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A structural account of Root node deletion in loanword phonology*

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1. Introduction

The study of loanwords has provided a valuable source of evidence for the development of generative phonology (see, among others, Hyman 1970; Kaye and Nykiel 1979; Singh 1987; Silverman 1992; Yip 1993; and Paradis and LaCharité 1996, 1997). When imported from a source to a borrowing language, loanwords often contain structures that violate the phonological well-formedness constraints of the borrowing language. In order to conform to these constraints, the ill-formed structures contained in loanwords must be adapted. These adaptations exhibit phonological alternations that constitute compelling evidence for a better understanding of the principles that govern the phonological component of the grammar of a language.

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Explaining the patterns found in loanwords nevertheless remains a complex task, one that must take into consideration the literature on, for example, sociolinguistics (languages in contact) and bilingualism, as well as many aspects of both the source and the borrowing languages. In order to achieve this challenging goal, Paradis and LaCharité (1996, 1997)[1] have proposed a model of loanword adaptation, couched within the Theory of Constraints and Repair Strategies (henceforth TCRS; see, e.g., Paradis 1988a,b). Their model makes interesting predictions concerning preservation versus deletion patterns found in loanwords adapted in different borrowing languages. However, one of the mechanisms proposed in their model, called the Threshold Principle, first advanced by Paradis, Lebel and LaCharité (1993),[2] poses problems. This principle, which entails that phonology can count, goes against standard views of phonological theory which avoid arithmetic counting (see, e.g., Kenstowicz 1994:597). In this paper, I propose an analysis of deletion contexts found in loanwords which accounts for the data on structural grounds only, without any appeal to arithmetic counting. Based on this analysis, I discuss the problems posed by the Threshold Principle and propose to eliminate it from the theory.

The two systematic contexts of Root node deletion discussed in the TCRS literature are found in rising diphthongs and nasal vowels. I will show in this paper that the distinction between the preservation and deletion patterns observed in French loanwords containing either of these structures can be predicted directly from 1) the representation of the input in the borrower's phonology, and 2) the licensing possibilities of the borrowing language. More precisely, I will show that both rising diphthongs and nasal vowels are represented in the loan input as two Root nodes licensed by a unique timing position, following the representations in (1).

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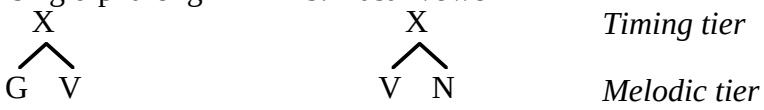
1 Throughout this paper, in my discussion of Paradis and LaCharité's hypotheses, I will refer to their 1997 paper only, as this paper contains the most recent version of their proposal.

2 See also Lebel (1994), Paradis and Rose (1995) and Rose (1995).

(1) Rising diphthongs and nasal vowels: two Root nodes under one timing unit

a. Rising diphthong b. Nasal vowel



Based on these representations, I will account for the deletion cases in a unified manner. As we will see, in all of the deletions observed (e.g. French *biscuit* [biskɥi] → [biski] 'biscuit' in Fula), only one of the two input Root nodes will be deleted. Thus, I will not discuss *segmental* deletion per se, but *Root node* deletion from input complex segments. In order to explain the Root node deletion cases found in the loanwords, I will invoke the syllable well-formedness constraints of the borrowing languages, as well as the Obligatory Contour Principle (OCP; see, e.g., Leben 1973; McCarthy 1986 and others), a general requirement against sequences of adjacent identical elements.

The paper is organised as follows. In section 2, I briefly describe and compare French, the source language, with Fula and Kinyarwanda, the two borrowing languages studied in this paper. In section 3, I present the data that will be discussed throughout the paper. I then discuss, in section 4, issues related to the nature of the input, in other words, the representation of the foreign form to be adapted by the borrower. For all of the cases where the borrowing language cannot cope with a given foreign structure, I propose a universalist view under which the input is represented according to the default options offered by Universal Grammar (UG), which will be determined on typological grounds. In section 5, I detail the current analysis. This analysis, which is compatible with either derivational or non-derivational approaches to phonology, as it does not imply multiple derivational steps between inputs and outputs, will be couched in derivational terms, mainly for clarity reasons. I will argue that the only relationship that is relevant in the loan input is the one that exists between the timing and the melodic tiers; other levels of representation such as the syllable structure of the foreign form are not relevant, at least for the loanwords currently under investigation. The branching configuration found in input rising diphthongs and nasal vowels, as represented in (1), will be taken as the main cause for the deletions observed in the data, which specifically affect Root nodes which do not host their own timing positions. Also, additional

evidence supporting the hypotheses proposed in this paper will be provided, from examples of French loanwords in Japanese. In light of the current proposal, I examine, in section 6, some aspects of Paradis and LaCharité's (1997) proposal, focusing mainly on the notion of arithmetic counting that they use in their analysis of segmental deletion in loanwords. Finally, concluding remarks are presented in section 7.

2. Description of the languages studied

The three languages discussed in this paper display important differences at both the segmental and syllabic levels of representation. As French is the source language of all the loanwords studied in this paper, I give a brief description of its phonological system in (2).

(2) French phonological system (Casagrande 1984)

a. Consonant inventory

	Labial	Coronal		Velar	Uvular
		+ant.	-ant.		
Stops	p, b	t, d		k, ɡ	
Fricatives	f, v	s, z	ʃ, ʒ		
Nasals	m	n	ɲ		
Liquids		l			ʁ

b. Vocoid inventory

	Coronal	Coronal-Labial		Labial
Glides	j	ɥ		w
Vowels	i	y		u
	e	ø		o
	ɛ, ɛ̃	œ, œ̃	(ə)	ɔ, ɔ̃
			a, ɑ̃	

c. Syllable structure[3]

- Branching onsets are allowed (σ[CCV; e.g., *bras* [bʁa] 'arm')
- Codas are allowed (C]σ; e.g., *mer* [mɛʁ] 'sea')
- Singleton and branching onsets followed by empty nuclei are allowed (σ[C#; σ[CC#; e.g., *halte* [alt] 'halt', *arbre* [aʁbʁ] 'tree')

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[3] The description of French and Fula syllable structure provided here differs slightly from that of Paradis and LaCharité (1997) as they assume a different syllable theory. However, the formulations proposed here do not affect the main points addressed in this paper.

The first borrowing language that will be discussed is Fula, a Niger-Congo language spoken in West Africa. The Fula phonological system is presented in (3).

(3) Fula phonological system (Paradis 1986)

a. Consonant inventory

	Labial	Coronal		Velar	Laryng.
		+ant.	-ant.		
Stops	p, b	t, d		k, ɡ	
Affricates			t͡ʃ, d͡ʒ		
Implosives	ɓ	ɗ	ƈ		
Fricatives	f	s			h
Nasals	m	n	ɲ	ŋ	
Liquids		r, l			

b. Vocoid inventory[4]

	Coronal	Labial
Glides	j	w
Vowels	i	u
	ɛ	ɔ
	a	

c. Syllable structure
- Branching onsets are disallowed (*σ[C̲C̲V)
- Codas are allowed (C̲]σ)
- Onsets followed by empty nuclei are disallowed (*σ[C̲#; *σ[C̲C̲#)

The second borrowing language to be discussed is Kinyarwanda, a Bantu language spoken mainly in Rwanda. The Kinyarwanda phonological system is described in (4). This language also allows for derived prenasalized consonants. As we will see in sections 3.2.2 and 5.2.2, French preconsonantal nasal vowels will yield consonant prenasalization in adapted forms.

(4) Kinyarwanda phonological system

a. Consonant inventory (Jouannet 1983:70)

	Labial	Coronal		Velar	Laryng.
		+ant.	-ant.		
Stops	p, b	t, d		k, ɡ	
Fricatives	f, v	s, z	ʃ, ʒ, ɕ		h
Affricates	p͡f	t͡s	t͡ʃ		
Nasals	m	n	ɲ		
Liquids		r			

[4] In the Futa Toro dialect of Fula (from which the Fula loanwords under investigation are taken), mid vowels are ATR-harmonised, yielding [e, o], in the environment of high vowels (see Paradis 1986 for details).

b. Vowel inventory (Kimenyi 1979)

	Coronal	Labial
Glides	j	w
Vowels	i, iː	u, uː
	e, eː	o, oː
	a, aː	

c. Syllable structure
- Branching onsets are disallowed (*σ[CCV)
- Codas are disallowed (*C]σ)
- Onsets followed by empty nuclei are disallowed (*σ[C#; *σ[CC#)

As mentioned above, the three languages differ in many respects. For example, all French vocoids that are not part of the Fula or Kinyarwanda vowel systems violate one or more of the constraints presented in (5). As we can see in (5a) and (5b), even though the features Labial, Coronal and [nasal] are contrastive in Fula and Kinyarwanda (see inventories in (3) and (4) respectively), neither of the two languages combines these features in their native vowel inventory. The French Labial-Coronal and nasal vocoids will have to be adapted in Fula and Kinyarwanda. We can also see, in (5c), that while French and Fula project the feature [ATR] in their representations, this feature is not part of the Kinyarwanda phonological system. The distinctions formalised in (5) will have a direct consequence on how the French loanwords containing these segments will be interpreted and adapted by the borrower.

(5) Segmental constraints[5]

a. Labial-Coronal[6]	French:	yes
	Fula:	NO (e.g., *ɥ, *y, *ø, *œ)
	Kinyarwanda:	NO
b. Nasal vowels	French:	yes
	Fula:	NO (e.g., *ɑ̃, *ɛ̃, *ɔ̃, *œ̃)
	Kinyarwanda:	NO
c. [-ATR]	French:	yes
	Fula:	yes (see footnote 4)
	Kinyarwanda:	NO (e.g., *ɛ, *ɔ)
d. Voiced fricative Cs	French:	yes
	Fula:	NO (e.g., *v, *z)
	Kinyarwanda:	yes

These languages also display many differences at the syllabic level. In contrast to French, Fula, on one hand, does not allow for branching onsets in its syllable structure. Kinyarwanda, on the other, is confined to the canonical CV syllable. Neither branching onsets nor codas are allowed in this language. Finally, consonant-glide-vowel (CGV) sequences, which are allowed in French, are prohibited in both of the borrowing languages. These contrasts between French, Fula, and Kinyarwanda are expressed in (6).

(6) Syllabic constraints

a. Branching onsets	French:	yes
	Fula:	NO (*σ[CCV)
	Kinyarwanda:	NO

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5 The term "constraint" is used loosely throughout this paper. The restrictions described by the constraints will reflect different properties absent from a particular grammar, both structural and featural (e.g., branching under a given syllabic constituent, branching between the timing and the melodic tiers, projection of particular features, combinations of features, etc.).

6 I assume the feature specifications proposed by Clements and Hume (1995), although this is not crucial for the point discussed here. Other feature combinations could be used to represent the front rounded segments of French.

b. Codas	French:	yes
	Fula:	yes
	Kinyarwanda:	NO (*C]σ)
c. CGV sequences[7]	French:	yes
	Fula:	NO (*σ[CGV)
	Kinyarwanda:	NO

We will see that the distinction between Fula and Kinyarwanda formalised in (6b) will permit us to explain the differences in the patterns found between these languages concerning the adaptation of French nasal vowels.

3. Data

In this section, I describe the data that will be discussed throughout the paper. In section 3.1, I introduce the preservation versus deletion patterns in French segmental sequences. As we will see, deletion is only attested in CGV sequences. This is followed, in section 3.2, by the presentation of the patterns found in French nasal vowels adapted in Fula and Kinyarwanda. The data on Fula are taken from Lebel (1994) and Paradis and LaCharité (1997); the data on Kinyarwanda are taken from Rose (1995).[8]

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[7] Under Paradis and LaCharité's (1997) proposal, C*ɥ* in a C*ɥ*V sequence is analysed as a branching onset. I will demonstrate below that C*ɥ*V should instead be analysed as a singleton onset followed by a light (monopositional) diphthong.

[8] In these works, percentages are provided in order to determine the relative prevalence of the patterns observed. As the goal of this paper is to provide an analysis of the patterns which are unambiguously driven by phonological requirements (and not by interfering factors; see section 4 for additional discussion on this issue), I will concentrate on all and only the systematic contexts and refer the reader interested in the few counter-examples found in these contexts to the primary sources given above (see also footnote 10).

3.1 Segmental sequences

One of the two systematic contexts of Root node deletion is found in CGV sequences. Before we look at the relevant examples, it is important to examine how segmental sequences are usually adapted in loanwords.

3.1.1 Preservation contexts

Most input segmental sequences are usually fully preserved (with all of their original Root nodes) in adapted loanwords. A simple case is exemplified in (7), where we can see that full preservation applies in both Fula and Kinyarwanda when the input sequence consists of any CV, VC or CVC sequence.

(7) (C)V(C) sequences

a. In Fula

député	[depyte]	→	[dɛpitɛ]	‘deputy’
autobus	[ɔtɔbys]	→	[ɔtɔbis]	‘bus’
budget	[bydʒɛ]	→	[bidzɛː]	‘budget’

b. In Kinyarwanda

député	[depyte]	→	[depitɛ]	‘deputy’
autobus	[ɔtɔbys]	→	[otobiːsi]	‘bus’
budget	[bydʒɛ]	→	[bidizɛ]	‘budget’

Likewise, French σ[CCV sequences, which violate the prohibition of both Fula and Kinyarwanda against branching onsets, are fully preserved in the adapted forms, as we can see in (8). They are adapted into CVCV sequences in both of the borrowing languages.

(8) σ[CCV sequences

a. In Fula

classe	[klas]	→	[kalaːs]	‘class’
drap	[dʁa]	→	[dara]	‘bed sheet’
frais	[fʁɛ]	→	[fɛrɛ]	‘fresh’

b. In Kinyarwanda

client	[klijɑ̃]	→	[cirija][9]	‘customer’
drapeau	[dʁapo]	→	[darapo]	‘flag’
fraude	[fʁod]	→	[foroːde]	‘fraud’

It is also important to notice that the status ‘well-formed’ or ‘ill-formed’ of the input segments contained in these segmental sequences does not have any effect on the preservation patterns. In all of the cases presented in (7) and (8), ill-formed segments are preserved and adapted into well-formed ones in both languages. For example, we can see, in (7), that the Labial-Coronal vocoid [y] is fully preserved in the adapted forms, even though it is melodically ill-formed in both Fula and Kinyarwanda (see the constraint in (5a)); [y] is adapted into [i] in both languages.

Finally, we can observe French CGV sequences in (9). When the glide of the French CGV sequence is melodically well-formed in the borrowing language, all of the input Root nodes are preserved.

(9) CGV sequences

a. In Fula

douane	[dwan]	→	[duwaːn]	‘customs’
lieutenant	[ljøtnɑ̃]	→	[lijɛtinaŋ]	‘lieutenant’
coiffeur	[kwafœʁ]	→	[kuwafɛr]	‘hairdresser’

b. In Kinyarwanda

douane	[dwan]	→	[duwaːne]	‘customs’
diamant	[djamɑ̃]	→	[dijama]	‘diamond’
chanoine	[ʃanwan]	→	[ʃanuwane]	‘canon’

We will see, in the next subsection, that these examples contrast with other cases of French CGV sequences: the latter show Root node deletion in the adapted forms.

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9 In Kinyarwanda, velar consonants are labialised in front of Labial vowels and palatalised in front of Coronal vowels (see Kimenyi 1979 for details). These assimilations also apply in loanwords.

3.1.2 Deletion contexts

Two deletion contexts are found in French CGV sequences adapted in Fula.[10] The first context is exemplified in (10). We can see that French [vw] sequences are reduced to [w] in Fula, that is, with deletion of one of the input Root nodes.

(10) [vw] → [w] in Fula

voyou	[vwaju]	→	[waju]	*[wuwaju]	‘hooligan’
voyage	[vwajaʒ]	→	[wajaːs]	*[wuwajaːs]	‘trip’
voiture	[vwatyʁ]	→	[watiːri]	*[wuwatiːri]	‘car’
au revoir	[oʁəvwaʁ]	→	[orewaːr]	*[orewuwaːr]	‘good-bye’

Likewise, deletion occurs in French [ɥi] sequences, which are also adapted with deletion of one of the Root nodes in Fula, as we can see in the examples in (11).

(11) [ɥi] → [i] in Fula

biscuit	[biskɥi]	→	[biski]	*[biskiji]	‘biscuit’
circuit	[siʁkɥi]	→	[sirki]	*[sirkiji]	‘circuit’
aujourd’hui	[oʒuʁdɥi]	→	[ɔsɔrdi]	*[ɔsɔrdiji]	‘today’
minuit	[minɥi]	→	[mini]	*[miniji]	‘midnight’

Recall that both [v] and [ɥ] are ill-formed according to Fula segmental constraints (see the constraints in (5)). In the analysis presented below, we will see that the adaptation pattern that this ill-formedness yields in Fula will be responsible for the deletions observed in (10) and (11).

The two patterns of deletion described above are not attested in the corpus of French loanwords in Kinyarwanda. The absence of the deletion pattern in (10) can be explained by the fact that the voiced fricative consonant [v] is part of Kinyarwanda’s rich consonantal inventory. None

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[10] Apart from the examples discussed in this subsection, Paradis and LaCharité (1997) also report two isolated examples of deletion in input French [vʁ] sequences, which are adapted with [v]-deletion in Fula (e.g., *cuivre* [kɥivʁ] → [kiri] ‘copper’). Rose (1998) provides counter-examples where these clusters are fully preserved in the adapted forms (e.g., *livre* [livʁ] → [liːbaːr] ‘book’) and demonstrates that the two deletion cases reported by Paradis and LaCharité (1997) are incompatible with the remainder of the data observed in the corpus studied. These two examples will not be further discussed in this paper.

of the segments contained in French [vw] violate the Kinyarwanda segmental constraints. Such sequences are adapted with preservation of all of their input Root nodes. For example, the French word *convoyeur* [kɔ̃vwajœʁ] is adapted into [kʷoːᵐvuwajeːri] ‘conveyor’ in Kinyarwanda. The absence of the pattern in (11) in Kinyarwanda is explained by the fact that French loanwords in Kinyarwanda were borrowed from Belgian French. This dialect of French does not have the front rounded glide [ɥ] in its inventory; it only has [w] and [j], that is, two glides which are well-formed according to the Kinyarwanda segmental constraints. Words that are pronounced with [ɥ] in Standard French are pronounced with [w] in Belgian French (e.g., Standard French *cuisine* [kɥizin] is pronounced [kwizin] ‘kitchen’ in the Belgian dialect). Consequently, [ɥi] sequences have not been introduced in this language; all of the input Root nodes of *cuisine* [kwizin] are preserved in the adapted form [kʷuwiziːni] ‘kitchen’ in Kinyarwanda.

In the next section, I turn to the patterns of adaptation of French nasal vowels in Fula and Kinyarwanda. We will see that the difference between the patterns observed in these languages may be tightly linked to the respective syllabic constraints of the borrowing languages.

3.2 Nasal vowels

3.2.1 Nasal vowels adapted in a CVC language: Fula

Consider (12). In French loanwords in Fula, when the nasal vowel is in an open syllable, it is adapted into an oral vowel-nasal consonant sequence (VN), as we see in (12a). When the nasal vowel is followed by a word-final consonant, nasality is lost, as in (12b).

(12) French nasal vowels adapted in Fula (data from Lebel 1994, Paradis and LaCharité 1997)

a. In open syllables: full preservation

canton	[kɑ̃.tɔ̃]	→	[kantɔn]	*[katɔ]	‘township’
ciment	[si.mɑ̃]	→	[siman]	*[sima]	‘cement’
conseil	[kɔ̃.sɛj]	→	[kɔnsɛj]	*[kɔsɛj]	‘advice’
ingénieur	[ɛ̃.ʒe.njœʁ]	→	[ɛnsɛnjɔr]	*[ɛsɛnjɔr]	‘engineer’

b. In 'closed' syllables: nasal deletion[11]

balance	[ba.lɑ̃s]	→	[balas]	*[balansa]	'scale'
dimanche	[di.mɑ̃ʃ]	→	[dimaːs]	*[dimansa]	'Sunday'
essence	[ɛ.sɑ̃s]	→	[ɛsaːs]	*[ɛsansa]	'gasoline'
dépense	[de.pɑ̃s]	→	[deppas]	*[deppansa]	'expense'

3.2.2 Nasal vowels adapted in a CV language: Kinyarwanda

The relevant contexts of French nasal vowels adapted in Kinyarwanda are presented in (13). Recall that Kinyarwanda allows for prenasalized consonants. We can see in (13a) that a word-internal nasal vowel is adapted in Kinyarwanda as an oral vowel and that the nasality of the French vowel anchors onto the following consonant, creating a nasal contour. However, the word-internal context contrasts with the word-final context in (13b), which shows a loss of nasality.

(13) French nasal vowels adapted in Kinyarwanda (data from Rose 1995)

a. Word-internal nasal vowels: full preservation[12]

ambassade	[ɑ̃basad]	→	[ambasadi]	*[abasadi]	'embassy'
bandit	[bɑ̃di]	→	[βaːⁿdi]	*[βaːdi]	'bandit'
fanfare	[fɑ̃faʁ]	→	[faːᵐfaːri]	*[faːfaːri]	'fanfare'
vidange	[vidɑ̃ʒ]	→	[vidaːⁿʒi]	*[vidaːʒi]	'garbage'

b. Word-final nasal vowels: nasal deletion

coussin	[kusɛ̃]	→	[kʷuse]	*[kʷuseni]	'cushion'
gérant	[ʒeʁɑ̃]	→	[ʒera]	*[ʒerani]	'manager'
maçon	[masɔ̃]	→	[maso]	*[masoni]	'mason'
frein	[fʁɛ̃]	→	[fure]	*[fureni]	'break'

Keeping these data in mind, we will now proceed to the elaboration of the current proposal. Before turning to the details of the analysis, we must first address issues pertaining to the phonological status of the input, that is, the phonological form which is adapted by the borrower's phonology.

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11 Regarding this deletion context, only word-final fricatives are found in the data. Paradis and LaCharité (1996) report one elicited example (*propagande* [pʁopagɑ̃d] → [pɔrpagan] 'propaganda') where the consonant following the nasal vowel is a stop. In this example, nasality is preserved in the final consonant.

12 In Kinyarwanda, non-initial vowels always surface as long before prenasalised consonants.

4. On the nature of the input

In this section, I argue that the loanwords studied in this paper are represented in the borrower's phonology as a string of Root nodes linked to the timing tier, and that this two-level representation constitutes the input to be adapted in the borrowing language. I first report on the sociolinguistic characteristics of loanwords, based on previous literature on languages in contact. I will follow Paradis and LaCharité's (1997) claims regarding the sociolinguistic characteristics of the loanwords under investigation. In light of this, I then discuss the level of representation accessed by the borrower in the adaptation of these loanwords. Regarding melodic content, I argue that, in cases where the borrowing language's phonological system contains the relevant contrastive features, these features are used to build the representation of the input form. I also discuss how the melodic material is associated to timing positions in the loan input. I demonstrate, for example, that rising diphthongs, which are phonetically glide-vowel sequences, are licensed by a unique timing position, following the configuration in (1a). This discussion is exemplified with a comparison between the representation of a CLV (consonant-liquid-vowel) sequence and that of a CGV (consonant-glide-vowel) sequence.

4.1 Phonological status of loanwords

In order to determine the status of loanwords, it is necessary to know in which context these words were borrowed. Sociolinguistic studies of languages in contact, among others, Haugen (1950), Weinreich (1970), Bowen (1975), Grosjean (1982), and Poplack, Sankoff and Miller (1988), all converge towards a description of loanword integration split into distinct stages. In what follows, I summarise the relevant generalisations concerning these stages and claim, following Paradis and LaCharité (1997), that the second stage of community bilingualism described in Haugen (1950) — to be discussed below — is relevant to the data studied in this paper. I will argue that this stage corresponds to a period where the borrower, the speaker who introduces and adapts the loanwords

into his/her native language, has access to the segmental level of the loan input forms, but not to the syllabic level.

4.1.1 Stage 1 of community bilingualism: pre-bilingual period

During Stage 1, referred to as the "pre-bilingual period" by Haugen (1950), loanwords are imported into the borrowing language "by a relatively small group of bilinguals and spread widely among the monolingual majority; the words show (almost) complete native substitution, with great irregularity in the phonetic results" (Haugen 1950:216).

I argue that Stage 1 is not relevant for the loanwords studied in this paper. On one hand, these loanwords come from communities where French has been spoken as a second language for several decades by a large number of speakers. On the other hand, the adaptations found in these loanwords are not irregular; they are indeed extremely systematic.

4.1.2 Stage 2 of community bilingualism: adult bilingualism

The second stage, referred to as the period of "adult bilingualism" by Haugen (1950), is marked by a growing knowledge of the source language by more speakers. Extended bilingualism in the community favours extended use of foreign words. This is confirmed by Poplack, Sankoff and Miller (1988) who show that "highly bilingual speakers are importers of lexical innovations, as evidenced by their preference for nonce and unattested borrowings" (p. 85). As reported by Haugen (1950:217), a unique substitution for each given foreign phoneme becomes consistently used in the new loanwords.

The data studied in this paper are compatible with these sociolinguistic and phonological observations. Concerning the French loanwords in Fula, Lebel (1994:5-6) reports that in most of the countries where Fula is spoken (e.g., Senegal, Mauritania), French appears to be the only common language. This language is therefore widespread throughout the community. Also, as reported by Paradis and LaCharité (1997), in the countries where Fula has borrowed words from French, "there have been several generations of borrowers since the beginning of the century"

(Paradis and LaCharité 1997:402). These facts are consistent with the great uniformity observed in the forms produced by the Fula informant in Lebel (1994) and Paradis and LaCharité (1997), which correspond in the vast majority of cases to the two written sources studied (Zoubko 1980 and Tioulenta 1987).

With regard to French loanwords in Kinyarwanda, the situation is comparable. Rwanda was colonised by Belgium from 1916 to 1961. However, French had already begun to be introduced by the Pères Blancs missionaries a decade before, so that the situation of bilingualism is about one century old (Jouannet 1984). The data from the corpus of Rose (1995) were gathered in 1994. By that time, a good proportion of the Rwandan population, mainly the post-primary-school-educated people, was Kinyarwanda-French bilingual (Jouannet 1984:22), Kinyarwanda and French being the two official languages of the country. In addition, the Kinyarwanda data show important uniformity across the three informants interviewed; they are also consistent with all of the sources used by Rose (1995) (e.g., Shyirambere 1978; Jouannet 1984; Jacob 1987).

4.1.3 Stage 3 of community bilingualism: childhood bilingualism

The last stage described by Haugen (1950) is called the "period of childhood bilingualism". This stage is characterised by importation of new sounds or new combinations of sounds into the borrowing language. At this stage, not only are new words introduced into the language, but they are also imported with much of their original (non-adapted) structure, both segmental and prosodic. A good example of Stage 3 can be found in Lingala, a lingua-franca spoken in the Congo. Lingala is described as a CV language which disallows codas and branching onsets (Kukanda 1983). In a large study of French loanwords in this language undertaken over six years, from 1970 to 1976, Kukanda (1983:60-63) has shown that while older loanwords are systematically nativised in Lingala, more recent loanwords tend to be introduced with foreign French segments and/or combinations of segments. We can see examples of these importations in (14b), which contrast with the older loanwords in (14a).

(14) Examples of French loanwords in Lingala (Kukanda 1983)

a. Older loanwords

chapelet	[ʃaplɛ]	→	[sapɛle]	'chaplet'
juge	[ʒyʒ]	→	[zuzi]	'judge'
docteur	[dɔktœʁ]	→	[dokotolo]	'doctor'

b. More recent loanwords

chéri	[ʃeʁi]	→	[ʃeri]	'(my) dear'
mariage	[maʁjaʒ]	→	[marjaʒe]	'wedding'
directeur	[diʁɛktœʁ]	→	[direkter]	'director'

The contrast between (14a) and (14b) clearly shows that French segments and combinations of segments which were previously adapted according to Lingala's native constraints tend to be imported in more recent loanwords.[13]

4.1.4 Status of the loanwords studied in this paper

The three stages of community bilingualism described above are formally different. Thus, the loanwords discussed in the literature on loanword phonology must not all be treated in the same fashion. The only way of determining the status of any set of loanwords lies in complementary studies, sociolinguistic and historical, for example, that can help to determine which period of integration the loanwords come from.

I follow Paradis and LaCharité (1997) who argue that the loanwords studied in Fula and Kinyarwanda come from Stage 2 of community bilingualism (which they label 'mid community bilingualism'). The arguments supporting this claim are summarised as follows. First, the two

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13 This is not meant to imply that the *user* of a loanword containing non-adapted structure must be bilingual. The examples in (14b) seem to be the result of an emergent peripheral phonology in Lingala (on the notion of periphery in phonology, see Paradis and C. Lebel 1994; Itô and Mester 1995; Paradis and É. Lebel 1997).

Another case of childhood bilingualism is found in English loanwords in Québec French. Paradis and C. Lebel (1994), and Paradis and É. Lebel (1997) show that Québec French speakers, especially in the Montréal area as compared to those in Québec City, tend to directly import English sounds into their pronunciation of loanwords (for a systematic comparison, see Paradis and É. Lebel 1997).

main corpora studied here are based on situations of languages in contact for a hundred years or more. Second, the corpora show great uniformity in the patterns of adaptation, inconsistent with Stage 1. Finally, there are no systematic patterns of foreign structure importations characteristic of Stage 3 like those observed in (14b).

4.2 On the representation of the loan input

Since the borrowing language does not contain all of the structures that may appear in a foreign word, the borrower must interpret these structures in some way, in order to have a representation to which s/he can apply the processes leading to the adapted form. In order to provide a formal account of this problem, several questions must be addressed, regarding both the perception and representation of the loan input. In this section, I address each of these issues in turn. I first discuss, in 4.2.1, the perception of the loan input. In the next two subsections, I tackle the representation of the loan input from two different angles, namely the prosodic shape of the input, in 4.2.2, and how loan segmental representations are built in the borrower's phonology, in 4.2.3.

4.2.1 Perception of the loan input is driven by L1 contrastive features

Perception of loan segments raises important issues. When a loan segment is present in the native language (L1) phonemic inventory, its perception and interpretation should not pose a problem. However, when a loan segment is not present in the L1 inventory, the way the borrowing language copes with this segment will have consequences for how it will be adapted.

Recent studies of loanwords propose different approaches to the issue of how loanwords are perceived by the borrower. Silverman (1992) and Yip (1993), in their respective studies of English loanwords in Cantonese, hypothesize that while the deletions observed in loanwords are generally governed by phonological factors, some deletion contexts must be accounted for through perceptual factors. Specifically, they claim that the segmental deletions observed in these particular contexts are caused by the fact that the segments that are deleted fall under a given threshold of phonetic salience at the perceptual level. Paradis and LaCharité (1997) provide several arguments against the

hypothesis that perceptual salience plays a role in the deletions observed in loanwords. They argue that the deletions found in Silverman's and Yip's examples are caused by a phonological constraint independently required in Cantonese (see, however, footnote 15 below). Jacobs and Gussenhoven (1999) argue, in line with Paradis and LaCharité (1997), that the deletions observed in the Cantonese corpus are the result of the borrowing language's phonology. In order to determine the way in which loanwords are perceived by the borrower, they propose the existence of a parser through which borrowers can access a "universal phonological vocabulary" which is "much larger than the subset that is incorporated in their native language" (Jacobs and Gussenhoven 1999:7). Under Jacobs and Gussenhoven's hypothesis, the borrower has access to a universal feature inventory, larger than the one available in the L1 phonological system.

I argue, following Jacobs and Gussenhoven (1999), that UG plays a determining role in the perception and interpretation of loan inputs. However, I adopt a more restrictive view concerning the "phonological vocabulary" that the borrower can access.

The position I defend follows from Brown (1997) who demonstrates, in a series of experiments on perception of non-native contrasts in second language (L2) learners, that new segments can be represented only when the contrastive features are present in the native phonology: L1 features can be combined in new ways, but new features cannot be added to the system. With regard to Japanese learners of English, Brown states:

> Since perception of a non-native contrast is blocked by the absence of the relevant feature from the learner's grammar, Japanese speakers will be unable to accurately perceive a contrast between /l/ and /r/ or between /s/ and /θ/. Lacking the features [lateral] and [distributed], the phonological system of the Japanese speaker's grammar will funnel the distinct acoustic stimuli for /l/ and /r/ into one perceptual category and for /s/ and /θ/ into another. Consequently, Japanese speakers will perceive instances of /l/ and /r/ as the same sound (likewise for /s/ and /θ/). (Brown 1997:227)

Following Brown, I propose that the borrower — a second language speaker of the source language (see section 4.1.2) — cannot access features that are not contrastive in his/her native

language. For example, a speaker of a language with no front rounded vocoids who has both Coronal and Labial in his/her L1 should be able to combine these two features to build a new representation for a vowel like [y]. The same should hold true of nasal vowels, whenever the L1 speaker has an underlying oral-nasal contrast in the consonant inventory of his/her language. The features Coronal, Labial, and [nasal] are contrastive in both Fula and Kinyarwanda. The borrowers in these languages (that is, Fula or Kinyarwanda speakers who are L2 speakers of French) therefore combine these available features in building segmental representations for French foreign sounds such as the front rounded vowel [y] and its glide counterpart [ɥ], by combining Labial and Coronal. They can also build a representation for the French nasal vowels, by combining the feature [nasal] with the representations of corresponding oral vowels. In these cases, schematised in (15a) and (15b), it is possible to analyse the modified sounds in the adapted loanwords as true phonological adaptations.

(15) Segmental representations for loanwords can combine L1 contrastive features

	L1 contrasts	Contrastive features	Possible new representations
a.	/u/ ~ /i/	Labial, Coronal	Labial-Coronal vocoids (e.g., /y/)
b.	/t/ ~ /n/	[nasal]	Nasal vowels ([nasal] may be added to vowels)
c.	*/e/ ~ /ɛ/	(No [ATR])	ATR contrast cannot be represented

However, when a contrast must be represented with a feature that is not present in the L1 phonology, following Brown (1997), I hypothesise that the new feature cannot be added to the system. This is illustrated in (15c), where we see that the absence of [ATR] as a contrastive feature in the L1 phonology precludes the speaker from representing [ATR] contrasts. This situation can be found in Kinyarwanda, a language that does not have [ATR] contrasts (see (4b)). The absence of such a feature should prevent Kinyarwanda speakers from building distinct representations for surface vowels like [e] versus [ɛ]. The contrast between these vowels should therefore be lost at the perceptual level, so that French vowels like [ɛ] and [ɔ], pronounced as [e] and [o] in the Kinyarwanda adapted forms, should not be considered as true *phonological* adaptations; rather,

they arise as a consequence of the loss of foreign contrast at the perceptual level.[14] This position, which is in essence akin to Silverman (1992) and Yip (1993), has the additional advantage of providing us with the formal apparatus for drawing a line between phonetics (perception) and phonology in the analysis of loanword adaptations.

4.2.2 Prosodic shape of the loan input

Concerning the prosodic shape of the input, Silverman (1992) and Yip (1993) adopt a strong phonetic position, claiming that the input is merely acoustic and devoid of any phonological representation. Paradis and LaCharité (1997) discuss Silverman's hypothesis and provide arguments against a strictly phonetic treatment of the loan input. They demonstrate that an analysis based solely on phonetic grounds cannot formally capture alternations found cross-linguistically in loanwords.[15] Taking a rather strong position on the opposite side, Paradis and LaCharité (1997) claim that the phonological output of the source language's phonology is directly incorporated into the host language's lexicon (dictionary). On this, they mention that "it has not yet been clearly established whether the input to L1 is the output of the L2 lexical or postlexical level" (Paradis and LaCharité 1997:395).

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14 This position contrasts with that taken by, e.g., Rose (1995) and Paradis and LaCharité (1997), who consider *all* modifications of the original (source) segments as true phonological adaptations.

15 Their demonstration should not, however, necessarily discredit Silverman's position. Recall that Silverman's and Paradis and LaCharité's respective arguments are based on different corpora of loanwords. While the former is based on elicited forms which may not (or not all) constitute integrated forms in Cantonese, the latter are based on attested loanwords verified with informants. It is thus expected that these distinct sets of evidence lead to different (if not contradictory) conclusions. A sociolinguistic study comparing these different situations of languages in contact — which would be far beyond the scope of this paper — could possibly reconcile some aspects of their respective positions.

Paradis and LaCharité's (1997) claim that the input to the borrowing language is the output of the source language's lexical or postlexical phonology entails that the input is incorporated into the borrowing language with its segmental *and* prosodic structure.[16] Under such a claim, one should expect syllable and stress patterns from the source language to be transferred with some consistency into the loanwords studied. However, as discussed above, there does not seem to be any empirical evidence supporting this claim; foreign structures imported as such in loanwords are only attested at Stage 3, a late stage of community bilingualism (described in section 4.1.3) which is not relevant to the data studied here.

I argue that, at Stage 2, syllable structure constituents (onset, rhyme, and nucleus) are not represented in the loan input, for two reasons. First, as implied above, syllable constituency found in the foreign form does not affect the way that loanwords are adapted. For example, a foreign word-initial CL cluster is broken up by an epenthetic vowel in languages which do not allow for branching onsets, as we saw in (8). Syllabification of loan input segmental sequences is thus predictable from the sonority profile of the string of segments to be adapted, which are organised into constituents following the syllabic constraints of the borrowing language. Second, as mentioned in the preceding paragraph, access to the syllabic level of representation is only characteristic of Stage 3, at which, for example, foreign syllabic patterns may be preserved in the loanwords (see 4.1.3 above). Therefore, I claim that, at Stage 2, a loan input is represented at the timing and melodic levels only, as illustrated in (16).

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16 However, Paradis and LaCharité (1997) do not formally take a position on what the shape of the input should be, as evidenced by the fact that inputs are not represented in the phonological processes they illustrate (as we will see below in section 6).

(16) Representation of a loan input: timing and melodic tiers only[17]

```
X   X   X       Timing tier
|   |   |
R   R   R       Melodic tier (R = Root node)
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As we will see in section 5, only the two levels of representation given in (16) are relevant in order to predict Root node preservation or deletion in the loanwords studied in this paper.

4.2.3 Loan representations are based on UG's default options

I hypothesised in 4.2.1 that French front rounded and nasal vocoids can be perceived by Fula and Kinyarwanda borrowers because the relevant features are all present in their native language. The borrower also needs to represent new contrasts in his/her phonology, and interpret the way that Root nodes are anchored to the timing tier, the other level of representation present in the loan input, as argued for in 4.2.2. In this section, I propose that representation of non-native contrasts is driven by UG. I will focus on the interpretation of the structural relationship that holds between the melodic and timing tiers, comparing CLV sequences with CGV sequences.

We saw earlier that French CLV sequences are adapted in Fula with preservation of all of the original segments. The adaptation of these sequences contrasts with that of certain French CGV sequences, which show deletion of one segment (usually the glide). Some examples are repeated for convenience in (17).

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17 The timing tier is represented here with skeletal positions. Note that equivalent predictions can be made in other frameworks (e.g., Moraic Theory). The melodic tier corresponds to the Root node and the segmental features that it dominates.

Broselow and Park (1995) provide evidence consistent with the claim made in (16). They demonstrate that English loanwords in Korean are represented in the borrower's phonology at the moraic tier, as well as at the melodic tier. They show that moras (which correspond more or less to the timing units assumed in this paper) are preserved in adapted forms, following the Mora Conservation Law proposed by Hayes (1989).

(17) a. Adaptation of CLV sequences: full preservation (repeated from (8a))

classe	[klas]	→	[kalaːs]	'class'
drap	[dʁa]	→	[dara]	'bed sheet'
frais	[fʁɛ]	→	[fɛrɛ]	'fresh'

b. Adaptation of CGV sequences: segmental deletion (repeated from (11))[18]

biscuit	[biskɥi]	→	[biski]	'biscuit'
circuit	[sikɥi]	→	[siriki]	'circuit'
minuit	[minɥi]	→	[mini]	'midnight'

In the analysis proposed by Paradis and LaCharité (1997), French CG clusters, like CL clusters, are treated as branching onsets.[19] They reject the other logical possibility, namely that the glide is interpreted as part of the nucleus, as follows:

> Interpreting the *w* of the **vw* clusters as part of a branching nucleus, rather than as part of a consonant cluster, is not an option because only falling (sonority) diphthongs are permitted in Fula. (Paradis and LaCharité 1997:409, footnote 43)

This argument is problematic because, following this logic, interpretation of the structure as a branching onset should not be an option either, since branching onsets are not allowed in Fula (see the constraint in (6a)). Why would the branching onset option be preferred over that of a rising diphthong when neither of these structures is permitted in Fula? The fact that Paradis and LaCharité (1997) consider CLV and CGV sequences to be prosodified in the same way (as part of a branching onset) forces them, in some sense, to invoke a device such as the Threshold Principle (see section 6). In this section, I will put the burden of explanation on the relation that exists between the Root node and timing tiers and show that the interpretation of CLV and CGV sequences leads to different formal relationships between these two levels of representation.

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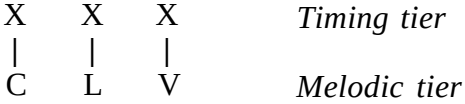
18 C[j]V and C[w]V sequences will be discussed in section 5.1.

19 According to Paradis and LaCharité's analysis, epenthesis in (17a) versus deletion in (17b) is due to the fact that [ɥ], contrary to [l], is featurally ill-formed in Fula (see section 6.2 for more detail).

Regarding foreign segmental strings which cannot be interpreted through the constraints present in the borrowing language (e.g. French CLV and CGV sequences, which violate the phonotactics of both Fula and Kinyarwanda), I propose that interpretation is done through UG. This view predicts that, in cases where the string of segments may be prosodified in two or more different ways, if none of the potential configurations are licit in the borrowing language's grammar, the UG unmarked interpretation will be favoured over more marked ones. I demonstrate, in subsequent sections, that these predictions are correct for the loanwords studied in this paper.

In the case of a CLV sequence, the situation is quite simple. Only one interpretation is universally possible: three distinct segments licensed by their own timing positions. This unique possibility is expressed in (18).

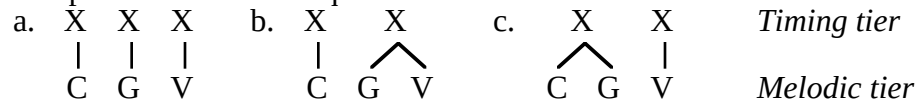
(18) Interpretation of CLV sequences[20]



In languages which allow branching onsets, CL in a CLV sequence will be syllabified as such.

The situation, however, is more complex in the case of a CGV sequence. When faced with such a sequence, in theory, the speaker can interpret it in three different ways. The options are expressed in (19).

(19) Interpretation of CGV sequences



The first option ((19a)) is that CGV is interpreted as a sequence of three distinct segments, each of which is licensed by its own timing position, that is, a configuration which is identical to that for

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[20] Kaye (1985) argues that Vata, a Kru language, licenses CLV sequences as a monopositional onset followed by a light diphthong containing the liquid and the vowel. Minimally, the interpretation illustrated in (18) can be considered to be the unmarked option.

CLV sequences. The second option ((19b)) is that the sequence is interpreted as a consonant followed by a monopositional (rising) diphthong. Finally, the last option ((19c)) is that CG is interpreted as a complex (secondarily-articulated) consonant followed by a vowel. As more than one option for the interpretation of a CGV sequence is available across languages, we must determine what the default option offered by UG is.

I will begin with (19a) and (19b). The claim underlying the investigation presented below is that the different relationships that hold between the melodic and timing tiers should lead to different syllabifications. According to Hayes (1985), Hyman (1985), and Schane (1987), true rising diphthongs, that is, GV sequences that are licensed within the nucleus, are monopositional.[21] Schane (1987) reports that only falling diphthongs (e.g. rhymal VG sequences) count as two positions in languages that treat long vowels and diphthongs as quantitatively equal. This analysis is also supported in Kaye and Lowenstamm (1984). On one hand, (19a) must lead to a CG.V[22] syllabification as represented in (20a), since syllabifying this configuration as C.GV would lead to a bipositional rising diphthong, a configuration which appears to be impossible across languages. On the other hand, (19b) can only be syllabified as C.GV, since the two positions available in this configuration must be syllabified as an onset-nucleus sequence, as illustrated in (20b).

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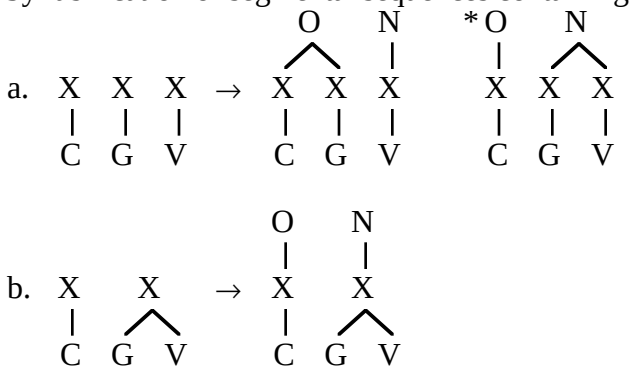
21 In terms of Moraic Theory, monopositional diphthongs are analysed as light (monomoraic) diphthongs.

22 The period (.) represents edges of syllabic constituents. For example, CG.V means that CG forms a branching onset and that V is part of the nucleus.

(20) Syllabification of segmental sequences containing glides



To tease apart (20a) and (20b), let us now examine the syllabification of CGV clusters across languages. The typological survey presented below is not exhaustive. Such a study would be beyond the scope of this paper. Yet from the few languages surveyed, it is possible to determine patterns that seem to be characteristic of the tendencies observed cross-linguistically. The results of this survey are presented in (21).[23] We can see in this table that, in languages that have CGV clusters, the C.GV syllabification seems to be favoured by far. Apart from the West Germanic languages Frisian and Dutch, which allow for (20a), and American English, which seems to allow for both options,[24] all of the languages surveyed syllabify the glide as the first member of a nuclear diphthong.

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[23] I resort to a typological approach to markedness in the absence of any other evidence. However, I acknowledge that cross-linguistic high frequency does not always correlate with unmarked status.

In order not to bias the survey, I did not include languages that do not allow for branching onsets (e.g., CL clusters, the most common type of branching onset observed cross-linguistically); consequently, the syllabification of CGV sequences does not depend on the absence of a possible CCV syllable template, but solely on the language-specific selection for CG.V or C.GV syllabification. Note that in languages like Korean and Japanese, which allow for CGV but not for CLV sequences, CGV sequences are not syllabified as branching onsets.

[24] Davis and Hammond (1995) demonstrate that in English CGV sequences, the glide [w] is part of the onset (C*w*.V) whereas the glide [j] is the first member of a rising diphthong (C.*j*V).

(21) Syllabification of CGV clusters cross-linguistically

Language	Family	C.GV	CG.V	Reference
Frisian	W. Germanic		√	Booij (1989)
Dutch	W. Germanic		√	Booij (1983)
American English	W. Germanic	√	√	Davis and Hammond (1995)
Old English	W. Germanic	√		Suzuki (1982)
Slovak	Slavic	√		Kenstowicz and Rubach (1987)
French	Romance	√		Kaye and Lowenstamm (1984)
Spanish	Romance	√		Harris (1983), Carreira (1992)
Italian	Romance	√		Marotta (1988)
Imyan Tehit	Indo-Pacific	√		Hesse (1995)

The monopositional rising diphthong option in (19b) is thus less marked than (19a). A more complex task resides in teasing apart (19b) from (19c), the secondarily-articulated consonant option. The typological evidence for this last option (C^{G}.V) remains very hard to determine because of the "derived" versus "non-derived" status of secondarily-articulated consonants, which is, for some languages, a subject of controversy (e.g., Otomi; see Maddieson 1984). Various facts, however, are important to consider. There are four possible secondary articulations found in the languages of the world: labial, palatal, velar, and pharyngeal. I will focus here on the two most common secondary articulations, labial and palatal. Labial is the most commonly attested (Ladefoged and Maddieson 1996:355). However, this preference for C^{w} must not be construed to mean that these consonants are common across languages. Firstly, the secondary articulator Labial "is largely confined to velars and uvulars" (Maddieson 1984:38), so that a C^{w} like [p^{w}] or [t^{w}] is typologically more marked than [k^{w}] or [q^{w}]. Secondly, Maddieson (1984:38) reports that, from all the languages that have [k] in his database, only 38 (13.4%) have [k^{w}], and from all the languages that have [ɡ], only 8% have [$ɡ^{w}$]. Thirdly, there are often restrictions on the manner of secondarily-articulated consonants. Stops are preferred while fricatives like [s^{w}] are typologically disfavoured. Finally, palatalised consonants are marked across languages, with labial and coronal consonants being better targets for palatalisation than velar consonants (e.g., [p^{j}] is less marked than [k^{j}]).

The fact that secondarily-articulated consonants are subject to a series of distributional constraints such as the ones mentioned above[25] prevents these consonants from being a class as freely distributed as, for example, plain consonants. Thus, it seems very unlikely that (19c) is the default option offered by UG in the interpretation of CGV sequences. I therefore conclude that (19b) constitutes the UG default interpretation available to the borrower.[26]

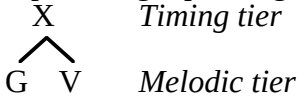
4.3 Representation of input rising diphthongs and nasal vowels

Recall that rising diphthongs and nasal vowels are the only two contexts of systematic Root node deletion observed in the loanwords studied in Fula and Kinyarwanda. In this section, I will provide the representation of these structures on which the analysis will be based. We will see that rising diphthongs and nasal vowels display the same configuration between the melodic and timing tiers.

4.3.1 Input representation of rising diphthongs

Following from the conclusions drawn in section 4.2.3, I assume the representation for the rising diphthongs which is illustrated in (22). It consists of a single timing unit which licenses the two Root nodes of the rising diphthong (see, e.g., Kaye and Lowenstamm 1984; Hyman 1985; Schane 1987).

(22) Input rising diphthong



I also adopt the standard view that there is no featural difference between glides (e.g., [ɥ]) and corresponding high vowels (e.g., [y]), and that whether the phonetic realisation is a glide or a

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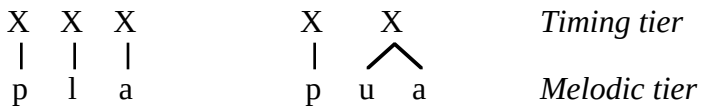
25 See Maddieson (1984:37-38) for more details on the distribution of secondarily-articulated consonants cross-linguistically.

26 Lebel, Goad and Rose (1999) show that this typological tendency is also reflected in child language.

vowel is driven by syllabification (see, e.g., Jakobson, Fant and Halle 1952; Clements and Keyser 1983; Levin 1985; Kaye and Lowenstamm 1984; Ladefoged and Maddieson 1996). The difference between a CLV and a CGV sequence is illustrated in (23) with the words *plat* [pla] ‘dish’ and *pois* [pwa] ‘pea’.

(23) Inputs: the contrast between CLV and CGV sequences

a. CLV: b. CGV:

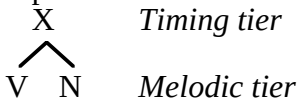


In loan input representations, there is thus a crucial difference between a CLV and a CGV sequence: the former comes with three timing units, each licensing its own Root node, whereas the latter comes with only two timing units, one of which is shared by the two Root nodes forming the rising diphthong. As we will see in the next section, the representation for rising diphthongs is parallel to that for nasal vowels.

4.3.2 Input representation of nasal vowels

The underlying structure of a nasal vowel is presented in (24). It contains a combination of two Root nodes anchored to a single timing unit.

(24) Input nasal vowel[27]



This representation (or that in footnote 27), which contains a branching configuration between the timing and melodic tiers, has been proposed by Paradis and Rose (1995) for the analysis of nasal vowels contained in loanwords, and by Paradis and Prunet (2000), who present additional arguments in favour of this representation from loanword phonology. This representation has also been proposed outside the domain of loanword phonology by Dell (1970), Prunet (1986), Piggott (1997), and Piggott and Humbert (1997). I assume that this structure holds for languages which have lexical nasal vowels.[28]

Again, as mentioned earlier, if the borrower were not provided with both the melodic and the timing tiers, s/he would not be in a position to represent a structure such as the one in (24). Given that a nasal vowel contains two Root nodes linked to a single timing position, if the borrower only had access to the melodic tier (Root nodes and their dependents), s/he would presumably interpret this structure as a sequence of two timing positions, each of which dominates its own melody. We will see in 5.2.3 that such an interpretation is indeed impossible to motivate and that the

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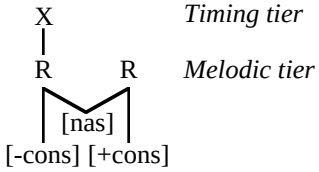
27 This representation differs slightly from the one proposed by Paradis and Prunet (2000), which is illustrated below. However, the schema in (24) is consistent with their proposal that two distinct Root nodes, which are anchored to a unique timing position, are present in the underlying representation of nasal vowels.

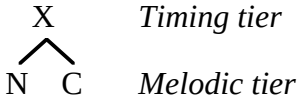


28 Languages like English which only have *phonetic* vowel nasalisation presumably do not have such a representation for nasal vowels.

consonantal Root node contained in the representation in (24) cannot be interpreted as an autonomous nasal consonant licensed by its own timing unit.

I also assume the representation of a prenasalised consonant in (25), which consists of a combination of a nasal Root node (N) and another consonantal Root node (C), which are both anchored to the same timing position. This representation will be needed to explain the adaptation of French word-medial nasal vowels in Kinyarwanda, presented below in section 5.2.2.

(25) Prenasalised consonant[29]



Keeping these representations in mind, we proceed, in the next section, to the current analysis of the adaptation patterns under investigation.

5. Analysis of the Root node preservation and deletion patterns

In order to provide an adequate account of the patterns observed in section 3, it is important to first express the relevant generalisations. As discussed earlier, deletion specifically affects Root nodes which do not host their own timing position; Root nodes which host their own timing unit are always preserved in the adapted forms, as stated in (26a).

(26) Generalisations on Root node preservation / deletion in loanwords
a. Input Root nodes which host their own timing units are preserved.
b. Input Root nodes which share a unique timing unit may be deleted.

The generalisation in (26b) applies whenever there is a branching configuration between the timing and melodic tiers in the input. I will demonstrate that Root node deletion only occurs in cases where

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[29] This representation is well-accepted in the literature on nasal features (e.g., Clements 1987). Other representations have also been proposed but this debate is not crucial for the issues addressed here, because the analysis I propose can easily be restated according to other types of representations.

preserving both Root nodes of the input branching structure would violate the licensing requirements of the borrowing language. In all such cases, deletion, which is formally the inability to license segmental features by higher prosodic structure, follows from Itô's (1986) Licensing Principle, which is defined in (27).

(27) Licensing Principle (Itô 1986:2)
All phonological units must be prosodically licensed, i.e. belong to higher prosodic structure.

5.1 Adaptation of French CGV sequences

We saw in the examples of French CGV sequences in section 3.1.2 that the only two sequences showing segmental deletion are the sequences [vw] and [ɥi], which are adapted in Fula as [w] and [i], respectively. I will explain these two examples in a unified fashion, by appealing to the OCP, whose general definition is given in (28).

(28) Obligatory Contour Principle (OCP; e.g., Leben 1973, McCarthy 1986)
Adjacent identical elements are prohibited.

We will see that full preservation of input [vw] and [ɥi] sequences in Fula would result in a violation of the OCP. Such a violation (and its resolution), linked with the fact that two Root nodes share the same timing position in an input rising diphthong, will provide us with an explanation for the Root node deletions found in input French [vw] and [ɥi] sequences adapted in Fula.[30]

Before I turn to these examples, I will first discuss the preservation patterns found in input CGV sequences.

5.1.1 Preservation cases

Recall that, apart from the two contexts mentioned above ([vw]V and C[ɥi] adapted in Fula), all French input CGV sequences are fully preserved when adapted in both Fula and Kinyarwanda. To illustrate this preservation pattern, I will take the example of the word *douane* [dwan], which is

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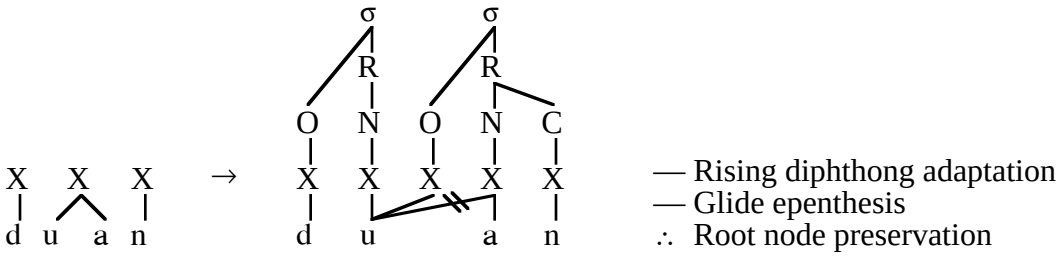
30 Paradis and Prunet (1989) also appeal to the OCP to explain alternations found in native words in Fula.

adapted into [duwaːn] ‘customs’ in Fula. In (29), we can see that the input rising diphthong is broken up and syllabified as a sequence of two vowels. The onset appearing between these vocoids is filled by glide epenthesis, whose segmental content comes from the first (high) vocoid.

(29) Adaptation of CGV sequences: glide epenthesis



The adapted form fulfills all of the syllabic requirements of Fula. It also shows full preservation of the input sequence. I explain preservation of both Root nodes in this context by the fact that they are vocalic Root nodes which constitute well-formed syllable heads and, therefore, can project their own syllable node in the adapted form. In section 5.2, we will see that the same cannot hold true of the nasal Root nodes found in input nasal vowels. These Root nodes are consonantal ones and thus do not constitute well-formed syllable heads in either Fula or Kinyarwanda, two languages which do not allow for nuclear consonants. In both of these languages, preservation of the nasal Root nodes will be conditioned by the presence of a potential licenser. Before I discuss these cases, I will first turn to the deletion cases observed in input CGV sequences.

5.1.2 Deletion cases: an OCP effect

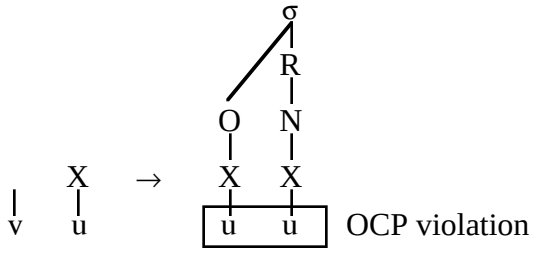
To better analyse the deletions observed in [vw] sequences, I need to briefly discuss the adaptation of the French voiced fricative consonant [v], which is ill-formed in Fula (see the constraint in (5d)). Most of the time, [v] is adapted into [w] in this language, as we can see in the examples in (30).

(30) French [v] → [w] in Fula[31] (Paradis and LaCharité 1997, Paradis and Prunet 2000)

avocat	[a<u>v</u>ɔka]	→	[a<u>w</u>ɔka]	'lawyer'
civil	[si<u>v</u>il]	→	[si<u>w</u>il]	'civil'
verre	[<u>v</u>ɛr]	→	[<u>w</u>ɛːr]	'glass'
ventilateur	[<u>v</u>ɑ̃tilatœʁ]	→	[<u>w</u>antilatɔr]	'fan'
vis	[<u>v</u>is]	→	[<u>w</u>is]	'screw'

In the adaptation of an input French [vw] sequence, a combination of full preservation of all of the input segments with segmental adaptation of [v] into [w] would result in a *[wu] sequence (underlyingly */uu/), which would violate the OCP. This is illustrated in (31).[32]

(31) *[vw] → [wu]: OCP violation



Paradis and Prunet (1989) argue that OCP violations result in fusion in Fula native vocabulary. In line with their hypothesis, I propose that the same process applies in loanwords. I illustrate the adaptation in (32), taking the example *voyou* [vwaju], which is adapted into [waju] 'hooligan' in Fula. What is particular to this fusion process is that it affects the input [w], which is part of a rising diphthong, and therefore does not host its own timing position. As one of the input Root

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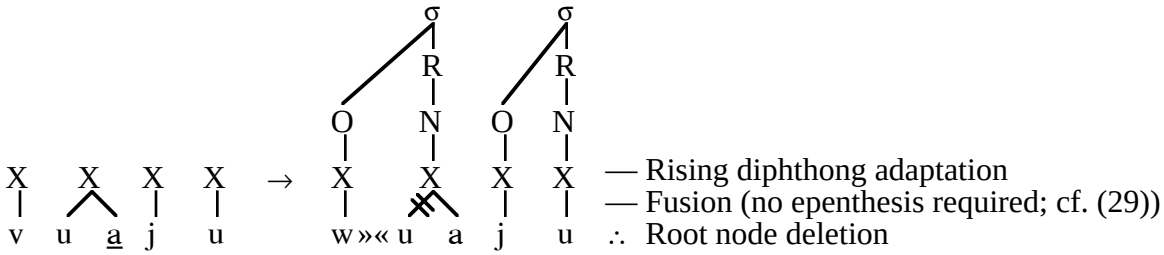
31 This pattern accounts for 77% (62/81 cases) of the examples found in the corpus of Lebel (1994). The second pattern, [v] → [b], is found in 17% of the cases. Paradis and LaCharité (1997) mention that loanwords showing this latter pattern may have been borrowed through another language, Serer (see Paradis and LaCharité 1997 for more details). Thus, [v] → [w] appears to be the regular pattern of [v] adaptation in Fula.

32 One example of the French sequence [vu] is found in Lebel's (1994) corpus. In this example, (*garde-à-vous* [gaʁdavu] → [gardebu] 'attention'), the French [vu] sequence is adapted as [bu], that is, without violation of the OCP.

nodes is suppressed by the fusion process, the remaining Root node can be licensed by its own timing position, without epenthesis.

(32) [vwa] → [wa]



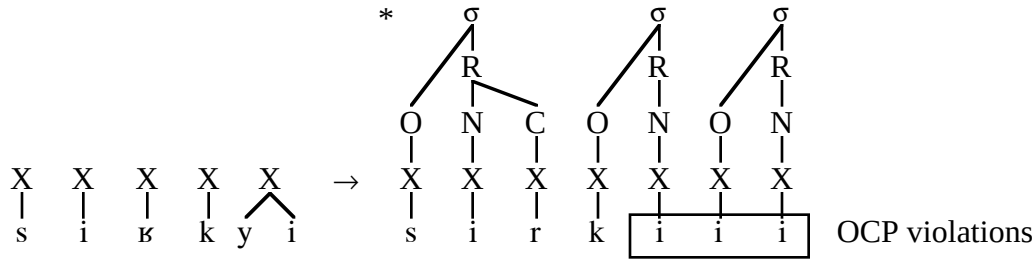
The same logic applies to French input [ɥi] sequences, which are adapted into [i] in Fula. As we saw in (5a), front rounded vocoids are disallowed in Fula. The vocalic counterpart of [ɥ], the vowel [y], is generally adapted into [i] in this language. Examples of this adaptation pattern are given in (33).

(33) French [y] → [i] in Fula (Lebel 1994, Paradis and LaCharité 1997; some repeated from (7a))

député	[depy̯te]	→	[dɛpi̯tɛ]	‘deputy’
autobus	[ɔtɔby̯s]	→	[ɔtɔbi̯s]	‘bus’
budget	[by̯dʒɛ]	→	[bi̯dzɛː]	‘budget’
crapule	[kʁapy̯l]	→	[karapi̯l]	‘scoundrel’
industrie	[ɛ̃dy̯stʁi]	→	[indi̯stri]	‘industry’

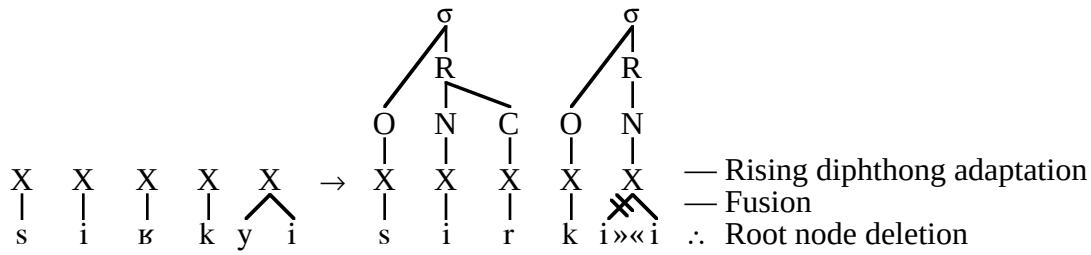
Recall from (29) that, in preservation contexts, an input GV sequence is adapted by glide epenthesis between the two vocoids. When this adaptation strategy is combined with the segmental adaptation pattern observed in (33), the likely solution for an input [ɥi] sequence should be to find a [iji] sequence in the adapted form. However, such a possibility would imply multiple violations of the OCP, as illustrated in (34), with the unattested adaptation of the input *circuit* [siʁkɥi] into *[sirkiji] ‘circuit’.

(34) *[ɥi] → [iji]: violation of the OCP[33]



I argue that the pattern of adaptation of French [ɥi] sequences into [i] in Fula also results from fusion. This analysis is illustrated in (35). In this case, fusion operates between the two members of the rising diphthong, leading to the simple vowel [i] observed in the data.

(35) [ɥi] → [i]



The analysis proposed here predicts that a language will not substitute a segmental adaptation strategy for another one in contexts where the latter would result in the loss of an input Root node. More explicitly, Fula does not adapt [y] into [u] (instead of [i]) in contexts where an adaptation into [i] would result in deletion. This prediction follows from the view in non-linear phonology that segmental and syllabification processes are independent and, therefore, have to be represented on

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[33] It is possible that the resulting form involves only one violation of the OCP (rather than two) in an analysis that treats glide epenthesis as spreading of vocalic material into the onset. Whichever analysis is adopted, what remains central to the point made here is that the OCP would be violated if all of the input Root nodes were preserved in the output.

different tiers (cf. Paradis and LaCharité 1997, who, as we will see below in section 6, treat segmental and syllabic adaptations as if they were exactly comparable).[34]

In the next subsection, I will briefly discuss examples of French loanwords in Japanese, which provide additional evidence supporting the account proposed above.

5.1.3 Additional evidence

Japanese does not allow for the high front rounded vocoids found in French. We can see in the examples in (36) that French [y] is adapted into a rising diphthong [ju] in Japanese (that is, with preservation of both the Labial and the Coronal articulators of the input vowel).

(36) French [y] → [ju] in Japanese (Shinohara 1997)[35]

crudité	[kry̯dite]	→	[kurju̯dite]	'raw vegetables'
manuscrit	[many̯skʁi]	→	[manju̯sukuri]	'manuscript'
allumer	[aly̯me]	→	[arju̯me]	'to light'
bousculer	[busky̯le]	→	[busukju̯re]	'to knock over'
calcul	[kalky̯l]	→	[karukju̯ru]	'calculation'

Preservation also applies in input French CGV sequences. In all of the cases presented in (37) below, we can see that the front rounded glide [ɥ] is also adapted into [ju], and that the vowel following the input glide is also preserved in the adapted form, which does not violate Japanese

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34 The current analysis predicts that input rising diphthongs *[wu] and *[ji] would also be adapted through fusion. However, there are no input rising diphthongs of this shape in French. This prediction is contrary to Paradis and LaCharité's (1997), who predict that both input Root nodes should be preserved in such contexts, as they are melodically well-formed (see further in section 6).

35 Although the vowel [u] used in the Japanese transcriptions presumably stands for the vowel [ɯ] in Standard Japanese, the transcriptions used here are consistent with Shinohara's (1997) system.

syllable structure constraints.[36] Moreover, as can be seen in (37b), preservation applies even in contexts where the input vowel following [ɥ] is the high front vowel [i].

(37) French [ɥ]V → [ju]V in Japanese (Shinohara 1997)

a.	*individualité*	[ɛ̃dividɥalite]	→	[andividjuarite]	'individuality'
	nuage	[nɥaʒ]	→	[njuazju]	'cloud'
	persuader	[pɛʁsɥade]	→	[perusjuade]	'to persuade'
b.	*cuisiner*	[kɥizine]	→	[kjuizine]	'to cook'
	suivi	[sɥivi]	→	[sjuivi]	'follow-up'

I attribute this preservation pattern to the fact that the segmental adaptation of input French front rounded vocoids never creates contexts violating the OCP in Japanese. French input front rounded vocoids are adapted as [ju] in Japanese. This segmental adaptation does not create a sequence of two identical vocoids and respects the Japanese language-specific syllabic requirements. Therefore, all of the input Root nodes can be preserved in the adapted forms.[37]

5.2 Adaptation of French nasal vowels

In this section, I present the case of French nasal vowels adapted in Fula and Kinyarwanda. We will see that the branching configuration contained in input nasal vowels, which is similar to the one for rising diphthongs, as it was first illustrated in (1), allows us to explain the patterns of

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[36] In Japanese, branching onsets are disallowed. Maximal syllables have the shape CGVV, CGVN or CGVC. In the latter, the syllable-final consonant must be the first member of a geminate consonant (see, e.g., Itô 1986 and Shinohara 1997:26 for additional details).

[37] Mester and Itô (1989) propose that CGV sequences constitute a secondarily-articulated consonant followed by a vowel (C^G.V), instead of a singleton consonant followed by a rising diphthong (C.GV). Whatever analysis is adopted, the resulting form consists of a syllabifiable sequence in Japanese, consistent with the analysis proposed here.

Also, under the current proposal, a hypothetical input *[qu] diphthong would result in an OCP violation (*[juu]). However, such a sequence does not occur in French.

adaptation found in both Fula and Kinyarwanda. We will also see that differences in the licensing possibilities offered by Fula and Kinyarwanda constitute the main cause for the different adaptation patterns found in these two languages.

5.2.1 French nasal vowels adapted in a CVC language: Fula

Recall from the examples presented in (12) that, when the nasal vowel appears in an open syllable, it is adapted into a VN sequence in Fula. When the nasal vowel is followed by a tautosyllabic consonant, nasality is lost. Some examples are repeated in (38) for convenience.

(38) French nasal vowels adapted in Fula (repeated from (12))

a. In open syllables: full preservation

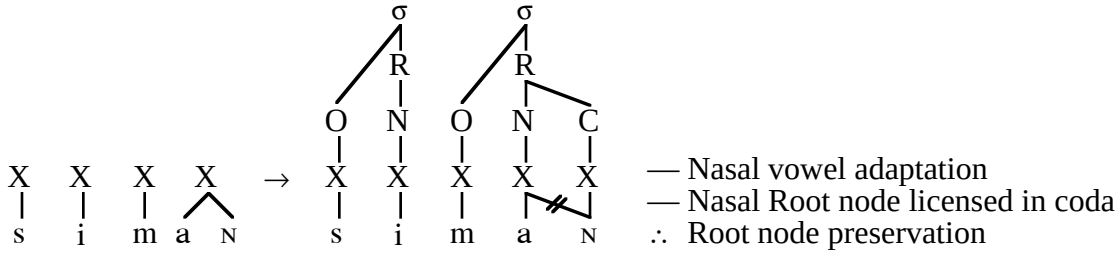
ciment	[si.mɑ̃]	→	[simɑ̃n]	*[simɑ̃]	‘cement’
conseil	[kɔ̃.sɛj]	→	[kɔ̃nsɛj]	*[kɔ̃sɛj]	‘advice’
ingénieur	[ɛ̃.ʒe.njœʁ]	→	[ɛ̃nsɛnjɔr]	*[ɛ̃sɛnjɔr]	‘engineer’

b. In ‘closed’ syllables: nasal deletion

balance	[ba.lɑ̃s]	→	[balɑ̃s]	*[balɑ̃nsɑ̃]	‘scale’
dimanche	[di.mɑ̃ʃ]	→	[dimɑ̃ːs]	*[dimɑ̃nsɑ̃]	‘Sunday’
essence	[ɛ.sɑ̃s]	→	[ɛsɑ̃ːs]	*[ɛsɑ̃nsɑ̃]	‘gasoline’

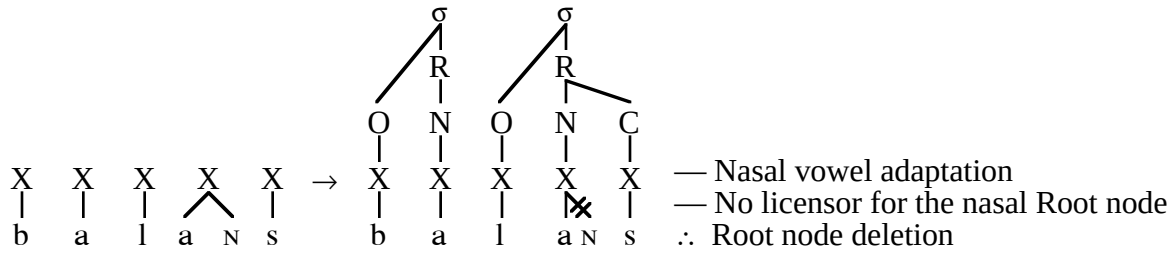
I propose, following Paradis and Rose (1995) and Paradis and Prunet (2000), that denasalisation of the French nasal vowel is triggered by the “unpacking” of the input configuration: the nasal Root node is delinked from the input structure so that the illicit combination of Root nodes is broken up in the adapted form. To demonstrate how this unpacking applies in Fula, and how the delinked nasal part can be rescued in the examples in (38a), I will first take the case of a French nasal vowel appearing in an open syllable. The analysis is illustrated in (39), with *ciment* [simɑ̃], which is adapted into [siman] ‘cement’, in Fula. In this context, the nasal part is delinked from the input nasal vowel and is syllabified as a coda. This strategy enables maximal preservation of all Root nodes contained within the source word.

(39) French nasal vowels in open syllable adapted in Fula



The situation is different when the French word contains a consonant that must be syllabified as a coda following the nasal vowel (see examples in (38b)). I illustrate this context in (40) with the word *balance* [balɑ̃s], adapted as [balas] 'scale' (not as *[balansa]) in Fula. The impossibility of licensing the nasal Root node in the examples in (38b) is attributed to the fact that rhymes are maximally bipositional[38] and that there is no extraprosodicity in Fula. Since the rhyme already contains both a vowel and a consonant, there is no position left to license the nasal Root node, which is therefore deleted.

(40) French nasal vowels in 'closed' syllable adapted in Fula



The reason why the unattested form *[balansa] is not produced follows from two conspiring facts. First, the input nasal Root node in French *balance* [balɑ̃s] does not host its own timing position. Therefore, it cannot be licensed like a true input nasal consonant.[39] Second, nasal Root

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38 See, e.g., Kaye and Lowenstamm (1981) and Booij (1983), who argue that, universally, the rhyme may not dominate more than two positions.

39 In section 5.2.3, I provide additional evidence regarding the formal difference between a nasal Root node and a true nasal consonant.

nodes do not constitute well-formed syllable heads in Fula and, thus, cannot project their own syllable node in the adapted form (Fula does not allow for syllabic consonants such as the nasal [n] in the English word *button* [bʌtn̩]). Preservation can only apply for nasal Root nodes when a potential licenser is available, as was the case for the examples in (38a), in which the nasal Root nodes were licensed in coda.[40] Since no licenser can rescue the nasal Root nodes found in the examples in (38b), deletion occurs. As we will see in the next section, this prediction also holds true for the nasal vowels adapted in Kinyarwanda.

Under the hypothesis developed in this paper, if the word *balance* were borrowed from English ([bæləns]), that is, from a word containing a true nasal consonant, the predicted adapted form in Fula would be [balansa], as all of the input Root nodes would host their own timing positions in the English input word. As we will see in section 5.2.3, this prediction holds true: nasal consonants (that is, nasal Root nodes anchored to their own timing position) are fully preserved in loanwords, no matter the context in which they appear in the input. Also, true nasal consonants in preconsonantal position found in French loanwords in Kinyarwanda bear out this prediction: the cases found in Rose's (1995) corpus (e.g. *omelette* [ɔmlɛt] → [omureti] 'omelet'; *imprimerie* [ɛ̃pʁimʁi] → [imhirimori] 'press')[41] are generally adapted with full preservation of all of the input segments.

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40 Recall from footnote 11 that a nasal vowel followed by a final stop shows preservation of the nasal feature (propagande [pʁopagɑ̃d] → [pɔrpagan] 'propaganda'). In this example, nasality can be rescued in the adapted form as stops constitute possible licensers for [nasal], contrary to fricatives, which cannot host nasality.

41 The prenasalized [h] found is in this example is caused by an independent process in Kinyarwanda whereby voiceless stops are debuccalized when prenasalized (Kimenyi 1979: 35-36). Interestingly, as we can see with this example, as well as in earlier observations (e.g., in footnote 9), not only the loanword is adapted to satisfy the phonotactics of Kinyarwanda but native processes also apply to this word, consistent with the assumptions made in section 4.

5.2.2 French nasal vowels adapted in a CV language: Kinyarwanda

We saw in the examples in (13) that French word-internal nasal vowels are adapted in Kinyarwanda as oral vowels followed by a prenasalised consonant. Word-finally, nasality is lost. A few examples are repeated in (41).

(41) French nasal vowels adapted in Kinyarwanda (repeated from (13))

a. Word-internal nasal vowels: full preservation

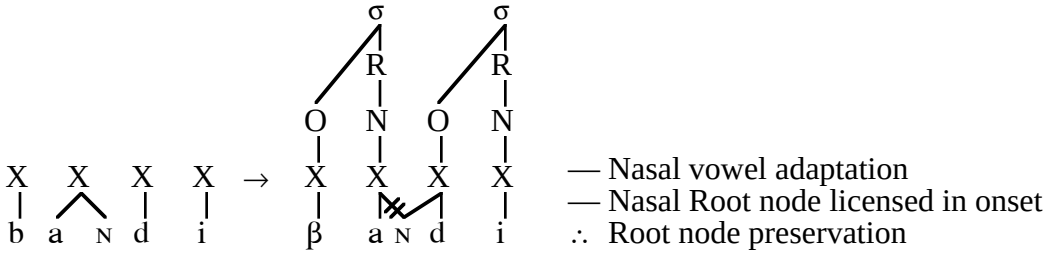
bandit	[bɑ̃di]	→	[βaːⁿdi]	*[βaːdi]	‘bandit’
ambassade	[ɑ̃basad]	→	[aᵐbasadi]	*[abasadi]	‘embassy’
vidange	[vidɑ̃ʒ]	→	[vidaːⁿʒi]	*[vidaːʒi]	‘garbage’

b. Word-final nasal vowels: nasal deletion

coussin	[kusɛ̃]	→	[kʷuse]	*[kʷuseni]	‘cushion’
avion	[avjɔ̃]	→	[avijo]	*[avijoni]	‘plane’
frein	[fʁɛ̃]	→	[fure]	*[fureni]	‘break’

In contexts where the input nasal vowel appears word-internally, this vowel is unpacked and the delinked Root node is licensed by the following consonant. The analysis is illustrated in (42) with the example of *bandit* [bɑ̃di], which is adapted into [βaːⁿdi] ‘bandit’ in Kinyarwanda. This adaptation yields a prenasalised consonant, a structure allowed in this language (see earlier in section 2), following the representation provided in (25).

(42) French word-internal nasal vowels adapted in Kinyarwanda

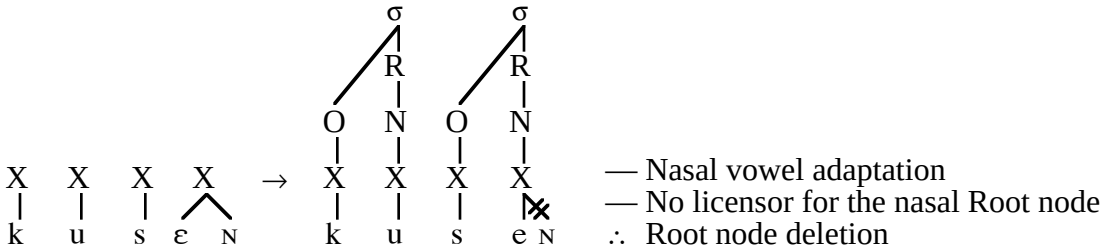


Since the delinked nasal Root node may be licensed by the following onset, full preservation of both Root nodes contained in the nasal vowel arises as expected. This prediction is analogous to the one made for the nasal vowels adapted in open syllables in Fula. An improper configuration between the timing and melodic tiers is repaired by delinking of the nasal (non-vocalic) Root node, and preservation applies following a licensing option offered by the borrowing language.

This preservation pattern, however, does not mean that the input nasal Root node is uniquely licensed by a timing position, like a true nasal consonant. If this were the case, we would — wrongly — expect these nasal Root nodes to trigger vowel epenthesis (*bandit* [bɑ̃di] → *[βanadi]), as epenthesis always happens with true nasal consonants in unsyllabifiable positions (e.g., *douane* [dwan] → [duwaani] ‘customs’; see section 5.2.3 for further discussion on this issue).

The situation is different when the French nasal vowel appears word-finally. I illustrate this context in (43) with the word *coussin* [kusɛ̃] ‘cushion’, which is adapted as [kʷuse] (not as *[kʷuseni]) in Kinyarwanda, showing loss of nasality.

(43) French word-final nasal vowels adapted in Kinyarwanda



In this case, the unpacking process applies in the same way. However, since no position can license the nasal Root node that is delinked from the vowel, and since Kinyarwanda does not allow for codas (cf. Fula above), no possible anchor is available in this context to rescue the delinked Root node, which is deleted in output. This is similar to what we saw for Fula in the preceding subsection: in the absence of a potential licenser, delinked nasal Root nodes cannot be preserved in adapted forms.

5.2.3 Against a perceptual approach to nasal vowel adaptation

One could object that the adaptations of nasal vowels observed in the preceding subsections may be analysed on perceptual grounds alone. The hypothesis, under this view, would be that nasal vowels are unpacked at the perceptual level. Under such an approach, these vowels would be interpreted in the loan input as true VN sequences. The examples in (44) enable us to falsify such a

hypothesis: word-final French VN sequences are adapted with full preservation of both Root nodes in Kinyarwanda.

(44) French word-final VN sequences adapted in Kinyarwanda (data from Rose 1995)

chanoine	[ʃanwa<u>n</u>]	→	[ʃanuwa<u>n</u>e]	*[ʃanuwa<u>a</u>]	‘canon’
douane	[dwa<u>n</u>]	→	[duwa<u>ːn</u>i]	*[duwa<u>a</u>]	‘customs’
capitaine	[kapitɛ<u>n</u>]	→	[kapitɛ<u>ːn</u>i]	*[kapitɛ<u>ɛ</u>]	‘captain’
carbone	[kaʁbɔ<u>n</u>]	→	[karuβɔ<u>ːn</u>e]	*[karuβɔ<u>ɔ</u>]	‘carbon’
bottine	[bɔti<u>n</u>]	→	[βɔti<u>ːn</u>i]	*[βɔti<u>i</u>]	‘ankle boot’

The word-final VN context contrasts with that of word-final nasal vowels, which always shows nasal deletion (see (41b)). This contrast is easily accounted for in the analysis proposed here, from the structural difference that exists between a VN sequence and a nasal vowel. In the former, each segment hosts its own timing position while, in the latter, the Root nodes share a unique timing position. In accordance with the generalisation in (26a), preservation is predicted in VN sequences, as all Root nodes are already licensed, in the input, by a higher constituent (at the timing level).

Thus, an approach for explaining segmental deletion in loanwords based on perception or salience cannot account for the adaptation contrast between (41b) and (44). This contrast strongly supports the view defended here that the loanwords studied in this paper are best accounted for on structural grounds. It also provides additional empirical evidence in favour of the analysis proposed in this paper that Root node deletion can only occur in contexts where two Root nodes share a unique timing position in the input. This approach, which is based on well-defined input representations, allows us to capture the different patterns found in the data, that are explained by appealing to the licensing possibilities offered by the borrowing languages.

In the next subsection, I discuss an alternative approach to the same deletion patterns as proposed by Paradis and LaCharité (1997). I will argue that their proposal, which is based on an arbitrary limit to derivational complexity, poses problems for a principled approach to phonology.

6. Loanword adaptation within TCRS: Paradis and LaCharité's (1997) proposal

As mentioned above in the introduction, Paradis and LaCharité's (1997) proposal to account for the alternations observed in this paper is couched within Theory of Constraints and Repair Strategies, a derivational constraint-based approach to phonology. TCRS shares with rule-based theories (e.g., Chomsky and Halle 1968) the notion of serial derivation, a notion rejected in other constraint-based theories such as Optimality Theory (OT; e.g., McCarthy and Prince 1993; Prince and Smolensky 1993). A significant difference between TCRS and OT is the level of representation at which constraints can be violated. OT allows for (minimal) constraint violations in output representations and is thus a theory of relative well-formedness. In TCRS, constraints cannot be violated in surface forms. In this framework, like in traditional rule-based approaches, surface forms must satisfy all well-formedness requirements present in a language.[42]

In TCRS, phonological constraints preclude the construction of surface representations that are not licit underlyingly in a language (in line with the principle of Structure Preservation; see, e.g., Kiparsky 1982). Foreign structures contained in loanwords must therefore be adapted (repaired) according to the phonological constraints of the borrowing language. Phonological adaptations are accomplished by the application of repair strategies, as defined in (45).

(45) Repair strategy (e.g., Paradis 1995a; Paradis and LaCharité 1997)
A universal, non-contextual phonological operation that is triggered by the violation of a phonological constraint, and which inserts or deletes content or structure to ensure conformity to the violated constraint.

The choice of (or preference for) the repair strategy to be applied to a given ill-formed structure is governed by three principles. These principles determine which repair strategy must be applied and therefore predict the way in which the ill-formed structure should be adapted. The first principle, called the Minimality Principle, is presented in (46).

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42 LaCharité and Paradis (1993) present a more complete comparison of constraint-based theories where the similarities and differences between TCRS and OT are discussed more thoroughly.

(46) Minimality Principle (e.g., Paradis 1995a; Paradis and LaCharité 1997)
a. A repair strategy must apply at the lowest phonological level[43] to which the violated constraint refers.
b. Repairs must involve as few strategies (steps) as possible.

Paradis and LaCharité's (1997) proposal is based on various corpora of loanwords: French loanwords in Fula, Kinyarwanda, and Moroccan Arabic, as well as English loanwords in Québec French. They show that segmental deletion occurs in only 3.6% of a total of 15,686 syllabic and segmental malformations found in these corpora. The second principle of TCRS, the Preservation Principle, which is presented in (47), predicts that segmental information is maximally preserved in loanwords.

(47) Preservation Principle (e.g., Paradis 1995a; Paradis and LaCharité 1997)
Segmental information is maximally preserved within the limits of the Threshold Principle.

TCRS nevertheless posits a limit on preservation, which is viewed as a limit on the price that languages are willing to pay to preserve segmental information. This limit is encoded by the third principle of TCRS, the Threshold Principle, presented in (48).

(48) Threshold Principle (e.g., Paradis 1995a; Paradis and LaCharité 1997)
a. All languages have a tolerance threshold to segment preservation.
b. This threshold is the same for all languages: two steps (or two repairs) within a given constraint domain.[44]

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[43] The "lowest phonological level" mentioned in the definition of the Minimality Principle is determined by the Phonological Level Hierarchy (e.g., Paradis 1995a; Paradis and LaCharité 1997), which is similar to the Prosodic Hierarchy (e.g., Selkirk 1978; McCarthy and Prince 1986). This hierarchy and other aspects of TCRS will not be discussed here, as they are not directly relevant to the issues addressed in this paper. For a complete description of TCRS, see Paradis and LaCharité (1997).

[44] A constraint domain constitutes the window within which constraint violations are assessed and repaired. For a description of constraint domain, see Paradis (1995a); Paradis and LaCharité (1997).

The first part of this principle (in (48a)) encodes a limit on segmental preservation, which is assumed to hold true of all languages. Paradis and LaCharité (1997) account for this limit by positing, in (48b), a maximum of two derivational steps for the adaptation of an ill-formed structure.

Before I discuss the issues directly related to the Threshold Principle, I first illustrate, in the next subsections, the way in which the principles of TCRS work together, under Paradis and LaCharité's (1997) proposal. This demonstration will be exemplified with some of the contrasting contexts found in French loanwords in Fula already described in section 3.

6.1 Preservation cases

In this subsection, I discuss the analysis of Paradis and LaCharité (1997) for contexts of segmental preservation, taking the examples of word-initial CL clusters. As they violate the constraint in (6a), French loanwords containing these clusters, for example, in words like *drap* [dra] 'bed sheet', must be adapted in Fula. *CL cluster can be repaired in two ways, that is, either by the insertion of a vowel between the two consonants or by deletion of one consonant. The Preservation Principle predicts vowel insertion to be the preferred strategy, as confirmed by the data in (8).

The adaptation of word-initial consonant clusters, as analysed by Paradis and LaCharité (1997), is illustrated in (49). A nucleus is first inserted between the two consonants.[45] The nucleus is then filled by the spreading of the vowel [α]. As a result, the constraint against branching onsets is satisfied without any loss of phonological information. Since the full adaptation of the illicit cluster only requires two steps, no violation of the Threshold Principle is encountered. [46]

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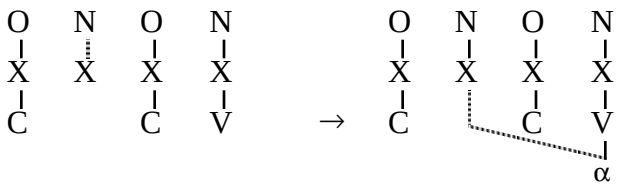
45 Paradis and LaCharité (1997) treat the insertion of a timing unit and of the syllabic constituent that dominates it as a single step.

46 As discussed below, the number of steps in the analysis crucially depends on the theory of syllabification assumed.

(49) CCV → CVCV (as analysed by Paradis and LaCharité 1997)
a. Nucleus insertion b. Vowel spreading

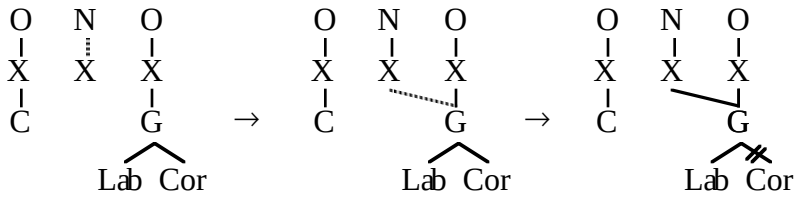


6.2 Deletion cases

According to Paradis and LaCharité (1997), segmental deletion only happens in contexts where the adaptation of a structure requires more than two derivational steps, violating the Threshold Principle. To illustrate such a context, let us appeal to another constraint in Fula. Recall from (5a) that this language disallows multiply-articulated vocoids, specifically vowels and glides that share Labial and Coronal articulators.

The deletions observed in French [ɥi] sequences in (11) clearly violate the Preservation Principle. Paradis and LaCharité (1997) propose that the Threshold Principle is at work in these cases. When a French loanword contains a segment like *[ɥ] in an unsyllabifiable *σ[CGV cluster, this segment simultaneously violates two constraints: the constraint in (5a) against Labial-Coronal and the constraint in (6a) against branching onsets (cf. footnote 7). The repair demands more than two derivational steps and therefore violates the Threshold Principle. The steps required to adapt a *C*ɥ* sequence are presented in (50). A nucleus is inserted in (50a). In (50b), the glide is spread into the inserted nucleus. Adaptation of the glide follows in (50c).

(50) *C*ɥ* → C*uw*: 3 steps (violation of the Threshold Principle, as analysed by Paradis and LaCharité 1997)
a. Nucleus insertion b. *ɥ* spreading c. *ɥ* adaptation



According to Paradis and LaCharité (1997), because a three-step adaptation is too costly for the Threshold Principle, segmental deletion occurs. Thus, biscuit [biskɥi] is adapted into [biski] 'biscuit' instead of *[biskuwi] in Fula.[47]

6.3 Some questions regarding the Threshold Principle

As we saw from the above illustration, under the analysis proposed by Paradis and LaCharité (1997), the Threshold Principle is responsible for the fact that phonological structures which are too complex tend to be deleted, instead of being preserved in the adapted loanwords. However, the Threshold Principle raises a number of questions.

6.3.1 General issues

The Threshold Principle requires that evaluation is done prior to the application of repair strategies. To decide whether a structure is to be adapted or deleted, the phonology must 'know' the number of steps required for an adaptation before it selects the right strategy. This implies that the speaker's phonology abstractly foresees the adaptation of the loanword before deciding what the end result should be. Under a derivational point of view, does the phonology, or the grammar in general, really apply such abstract evaluations in order to determine which strategy (e.g., segmental adaptation versus deletion) should be favoured?

Second, the Threshold Principle entails that phonology is a component of the grammar that is able to count: under Paradis and LaCharité's (1997) proposal, preservation versus deletion of segmental material is based on the sum of the derivational steps involved in a given adaptation. In a derivational approach to phonology, it is logical to expect that inputs containing malformations at both the segmental and syllabic levels require a great number of steps to be adapted. However, this

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47 Paradis and Rose (1995) propose a similar analysis for the deletion cases found in the adaptation of French nasal vowels in Fula and Kinyarwanda. The current analysis for these deletion cases was presented in section 5.

does not entail that the number of steps involved is really the *cause* of the segmental deletions observed.

It is standardly assumed that counting plays a role neither in grammars nor in theory construction. According to Paradis and LaCharité (1997), however, the notion of counting seems to be well-established in linguistic theory. Regarding this notion, they state that:

> There is independent evidence indicating that languages do count. It is commonplace for languages to count syllables, moræ, metrical feet and so on. The mere notion of 'binarity' requires counting (on the magic of number '2', see von Neumann (1958:53), Carlson (1981:31). (Paradis and LaCharité 1997:385, footnote 8)

In contrast to Paradis and LaCharité (1997), I support the standard view that there is no counting, in the sense of an arithmetic operation, in phonology. In phonological representations, for example in the Prosodic Hierarchy, the "magic" number 2 is an artefact of the hypothesis that languages select binary versus unary constituents. Thus, the question does not bear on the absolute number of dependents a given node may dominate, but only on the branching / non-branching distinction for this given node. Related to this, when branching is possible, two and only two branches are possible. If arithmetic counting were allowed in representations, we would also expect ternary or quaternary constituents, a possibility which is arguably not required.[48] I will elaborate more on the issue of counting in the following section.

Regarding how the Threshold Principle should be implemented in the phonology, other theory-specific assumptions also come into play. At the segmental level, for example, Paradis and LaCharité (1997) argue that "[…] distinctive segmental combinations […] are radically underspecified in line with the markedness view of Kiparsky (1982, 1985), Archangeli (1984), Pulleyblank (1986) and Paradis and Prunet (1991)" (Paradis and LaCharité 1997:395). Would the

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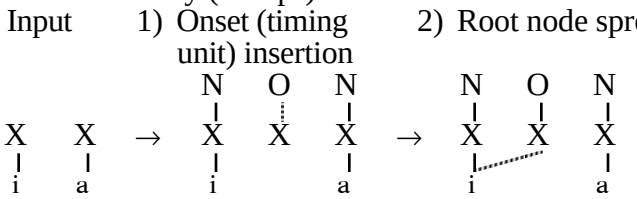
[48] A few languages show stress patterns that seem to require ternary feet. However, following the arguments presented in Levin (1988) and Hayes (1995), for example, ternary feet can be avoided in the analyses of these stress systems.

evaluation change if another theory of underspecification were used? Under an analysis following any theory of underspecification, what should the status of default structure-building rules be? Are these rules calculated into the equation leading to the evaluation of complexity, and, if so, how?

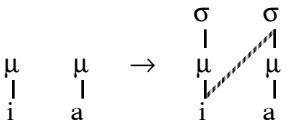
Similar concerns arise at the prosodic level. In (51), I illustrate that the number of steps required in loanword adaptations may very well be an artefact of the theory of syllabification adopted. We can see that glide epenthesis between two vowels requires two steps in Skeletal Theory, but only one in Moraic Theory, an approach to syllabification in which there is no correlate of the onset constituent; in this latter theory, onset creation results automatically from Root node spreading.

(51) The number of steps can be affected by different theoretical assumptions

a. Skeletal Theory (2 steps)



b. Moraic Theory (1 step)



Furthermore, it is conceptually plausible that different types of derivational steps have different psychological status. Should we consider, for example, timing unit insertion to be equivalent to feature insertion or deletion? In the system proposed by Paradis and LaCharité (1997), all steps have the same status, so that processes which are of a formally different nature (e.g., segmental versus syllabic) are in fact treated as if they were exactly comparable, an assumption which remains questionable.

Related to this, under Paradis and LaCharité's (1997) analysis, insertion of syllabic constituents counts as one step (e.g., (49a) and (50a)). Should this type of insertion (as compared

to insertion of segmental material) be calculated into the evaluation at all, given that it is an automatic consequence of the view that segmental material must be parsed into prosodic constituents?[49]

Finally, on empirical grounds, Ulrich (1997) has shown from his corpus of French and English loanwords in Lama that the alternations found in these loanwords cannot be predicted from a device such as the Threshold Principle. Regarding this, he concludes that "the Lama facts suggest that whether a language has a threshold at all should be parametrised, with Lama lacking a threshold entirely" (Ulrich 1997:460).

6.3.2 Arithmetic counting obscures structural relationships

All of the deletion cases discussed by Paradis and LaCharité (1997) are found in contexts where a melodically ill-formed segment appears in an unsyllabifiable sequence. The relationship between segmental and higher prosodic structure should therefore play a central role in the analysis. However, under the Threshold Principle, this relationship is lost, as the counting implicit in this principle does not permit us to distinguish between elements which are formally distinct (e.g., insertion of segmental features versus insertion of syllabic constituents).

Considering all of the arguments provided above, I propose to eliminate the Threshold Principle from the theory as a device for determining segmental deletions. I do not accept the hypothesis that a limit on the number of derivational steps is the fundamental cause of segmental deletion in loanword adaptation. A theory based solely on a mechanism such as arithmetic counting for encoding complexity seems inadequate for defining the computational limit on segmental preservation in loanword adaptation — if there is one at all.

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[49] As we saw in the analysis proposed earlier (in section 5), inputs are not syllabified (as implied in (51)) and, thus, syllabification does not count in the sense that it does not, I argue, affect the way loanwords are adapted; only the relationship between the timing and melodic tiers is relevant for the loanwords studied in this paper.

As it was demonstrated in section 5, counting can be avoided if we take into consideration both the structural relationship existing between elements present in a given input configuration and how this configuration can be realised in the borrowing language. The relation between the timing and melodic tiers was used to diagnose an improperly branching configuration between these two tiers. The licensing possibilities of the borrowing language were also taken into account, as they enabled us to predict, for each context studied, and for both of the borrowing languages studied, which adaptation pattern should apply.

7. Conclusion

In this paper, I have proposed an analysis of the deletion cases for which the Threshold Principle was first formulated and have demonstrated that these data can be correctly accounted for without any appeal to an arithmetic counting device.

I have discussed questions central to loanword phonology, namely, how the loan input is perceived by the borrower, how this input is represented in the borrower's phonology, and, finally, what governs the adaptation of the loan input. I have argued against proposals based on perceptual salience (e.g. Silverman 1992, Yip 1993), taking the position that a phonologically-based analysis of the data best accounts for the adaptation patterns found in the loanwords under present investigation.

Recall that rising diphthongs and nasal vowels are the only two contexts where deletion of a Root node is consistently found in the data. I have established a correlation between this observation and the structural similarity existing between rising diphthongs and nasal vowels. In both of these segments, two Root nodes are anchored to a unique timing position. This two-tiered representation is necessary in order to account for the alternations observed in this paper. In all contexts where one of these Root nodes cannot be licensed in the borrowing language, it is deleted in the adapted form. The deletion cases follow the general prediction of Itô's (1986) Licensing Principle that segments (formally Root nodes) are deleted when they cannot be licensed by higher prosodic structure.

The proposals made in this paper allow for some flexibility concerning what should be preserved and deleted in the borrowing language, as various patterns of adaptation may arise from a single input representation. Note that this flexibility does not allow for an unlimited number of options. It is constrained, on one hand, by the representation of the input, whose foreign structures are interpreted through the default options provided by UG, and, on the other hand, by the licensing possibilities offered by the borrowing language, which enable us to predict how a given input must be adapted in different contexts. Under this analysis, patterns of loanword adaptation, as well as variation observed across borrowing languages, can be accounted for in a principled way, on structural grounds alone.

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