CHAPTER 3

VOWEL DELETION IN LATVIAN

Vowels in final unstressed syllables are subject to variable deletion in Latvian (Karinš, 1995a).[1] The word *taka* “path” can therefore be pronounced as either [tá.ka] or [ták]. This deletion pattern is not random, but is strongly influenced by grammar. One of the most robust phonological factors that influence the likelihood of deletion is the length of the word – a vowel is more likely to delete from a tri-syllabic word than from a bi-syllabic word. In this chapter I provide an analysis of this variable deletion pattern within the rank-ordering model of EVAL. The main purpose of this chapter is not to give a full account of this phenomenon in Latvian, but rather to illustrate how the rank-ordering model of EVAL applies to variable processes. The focus of the discussion will therefore be more on the theoretical assumptions that I make than on the actual analysis of Latvian. Since the phenomenon of vowel deletion in Latvian is relatively simple, it lends itself to such a treatment. In the next two chapters I discuss two more complicated examples of variable phenomena (vowel deletion in Faialense Portuguese and final [t, d]-deletion in English). In these two later chapters, the focus is less on explaining how the rank-ordering model of EVAL works and more on the actual analysis of the phenomena.

The rest of this chapter is structured as follows: In §1 I introduce the data on variable vowel deletion in Latvian. An analysis of this phenomenon is then presented in §2. I postpone a discussion of alternative accounts of variation until the end of the section of the dissertation that deals with variable phenomena (Chapter 5 §3).

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[1] I presented an earlier version of this chapter at the MIT Phonology Circle. The analysis presented here benefited greatly from discussions with the members of this group.

1. The data

Latvian builds syllabic trochees from the left edge of the word. The initial foot is the head foot so that stress falls on the initial syllable of a word (Karinš, 1995a, 1995b). The result of this is that in both bi-syllabic and tri-syllabic words, the final syllable is unstressed, and therefore occurs in a prosodically weak position.

(1) **Bi- and tri-syllabic words in Latvian**

(tá.ka)	‘path’	(pá.zi)nu	‘I knew’
(trá.ki)	‘crazy’	(bá.lo)dis	‘pigeon’

In the Riga dialect of Latvian all vowels in final unstressed syllables are subject to variable deletion. As a result of this, polysyllabic words in Latvian have two grammatical pronunciations. In (2) I give a few examples. These examples are from Karinš (1995a:18).

(2) **Variable deletion of final unstressed vowels in Latvian**

/spligti/	→	[spligti] ~ [spligt]	‘dazzling’ (m. pl.)
/pele/	→	[pele] ~ [pel]	‘mouse’
/spligtas/	→	[spligtas] ~ [spligts]	‘dazzling’ (f. pl.)
/vajag/	→	[vajag] ~ [vaig]	‘need’
/sakne/	→	[sák.ne]~[sa.kn̥]	‘root’ (f. sg.)

This deletion process is not random, but is strongly influenced by phonology. Karinš (1995a) identifies several phonological factors that co-determine the likelihood that a vowel will delete. One of the most significant is the length of the word – a vowel is more likely to delete from a tri-syllabic than from a bi-syllabic word. I will focus on this aspect of the phenomenon here. The table in (3) contains the data on the likelihood of deletion from bi- and tri-syllabic words. The data are from Karinš (1995a:21).

(3) **Variable vowel deletion in bi- and tri-syllabic words in Latvian**[2, 3]

	n	**Retained**	**Deleted**	**% deleted**
Bi-syllabic	1,389	264	1,125	81
Tri-syllabic	743	59	684	92

In this dissertation I propose two changes in the way that we think about EVAL. First, I propose that EVAL imposes a rank-ordering on the full candidate set and does not distinguish only between the winner and the mass of losers. Secondly, I propose that EVAL can compare morphologically unrelated forms with each other. In the rest of this chapter I will show how we can use these two extensions to EVAL to account for the variable deletion pattern exemplified in (3).

2. The analysis

There are three aspects of the variation pattern in (3) that we need to account for. These are: (i) *Intra-contextual variation*. For both a bi-syllabic and a tri-syllabic input there are two variants – one with deletion of the final unstressed vowel and one with retention of this vowel. Of these two variants the deletion variant is the more frequently observed. This is what I will refer as "intra-contextual variation". We need to account for the fact that for any given input one of the variants is observed more frequently than the other. I

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[2] These data are based on recordings of 8 Latvian speakers that Karinš made in Riga in 1991.

[3] Karinš (1995a:27) reports that the difference between the deletion rates in these two classes was significant for all of his subjects.

discuss this aspect of the variation pattern in §2.1. (ii) *Inter-contextual variation*. Although deletion is the most frequent variant for both bi-syllabic and tri-syllabic forms, deletion is observed more frequently in tri-syllabic contexts than in bi-syllabic contexts. This variation between contexts is discussed in §2.2. (iii) *Limits on variation*. Only two variants are observed – either retention or deletion of the vowel. But there are more ways than just deletion to avoid a final unstressed vowel – for instance, it is also possible to assign secondary stress to the final vowel. We need to explain why other variants such as these are never observed. This is discussed in §2.3. This chapter then ends with a discussion of ranking arguments (McCarthy, 2002b:4-5) in §2.4. Under the rank-ordering model of EVAL, the notion of a ranking argument has to be redefined. Finally, I summarize the analysis in §2.5.

2.1 Intra-contextual variation: more deletion than retention

My basic argument is the following: EVAL imposes a harmonic ordering on the full candidate set, and language users have access to all levels of this fully ordered set. However, the accessibility of a candidate is directly related to how high it occurs on this harmonic ordering. The candidate rated best by EVAL (occurring highest in the harmonic ordering = the optimal candidate of classic OT), is the most accessible; the candidate rated second best is the second most accessible; etc.

Returning to the Latvian example: Vowels from final unstressed syllables can be realized in one of two ways. They can be faithfully preserved in pronunciation, or they can delete. As the data in the table in (3) show, the deletion candidate is observed more frequently than the faithful candidate in both bi- and tri-syllabic words. For both of these two kinds of words EVAL therefore has to rate the deletion candidate better than the retention candidate, i.e. |∅ ™ v̆|.[4] This can be achieved if the highest ranked constraint that disfavors the retention candidate outranks the highest ranked constraint that disfavors the deletion candidate.[5] At this point it is therefore necessary to determine the constraints that are violated by the retention and the deletion candidates. For the deletion candidate, this is easy – it violates the anti-deletion constraint MAX. I propose that the constraints that drive deletion are different for the bi-syllabic and the tri-syllabic forms. Deletion in bi-syllabic forms is driven by a constraint against vowels in unstressed final syllables. Deletion in tri-syllabic forms is driven by a constraint that requires all syllables to be parsed into higher prosodic structure. I discuss the bi-syllabic forms first, and I begin by defining the constraint that drives deletion in these forms in (4).

(4) ***v̆]$_{\sigma}$]$_{\omega}$**

Do not allow a vowel in an unstressed prosodic word-final syllable.

It is well established that vowels are marked/avoided in prosodically weak positions. This is often the driving force behind vowel reduction and deletion – see for instance Crosswhite (2000a, 2000b, 2001) and the discussion of Faialense Portuguese in Chapter 4 of this dissertation. In a language like Latvian with initial stress, the word final syllable is arguably the prosodically weakest position. It is therefore not surprising that this is the position in which vowels are deleted.

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[4] Throughout the discussion I will use ∅ to stand for the deletion candidate and [v̆] for the retention candidate.

[5] The idea of constraints favoring or disfavoring a candidate comes from Samek-Lodovici and Prince (1999). Let $C(x)$ represent the number of violations constraint C assigns to candidate x, and K the set of all candidates under consideration. For some candidate *Can* to be favored by constraint C, the following statement must then be true: $\neg\exists\ k \in K\ (C(k) < C(Can))$. Conversely, for some candidate *Can* to be disfavored by constraint C, the following statement must be true: $\exists\ k \in K\ (C(k) < C(Can))$.

We have to answer two questions about the constraint in (4). (i) Why is this constraint formulated as a constraint against vowels in unstressed, prosodic word-final syllables? Why is it not rather formulated as a constraint against unstressed vowels in prosodic word-final position? There are several examples of languages that delete vowels from absolute final position in prosodic words – see the discussion in Chapter 4 §3.2.2. The reason for this is that Latvian deletes vowels even from closed final unstressed syllables. See for instance the word *spligtas* ‘dazzling’ (f. pl.) from (2) above. The vowel from the final syllable of this word is also subject to deletion, so that this word can be pronounced as [splígts]. It is therefore necessary that the operative constraint is violated also by an unstressed vowel that is not in absolute final position in a prosodic word. (ii) Why do we not simply state this as a constraint against final unstressed syllables? The reason for this is that the deletion of the vowel from the final unstressed syllable does not always result in deletion of the final syllable. When the unstressed vowel is followed by a nasal or liquid, the nasal or liquid becomes syllabic so that syllable count of the word does not change. See for instance the word *sakne* ‘root’ from (2) above. The final nasal of this word syllabifies when the vowel deletes so that it is pronounced as [sa.kn̥].[6]

The retention candidate therefore violates the markedness constraint $*\check{v}]_{\sigma}]_{\omega}$ and the deletion candidate violates MAX. Under the ranking $||*\check{v}]_{\sigma}]_{\omega}$ o MAX||,[7] the deletion candidate violates the lower ranking constraint and will therefore be rated as better by

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[6] This is echoed in English – vowels from unstressed word final syllables often delete when followed by liquids/nasals. The liquid/nasal then becomes syllabic. See for instance *battle* pronounced as [bætl̥] and *even* pronounced as [i:vn̥].

[7] On the motivation for this ranking, see the discussion on ranking arguments in §2.4 below.

EVAL. This is shown in the tableaux in (5). On the typographical conventions used in the tableau, see Chapter 1 §2.2.1.

(5) **Deletion preferred over retention in bi-syllabic forms**

			$*\check{v}]_\sigma]_\omega$	MAX
/taka/	2	(tá.ka)	*	
	1	(ták)		*

Output of EVAL

L ták $_{\text{MAX}}$
|
L tá.ka $_{*\check{v}]\sigma]\omega}$

The deletion candidate violates MAX, and the retention candidate violates $*\check{v}]_\sigma]_\omega$. However, because of the ranking ||$*\check{v}]_\sigma]_\omega$ o MAX||, EVAL rates the deletion candidate better than the retention candidate. EVAL therefore imposes the following rank-ordering on the candidate set: |∅ ™ v̌|. The language user now has access to both of these candidates via the rank-ordering that EVAL imposes on the candidate set. However, the likelihood that the language user will actually access a candidate depends on the position that the candidate occupies in the rank-ordering. The higher a candidate appears in the rank-ordering, the more likely it is that the language user will access it as output. Since the deletion candidate appears higher than the retention candidate, the prediction is that the language user will be more likely to select the deletion candidate as output. We therefore expect to see the deletion variant more frequently than the retention variant.

Now consider tri-syllabic forms. When the final unstressed vowel is deleted from a tri-syllabic form, a bi-syllabic form with an unstressed vowel in the final syllable results. To make this concrete, consider the form *pazinu* ‘I knew’. This form has two pronunciations: the faithful retention form [(pá.zi)nu] and the unfaithful deletion form [(pá.zin)]. Both of these forms have a vowel in a final unstressed syllable, and both of them therefore violate $*\check{v}]_\sigma]_\omega$. It cannot be this constraint that drives deletion in tri-syllabic forms. However, there is another difference between retention and the deletion forms. The retention variant has a final syllable that is not parsed into a foot and therefore earns a violation in terms of the constraint PARSE-σ that requires every syllable to be parsed into a foot. I claim that it is PARSE-σ that drives deletion in tri-syllables. Since tri-syllables also show more deletion than retention, we need the deletion candidate to be rated better than the retention candidate by EVAL. This can be achieved if the highest ranked constraint that disfavors retention outranks the highest ranked constraint that disfavors deletion – i.e. we need the ranking ||PARSE-σ o MAX||.[8] This is illustrated in the tableau in (6).

(6) **Deletion preferred over retention in tri-syllabic forms**

			PARSE-σ	$*\check{v}]_\sigma]_\omega$	MAX
/pazinu/	2	(pá.zi)nu	*	*	
	1	(pá.zin)		*	*

Output of EVAL

L (pá.zin) MAX

|

L (pá.zi)nu PARSE-σ

Both the retention and the deletion candidate violate $*\check{v}]_\sigma]_\omega$ and this constraint therefore does not distinguish between the two candidates. However, the retention candidate violates PARSE-σ while the deletion candidate violates MAX. Because of the ranking ||PARSE-σ o MAX|| EVAL rates the deletion candidate better than the retention candidate – i.e. |∅ ™ v̌|. The deletion candidate consequently occupies a higher slot in the rank-ordering that EVAL imposes on the candidate set, is more accessible as output, and is predicted to be the more frequently observed variant.

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[8] See the discussion in §2.4 for more discussion about the motivation for this ranking.

This analysis accounts for the following two facts: (i) that variation is observed – by allowing language users access to candidates beneath the best candidate; (ii) that deletion is more frequent than retention – since the deletion candidate occupies a higher slot in the rank-ordered candidate set and is therefore more accessible.

2.2 Inter-contextual variation: more deletion in tri-syllabic than in bi-syllabic words

Even though we can now account for the fact that deletion is observed more often than retention in both bi- and tri-syllabic forms, we still have to account for the fact that tri-syllabic words are associated with a higher deletion rate than bi-syllabic words. To account for this, I call on the ability of EVAL to make comparisons between morphologically unrelated forms. The non-deletion candidate of a tri-syllabic word is more marked than the non-deletion candidate of a bi-syllabic word, and the drive to delete is therefore stronger in tri-syllabic words. In order to account for this we have to consider the non-generated comparison set that contains the faithful candidates from bi-syllabic and tri-syllabic inputs.

The fully faithful candidates from tri-syllabic and bi-syllabic inputs have the following form: [(σ́.σ)σ] and [(σ́.σ)] – cf. [(pá.zi)nu] and [(tá.ka)]. Both of these forms violate $*\breve{v}]_{\sigma}]_{\omega}$, and this constraint can therefore not distinguish between them. However, the tri-syllabic form also violates the constraint PARSE-σ that requires all syllables to be parsed into feet. Because of its final unfooted syllable, the faithful candidate of a tri-syllabic word is more marked than the faithful candidate of a bi-syllabic word. This explains why tri-syllabic words are associated with higher deletion rates – a faithful tri-syllabic word is more marked than a faithful bi-syllabic word, and therefore the drive to delete is stronger in tri-syllabic words. This is shown in the tableau in (7).

(7) **Non-generated comparison set containing the faithful candidates of a bi-syllabic and a tri-syllabic input**

		PARSE-σ	*v̌]$_{\sigma}$]$_{\omega}$	MAX
1	(tá.ka)		*	
2	(pá.zi)nu	*	*	

Output of EVAL

(tá.ka)

│

(pá.zi)nu$_{\text{PARSE-}\sigma}$

By allowing EVAL to compare forms that are not related to each other via a shared input, we can formally capture the intuition that retention of the unstressed vowel is more marked in tri-syllabic forms than in bi-syllabic forms.

2.3 Limits on variation

Up to this point in the discussion I have considered only two candidates for each input – namely a faithful retention candidate and an unfaithful deletion candidate. However, the generated candidate sets undoubtedly contain many more candidates than just these two. Under the rank-ordering model of EVAL, each of these candidates will occupy a slot in the rank-ordering. And under the assumption that the language user has access to levels below the highest level in this ordering, we predict that these other candidates should also be observed as variants. This problem becomes particularly acute when we consider candidates other than the deletion candidate that also avoid violation of the deletion inducing constraints *v̌]$_{\sigma}$]$_{\omega}$ and PARSE-σ. For the purposes of the illustration here I will discuss only one example of this kind of candidate, namely candidates that impose an alternative foot structure on the output.

I will explain in two steps how the non-observed forms are ruled out. First, I will show that these forms are less well-formed than the two variants that are observed (the retention and the deletion candidate). The non-observed forms will therefore occupy a lower slot in the rank-ordering that EVAL imposes on the candidate set. Even had they been observed as variants, the prediction would then be that they will be observed less frequently than the retention and the deletion candidates. After this has been established, I will introduce the notion of the “critical cut-off”. The critical cut-off is a position on the constraint hierarchy that represents a line that is crossed only under great duress – only when no other options are available will the language user be willing to access candidates eliminated by constraints ranked higher than the cut-off. I will then argue that the non-observed forms are all eliminated by constraints ranked higher than the cut-off, and that this explains why they are never accessed as variant outputs.

(8) **Other candidates that avoid a *v̆]$_\sigma$]$_\omega$-violation**

Input	**Observed**	**Not observed**
/taka/	[(ták)]	*[(tá)(kà)]
/pazinu/	[(pá.zin)]	*[(pá.zi)(nù)]

First, let us consider why the un-observed forms from the right hand column in (8) are less well-formed than the faithful retention candidate and the deletion candidate. As I mentioned in §1, Latvian feet are syllabic trochees. This means that Latvian feet are preferably bi-syllabic. The preference for bi-syllabic feet can be enforced by the constraint FTBIN-σ which is violated by any mono-syllabic (degenerate) foot. The un-observed forms in the right hand column of (8) all have such degenerate feet and therefore all violate FTBIN-σ. Initially it therefore seems that this constraint could account for the fact that these forms are less well-formed than the forms that are actually attested. However, there is a complication – Latvian does tolerate degenerate feet. There are many mono-syllabic words in Latvian, and these words are not augmented by epenthesis in order to create bi-syllabic feet. Also, when a vowel is deleted from a bi-syllabic word, it is usually the case that a mono-syllabic form is created. And vowels delete very often from bi-syllabic forms. In fact, one of the examples in (8) shows this – the form /taka/ can be pronounced as [(ták)]. Latvian does therefore tolerate degenerate mono-syllabic feet.

However, Latvian tolerates mono-syllabic feet only in strong positions – i.e. only if the foot happens to be the foot that carries the main stress of the prosodic word, can it be a mono-syllabic foot. The result is that the only mono-syllabic feet tolerated in Latvian are in mono-syllabic prosodic words. The single syllable in these forms is then parsed into a foot, which, since it is the only foot, is also the main foot and therefore receives main stress. No foot that receives only secondary stress can ever be mono-syllabic. This is a very well documented cross-linguistic pattern. In fact, Hayes (1995:87) claims that languages can be divided into two classes – those that do not allow degenerate feet al all, and those that allow degenerate feet only in strong position (i.e. if the foot is also the main foot of a prosodic word). Based on this fact, I propose that there are actually two versions of the foot binarity constraint – one that applies to all feet and one that applies only to feet that do not function as the head of some prosodic word. Latvian tolerates violation of the general constraint – mono-syllabic words are tolerated because in these forms the single syllable is parsed into the head foot of the prosodic word. Latvian does not tolerate violation of the constraint against non-head degenerate feet – this is why a form with an uneven number of syllables always ends in an unfooted syllable.

(9) **Foot binarity constraints**

FTBIN-σ

Feet are bi-syllabic.

FTBIN-$\sigma_{\text{Non-main foot}}$

A foot that is not the head of a prosodic word is bi-syllabic.

We now have to figure out where these two foot binarity constraints should be ranked. Let us start with the general constraint FTBIN-σ. We can show that this constraint must rank below $*\check{v}]_{\sigma}]_{\omega}$, i.e. $||*\check{v}]_{\sigma}]_{\omega}$ o FTBIN-σ||. A bi-syllabic input such as /taka/ can be pronounced with or without its final vowel, i.e. as [(tá.ka)] or as [(ták)]. The retention candidate [(tá.ka)] violates only $*\check{v}]_{\sigma}]_{\omega}$, while the deletion candidate [(ták)] violates both MAX and FTBIN-σ. Of these two variant pronunciations the deletion candidate is the more frequently observed variant. This means that EVAL should rate this candidate better than the retention candidate. This, in turn, is only possible if the highest ranked constraint that disfavors the retention candidate is ranked higher than the highest ranked constraint that disfavors the deletion candidate. This means that we need the ranking $||*\check{v}]_{\sigma}]_{\omega}$ o {MAX, FTBIN-σ}||. I have already argued for the ranking $||*\check{v}]_{\sigma}]_{\omega}$ o MAX|| in §2.1 above. The only new ranking that we need to add is that between $*\check{v}]_{\sigma}]_{\omega}$ and FTBIN-σ. The need for this ranking is shown in the tableau in (10).[9]

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[9] There is no evidence for the ranking ||FTBIN-σ o MAX||. However, throughout this dissertation I follow the principle of "ranking conservatism" (Itô and Mester, 1999, 2003, Tesar and Smolensky, 1998, 2000). This principle is based on the assumption that the original state of the grammar has the ranking ||Markedness o Faithfulness|| (Smolensky, 1996). The claim is that this ranking should be preserved unless there is evidence to contrary. I will therefore rank faithfulness constraints as low as possible, promoting them to above a markedness constraint only if there is positive evidence for this.

(10) **||$*\check{v}]_{\sigma}]_{\omega}$ o FTBIN-σ||**

			$*\check{v}]_{\sigma}]_{\omega}$	FTBIN-σ	MAX
/taka/	1	(ták)		*	*
	2	(tá.ka)	*		

Output of EVAL

L (ták) FTBIN-σ

|

L (tá.ka) $*\check{v}]\sigma]\omega$

The faithful candidate violates $*\check{v}]_{\sigma}]_{\omega}$, and the deletion candidate violates FTBIN-σ. However, because of the ranking ||$*\check{v}]_{\sigma}]_{\omega}$ o FTBIN-σ|| EVAL rates the deletion candidate better, and imposes the following ordering on the candidate set: |∅ ™ v̌|. The deletion candidate therefore occupies a higher slot in the rank-ordering and is more accessible. From this follows that it would be observed more frequently as output.

Now we can consider where the constraint FTBIN-σ$_{\text{Non-main foot}}$ should be ranked. This time consider a tri-syllabic input such as /pazinu/. One of the variant pronunciations for this input is the faithful preservation candidate [(pá.zi)nu] that violates $*\check{v}]_{\sigma}]_{\omega}$ and PARSE-σ. The candidate that imposes an alternative foot structure on the output, i.e. [(pá.zi)(nù)], is not observed. Of the constraints that we are dealing with here, this non-observed form violates only FTBIN-σ$_{\text{Non-main foot}}$. If we think in terms of variation about the fact that [(pá.zi)(nù)] is never observed, we can say that [(pá.zi)(nù)] is observed less frequently than the variants [(pá.zi)nu] – in fact [(pá.zi)(nù)] is never observed while [(pá.zi)nu] is sometimes observed. This would require that [(pá.zi)(nù)] occupies a lower slot in the rank-ordering that EVAL imposes on the candidate set than [(pá.zi)nu]. This can be achieved if the highest ranked constraint that disfavors [(pá.zi)(nù)] outranks the highest ranked constraint that disfavors [(pá.zi)nu] – i.e. we need FTBIN-σ$_{\text{Non-main foot}}$ to outrank $*\check{v}]_{\sigma}]_{\omega}$, and PARSE-σ. This is shown in the tableau in (11).

(11) **||FtBin-σ$_{\text{Non-main foot}}$ o {Parse-σ, *v̌]$_{\sigma}$]$_{\omega}$}||**

			FtBin-σ Non-main foot	Parse-σ	*v̌]$_{\sigma}$]$_{\omega}$
/pazinu/	1	(pá.zi)nu		*	*
	2	(pá.zi)(nù)	*		

Output of EVAL

L (pá.zi)nu {Parse-σ, *v̌]σ]ω}

|

(pá.zi)(nù) FtBin-σNon-main foot

We now have the ranking ||FtBin-σ$_{\text{Non-main foot}}$ o {Parse-σ, *v̌]$_{\sigma}$]$_{\omega}$} o FtBin-σ o Max||. With this ranking we can show that the non-observed forms (with degenerate non-head feet) are less well-formed than the observed variants. The non-observed forms do occupy a slot in the rank-ordering, but they will always occupy a lower slot. This is shown in the tableaux in (12).

(12) a. **Bi-syllabic: [(tá)(kà)] less well-formed than [(ták)] and [(tá.ka)]**

			FtBin-σ Non-main foot	Parse-σ	*v̌]$_{\sigma}$]$_{\omega}$	FtBin-σ	Max
/taka/	2	(tá.ka)			*		
	1	(ták)				*	*
	3	(tá)(kà)	*			**	

Output of EVAL

L (ták) FtBin-σ

|

L (tá.ka) *v̌]σ]ω

|

(tá)(kà) FtBin-σNon-main foot

b. **Tri-syllabic: [(pá.zi)(nù)] less well-formed than [(pá.zin)] and [(pá.zi)nu]**

			FtBin-σ Non-main foot	Parse-σ	*v̌]$_{\sigma}$]$_{\omega}$	FtBin-σ	Max
/pazinu/	2	(pá.zi)nu		*	*		
	1	(pá.zin)			*		*
	3	(pá.zi)(nù)	*			*	

Output of EVAL

L (pá.zin) *v̌]σ]ω

|

L (pá.zi)nu Parse-σ

|

(pá.zi)(nù) FtBin-σNon-main foot

These tableaux in (12) show that the non-observed candidates [(tá)(kà)] and [(pá.zi)(nù)] do occupy a slot in the rank-ordering that EVAL imposes on the candidate set. However, since these two candidates violate the constraint FTBIN-σ$_{\text{Non-main foot}}$ that is ranked higher than any of the constraints violated by the observed variants, the non-observed candidates occupy a lower slot in the rank-ordering. This completes the first step in explaining how to limit variation to only the observed variants – I have now shown that the non-observed forms are less well-formed than all of the observed forms. However, this still does not explain why these forms are never observed as variants. Under the assumption that the language user has potential access to the full candidate set via the rank-ordering that EVAL imposes on the candidate set, these non-observed forms should also be accessible. The best we can say at this moment is that these forms should be observed as less frequent variants. We cannot yet explain that they are never selected as output. In order to explain this, I introduce the concept of the critical cut-off.

It seems to be the case that there are certain constraints that Latvian are willing to violate – these are the constraints violated by the actually observed variants, i.e. MAX, *v̌$]_{\sigma}]_{\omega}$, PARSE-σ, and FTBIN-σ. However, there are certain other constraints of which Latvian will not tolerate violation. One such a constraint is the constraint FTBIN-σ$_{\text{Non-main foot}}$ violated by the non-observed forms [(tá)(kà)] and [(pá.zi)(nù)]. The constraint set can therefore be divided into the set of constraints that the language is willing to violate in a variable phenomenon, and the set of constraints that the language is not willing to violate in a variable phenomenon. I claim there is a critical cut-off on the constraint hierarchy that distinguishes these two classes of constraints from each other. Only those constraints that a language is willing to violate in a variable phenomenon are ranked lower than the critical cut-off. All others are ranked higher than the critical cutoff. In Latvian all of constraints violated by the observed variants rank below the cut-off (i.e. MAX, $*\check{v}]_{\sigma}]_{\omega}$, PARSE-$\sigma$, and FTBIN-$\sigma$), while the constraints violated by the non-observed forms (FTBIN-$\sigma_{\text{Non-main foot}}$) rank above the cut-off. The role of the critical cut-off is important enough that I state it explicitly in (13).

(13) **Critical cut-off**[10]

a. The critical cut-off is a point on the constraint hierarchy.

b. In general the language user will not select as output candidates that are eliminated by constraints ranked higher than the critical cut-off – i.e. if there is any candidate that does not violate any constraint ranked higher than the cut-off, then no candidate that does violate a constraint ranked higher than the cut-off will be selected as output.

In Latvian the critical cut-off appears right between FTBIN-$\sigma_{\text{Non-main foot}}$ and the two markedness constraints PARSE-σ and $*\check{v}]_{\sigma}]_{\omega}$. In (14) I repeat the tableaux from (12) above, this time with the critical cut-off included. In both of these tableaux the non-observed forms do occupy a slot in the rank-ordering that EVAL imposes on the candidate set. However, these forms are disfavored by FTBIN-$\sigma_{\text{Non-main foot}}$ which ranks higher than the cut-off. Since there are candidates available that are not disfavored by any constraint ranked above the cut-off, these candidates will never be accessed as variable outputs. (On the typographical conventions used in these tableau, see Chapter 1 §2.2.3.)

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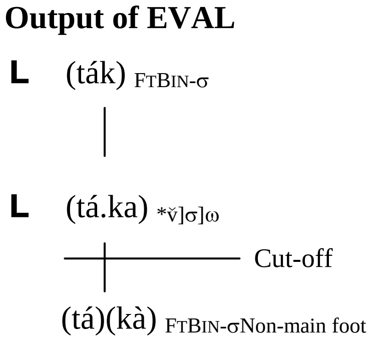
[10] For more general discussion about the critical cut-off, see Chapter 1 §2.2.3.

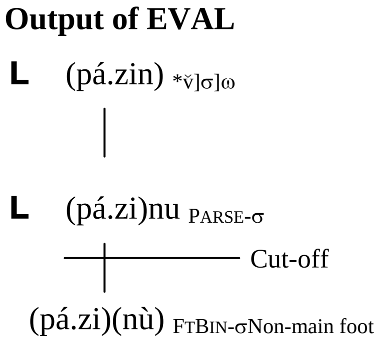
(14) a. **Bi-syllabic: With the critical cut-off included**

			FtBin-σ Non-main foot	Parse-σ	$*\check{v}]_\sigma]_\omega$	FtBin-σ	Max
/taka/	2	(tá.ka)			*		
	1	(ták)				*	*
	3	(tá)(kà)	*!			**	



b. **Tri-syllabic: with the critical cut-of included**

			FtBin-σ Non-main foot	Parse-σ	$*\check{v}]_\sigma]_\omega$	FtBin-σ	Max
/pazinu/	2	(pá.zi)nu		*	*		
	1	(pá.zin)			*		*
	3	(pá.zi)(nù)	*!			*	



By introduction of the critical cut-off point we are able to account for the fact that variation is usually limited to only the best two or three candidates. Although all candidates occupy a slot in the rank-ordering that EVAL imposes on the candidate set, language users will usually not access this rank-ordering to an arbitrary depth. Candidates eliminated by constraints ranked higher than the cut-off are not accessed as variable outputs. In the discussion in this section I have considered only one kind of non-observed form. However, all other non-observed forms will be treated in exactly the same manner – each of them has to violate at least one constraint ranked higher than the cut-off.[11]

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[11] Although language users do not access candidates eliminated by constraints ranked higher than the cut-off in variable phenomena, these candidates are in principle accessible to language users. See the discussion in Chapter 1 §2.2.3 for how language users can access these candidates in categorical

2.4 Ranking arguments

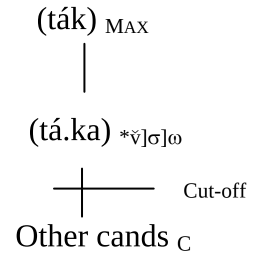
In classic OT, constraint rankings are motivated by "ranking arguments" (McCarthy, 2002b: 4-5, 30-39). A ranking argument is constructed to show that the ranking between two constraints is crucial for the selection of the single optimal candidate – i.e. the opposite ranking will result in selection of an incorrect optimal candidate. In the rank-ordering model of EVAL we have to think differently about ranking arguments. Ranking arguments can now also be frequency based. In this section I will point out how frequency based ranking arguments can be constructed.

Consider again tableau (5) from above in which I have relied in the ranking ||$*\check{v}]_\sigma]_\omega$ o MAX||. I repeat this tableau in (15). However this time I include the location of the critical cut-off. In (14) just above I have shown that both $*\check{v}]_\sigma]_\omega$ and MAX rank below the critical cut-off. In this tableau C stands for any constraint ranked higher than the cut-off.

(15) **[(tá.ka)] and [(ták)] as only variants under ||$*\check{v}]_\sigma]_\omega$ o MAX||**

			C	$*\check{v}]_\sigma]_\omega$	MAX	
/taka/	2	(tá.ka)		*		L
	1	(ták)			*	
	3	All other cands	*!			L

Output of EVAL



For the input /taka/ there are two possible outputs, namely [(tá.ka)] and [(ták)]. As the tableau in (15) shows, these are indeed the only two candidates that are selected as

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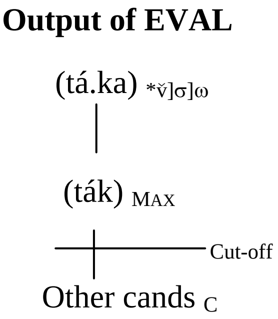
phenomena. See also Chapter 6 for evidence that language users do access information about these candidates in word-likeness judgments and in lexical decision tasks.

output with the ranking ||*v̌]$_\sigma$]$_\omega$ o MAX||. However, this ranking is not crucial to assure that these two are indeed the only two observed outputs. Even under the opposite ranking only these two will be selected. This is shown in the tableau in (16).

(16) **Even under opposite ranking ||MAX o *v̌]$_\sigma$]$_\omega$|| [(tá.ka)] and [(ták)] are the only variants**

			C	MAX	*v̌]$_\sigma$]$_\omega$	
/taka/	1	(tá.ka)			*	L
	2	(ták)		*		
	3	All other cands	*!			L



Even in this tableau only the two actually observed variants are predicted as possible. However, under this ranking it is predicted that the faithful, non-deletion candidate should be the more frequently observed variant. And we know that this is not true. The argument for the ranking ||*v̌]$_\sigma$]$_\omega$ o MAX|| can therefore not be based on a ranking argument of classic OT. It is not the case that the opposite ranking selects a non-observed form as output. This argument rather takes the following form: Under the opposite ranking the variant that occurs more frequently is wrongly predicted to occur less frequently.

Classic OT ranking arguments can still be used in categorical processes – i.e. where there is indeed only one correct output for some input. In such situations we can show that some rankings will lead to selection of the wrong output. However, even in these cases it is not necessary to use a classic OT ranking argument. We can think even about these ranking arguments in terms of frequency. To see how this can be done, let us consider an example where a classic OT ranking argument can be used. Mono-syllabic words in Latvian are not augmented by epenthesis. This means that the output of a mono-syllabic word will violate the constraint FTBIN-σ, requiring feet to be bi-syllabic. Latvian could have avoided this violation by augmenting the word via epenthesis, i.e. at the expense of a DEP-violation. The fact that Latvian does not do this is evidence for the ranking ||DEP o FTBIN$_{\sigma}$||. A classic OT ranking argument can be constructed for this ranking since it can be shown that under the opposite ranking the incorrect (augmentation) candidate will be selected as optimal. This is shown in (17).

(17) **Ranking argument for ||DEP o FTBIN-σ||:**
With the opposite ranking the incorrect output candidate is selected

/nest/ “to carry”	FTBIN-σ	DEP
a. ; (nést)	*!	
b. L (nés.tV)		*

Under the ranking ||FTBIN-σ o DEP||, it is predicted that the augmentation candidate is better than the faithful candidate. However, we know that Latvian does not augment mono-syllabic inputs to avoid a violation of FTBIN-σ. This gives us the evidence that DEP outranks FTBIN-σ.

We can view a categorical phenomenon such as this in terms of variation. We can consider both the faithful candidate [(nést)] and the augmentation candidate [(nés.tV)] as variants. But this is an extreme example of variation where one of the variants occurs infinitely more frequently than the other. The faithful [(nést)] occurs 100% of the time while the augmentation candidate [(nés.tV)] occurs 0% of the time. Now the ranking argument in (17) can also be recast in terms of frequency. Under the ranking ||FTBIN-σ o

DEP|| the variant that is observed more frequently (in fact 100% of the time) is predicted to occur less frequently. Therefore, we need the ranking ||DEP o FTBIN-σ || between these two constraints.

2.5 Summary

In (18) I list all of the rankings that I have argued for above. The first column contains the ranking, the second column a short motivation for the particular ranking, and the last column a reference to where in the preceding text that particular ranking was discussed. After the table I give a graphic representation of the rankings.

(18) **Summary of rankings necessary to explain vowel deletion in Latvian**

Ranking	**Motivation**	**Where?**
$*\breve{v}]_{\sigma}]_{\omega}$ o MAX	More deletion than retention in bi-syllabic forms	(5)
PARSE-σ o MAX	More deletion than retention in tri-syllabic forms	(6)
$*\breve{v}]_{\sigma}]_{\omega}$ o FTBIN-σ	More deletion than retention in bi-syllabic forms	(10)
FTBIN-$\sigma_{\text{Non-main foot}}$ o Cut-off	No degenerate feet that are not the head of a prosodic word	(14)
Cut-off o MAX, $*\breve{v}]_{\sigma}]_{\omega}$, PARSE-σ, FTBIN-σ	Variation between deletion and retention observed	(14)
FTBIN-σ o MAX	Ranking conservatism	(10), footnote 9

(19) **Graphic representation of the rankings for Latvian vowel deletion**