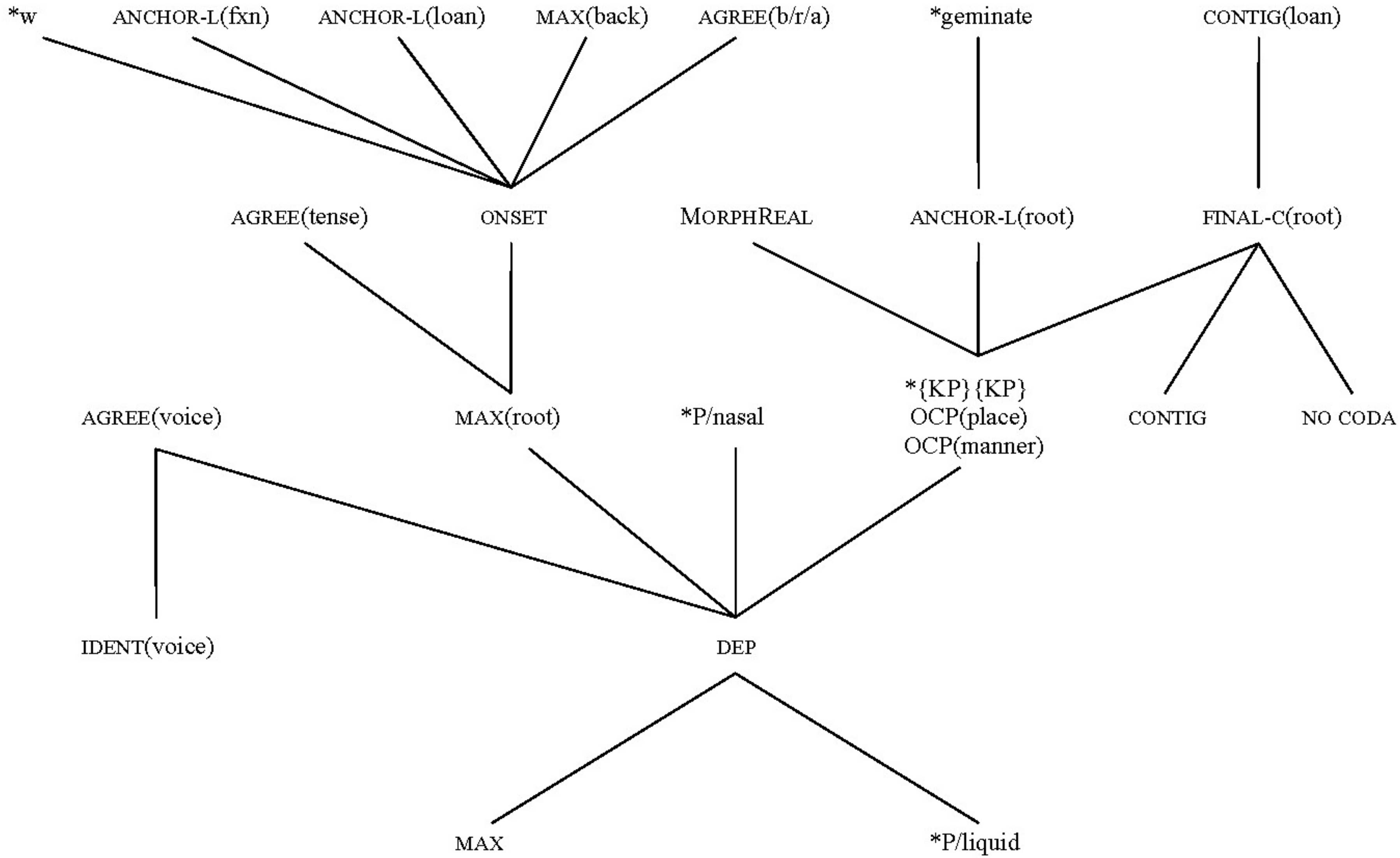
Appendix I: Vowel parallelogram after Dankovicová (1999:72)



Appendix II: Consonantal inventory adapted from Dankovicová (1999:70)

	Bilabial	Labiodental	Alveolar	Postalveolar	Palatal	Velar	Glottal
Plosive	p b		t d		c ɟ	k g	
Nasal	m		n		ɲ		
Fricative		f v	s z	ʃ ʒ		x	ɦ
Affricate			t͡s	t͡ʃ d͡ʒ			
Trill			r ř				
Approximant					j		
Lateral Approximant			l				


*w
ANCHOR-L(fxn)
ANCHOR-L(loan)
MAX(back)
AGREE(b/r/a)
*geminate
CONTIG(loan)
AGREE(tense)
ONSET
MORPHREAL
ANCHOR-L(root)
FINAL-C(root)
AGREE(voice)
MAX(root)
*P/nasal
*{KP}{KP}
OCP(place)
OCP(manner)
CONTIG
NO CODA
IDENT(voice)
DEP
MAX
*P/liquid