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Loan Phonology: Perception, Salience, the Lexicon and OT

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5.1 Introduction

Unless they are treated as exceptions, loanwords whose phonological stucture does not fit into the phonology of the borrowing language need to be adapted to it. Rule-based accounts of the adaptation (or 'nativisation') of loanwords are typically confronted with the duplication problem (Kenstowicz and Kisseberth 1977: 136). This situation arises when a rule needs to be added to the grammar which duplicates a morpheme structure constraint, of which the sole function is to adapt loanwords to the native phonological system. As has been argued by Yip (1993), a constraint-based theory like Optimality Theory (OT) does not have to add extra rules to account for the nativisation of loan words. Rather, the adaptation ought to follow from the constraint ranking of the borrowing language.

This chapter readdresses this question and is organized as follows. In Section 5.2, we will discuss Silverman's rule-based account of loanword phonology in Cantonese and Yip's argument that a constraint-based model in contrast to a rule-based theory does not have to add extra rules but can make the nativisation simply follow as an automatic consequence of the constraint hierarchy of the language. Following Silverman, Yip distinguishes two levels: a Perceptual and an Operative level. In Section 5.3, we will go one step further and claim that the Perceptual level can entirely be dispensed with and that the constraint hierarchy alone suffices to deal adequately with loanword phonology.

An important claim that we will make is that what counts as an input to the phonological grammar of the borrowing language is not an unanalysed acoustic pattern but a universally defined, fully specified phonological representation, which is identical to what counts as an input to the phonological grammar of a child acquiring his or her language. We thus dispense with the notion of 'phonetic salience', appealed to by Silverman and Yip to explain the exclusion of certain segments from the nativised loans. The difference between child phonology and loan phonology is to be located in what Smolensky (1996) has called the Constraint Demotion algorithm, which is active in child phonology but is not, or is only marginally, active in loan phonology. It will be argued that the fact that Constraint Demotion does not play a role in loan phonology has important consequences for the underlying representation of loanwords. Finally, Section 5.4 summarizes the main conclusions.

5.2 Loanword Phonology: Rule-Based Versus Constraint-Based

5.2.1 *Silverman (1992)*

Silverman (1992) has advanced a rule-based account of loanword phonology in which a distinction is made between two levels: a Perceptual level and an Operative level. At the Perceptual level, the input, which according to Silverman (1992: 289) consists 'solely of a superficial acoustic signal, lacking all phonological representation' is interpreted as a string of native segments, in conformity with the Perceptual Uniformity Hypothesis in (1) (cf. Silverman 1992: 297, 325).

(1) Perceptual Uniformity Hypothesis

At the Perceptual Level, the native segment inventory constrains segmental representation in a uniform fashion, regardless of string position.

Caveat: input whose acoustic phonetic properties cannot be discerned due to its presence in an impoverished context (a context to be determined on a language-specific basis) is not supplied [a] representation.

Some examples from Cantonese in (2) will make this clear.

(2)

Input	Perceptual level
sharp	[sap]
shaft	[saf]
soda	[sota]
size	[says]
cheese	[tsis]

Silverman's assumption is that because Cantonese has only a single coronal fricative, the differences between [s], [z], [ʃ] and [ʒ] are not perceived by Cantonese speakers, and all four sibilants are replaced by the Cantonese segment [s]. Similarly, Cantonese does not have any voiced obstruents, which means that the difference between [d] and [t], for instance, is not perceived. Hence, [d] in *soda* is represented as [t].

In addition to the translation of foreign segments into native segments, there are two further elements in Silverman's treatment that contribute to the phonological shape of of the loanword: phonological rules and a pre-grammatical evaluation of the phonetic salience of the segments in the foreign word.

First, we discuss the rules, which constitute the Operative level. Here, Syllable

Structure Constraints hold, and to satisfy these in the case of Cantonese, a phonological process (peculiar to that level of loanword phonology) of occlusivation will apply to fricatives and affricates that have been assigned a coda position. In Cantonese, the only possible codas are [-cont] segments and the glides [j] and [w]. The occlusivation rule Silverman proposes is given in (3).

(3) Occlusivisation C → [–cont] / ___]$_\sigma$

The rule in (3) will change loans such as *shaft* as in (4).

(4)

Input	*shaft*
Perceptual level	[saf]
Operative level	[sap]

Unlike [f], [s] in coda position does not undergo (3), i.e. does not lead to [t]. Instead, regardless of its original identity in the lending language, [s] is subject to a rule of vowel epenthesis, given in (6).

(5)

Input	*tips*	*waste*	*bus*
Perceptual level	[tips]	[ways]	[pas]
Operative level	[tipsi]	[waysi]	[pasi]

(6) Epenthesis Ø → V/ s]$_\sigma$ ___

The question arises as to why the data in (4) and (5) are treated differently. Yip (1990) suggests that occlusivisation primarily applies to coda continuants when they are followed by a stop, and that a process of segment merger which preserves the place of articulation of the fricative and the manner of articulation of the stop should be postulated to account for [ft] → [p]. Yip also notes that fricatives in non-branching codas normally undergo epenthesis, as in *bus*→[pasi] (*[pat]). However, given that *waste* becomes [weysi] and not *[weyt], it seems unlikely that the branching coda is of any relevance. Rather, it seems that a distinction between [s] and [f] has to be made. In Silverman's account, this difference can be accounted for by ordering Epenthesis (6) before Occlusivisation (3). If Occlusivisation were to apply first, [s] would become [t].

The second additonal element in the process of loanword adaptation is illustrated by the treatment of final consonants in a cluster. If the final consonant is [t], as in *lift*, *shaft* and *waste*, it is not realised in Cantonese, whereas if it is [s], as in *tips*, it is realised as an onset consonant. Given that both [t] and [s] are part of the Cantonese segment inventory, both segments must be perceivable by Cantonese speakers in Silverman's view. Silverman (1992: 325) accounts for this difference by relying on a notion of phonetic salience, given as the caveat in (1). Essentially, this boils down to the assumption that postconsonantal [s] in these examples is above some level of phonetic salience for Cantonese speakers, but that postconsonantal [t] is not. The latter consonant is thus not included in the representation at the Perceptual level.

In summary, Silverman's analysis of English loans in Cantonese rests on three assumptions. First, before the grammar is called into action, segments of which the phonetic salience falls below some language-specific cut-off point are excluded, even though they are part of the borrowing language's segment inventory. Second, the analysis requires a level of representation, the Perceptual level, which acts as a filter on what is to be processed by the rules of loanword phonology. It adjusts the feature configurations of any segments that do pass the salience test, but that do not occur as such in Cantonese, so as to bring them in line with segments that do form part of the Cantonese inventory. Third, ordered rules must be postulated that are specific to loanword phonology. In fact, Silverman stresses that because of the highly constrained nature of the Cantonese morphophonology, the need for segmental rules is virtually non-existent, and therefore all segmental processes are to be relegated to the loanword phonology. This illustrates quite dramatically that a rule-based analysis will typically run into the duplication problem (Kenstowicz and Kisseberth 1977: 136), the point also stressed by Yip (1993). That is, a rule-based theory can account for loanword phonology, if rules are added to the grammar which duplicate morpheme structure constraints.

5.2.2 *Yip (1993)*

Yip (1993) claims that a constraint-based theory can account for loanword adaptations without extra machinery. More specifically, she claims that the adaptation follows as an automatic consequence of the constraint hierarchy that is independently needed to describe the phonology of the language. The phonological scan, she claims, is nothing more than 'the set of ranked constraints independently needed for the native vocabulary'. In other words, the first objection—that of the duplication problem—is met in her approach. However, Yip follows Silverman's division of the loanword phonology into two scans, a perceptual and a phonological one. This has the consequence that the filtering out of ill-formed segments is not accounted for in her OT analysis. Yip also follows Silverman's suggestion that relative salience plays a role in loanword phonology and proposes to that end a somewhat modified PARSE constraint (viz. PARSE(salient)). This constraint will see to it that, in the case of Cantonese, [s] will always be parsed; that other consonants, like liquids, will be parsed depending on the context; while post-consonantal stops are not parsed at all. We illustrate this with the Cantonese adaptation of English *bus*. Tableau (7), from Yip (1993: 284), illustrates the constraints involved. OK-σ is a blanket constraint that inspects the syllabic well-formedness of the output candidate, Faithfulness demands that the underlying form is not altered (i.e. does not lose or gain segments), MinWd requires the output candidate to be bisyllabic, and Fill, apparently partly duplicating Faithfulness, avoids inserted segments. Recall that □ indicates an inserted segment, and ⟨ ⟩ embrace a deleted segment.

(7) /bʌs/	OK-σ	Faithful	MinWd	PARSE (salient)	Fill
pas.	*!		*		
☞ pa.s□		*			*
pa.⟨s⟩		*	*!	*	

With examples like (7), Yip shows that the constraints she uses are independently needed in the language. Hence, there is no need for a rule like Epenthesis (6); rather, the adaptation of coda [s] in *bus* follows as an automatic consequence of the independently-needed constraint hierarchy. The effect of the perceptual scan can be observed in (7) in that the feature [+voice] is not perceived at all in the context of [-son] by Cantonese speakers, there being no voiced obstruents in Cantonese, and that as a result both the input form and the output form have a voiceless initial [p] (Yip 1993: 266–8). And the disappearance of [t] in words like *lift* is dealt with by allowing PARSE(salient) to be satisfied when [t] is not parsed, and violated when it is.

Yip's point that, in OT, adaptations can be described with the same grammar that is needed for the language anyway is obviously very important, and we fully subscribe to it in general terms. However, her adherence to Silverman's Perceptual Uniformity Principle (1), which says that the perception of segments in the input depends on their presence in the segment inventory of the borrowing language, is less well motivated. There is no evidence that people cannot in general perceive segmental contrasts that do not occur in their own language. For example, her position leads to the unlikely conclusion that speakers of German or Dutch do, but Cantonese speakers do not, perceive voice contrasts in obstruents in word-final position, even though they are neutralized in both languages. Since in Dutch, voiced and voiceless obstruents are contrastive in onset position, their Perceptual representation of an English loanword like [klʌb] *club* would contain a [b], which is subsequently rejected in favour of [p], whereas the Cantonese speaker would perceive a [p] right from the start. This language-specific conception of perception leads to even less probable positions in the case of languages with small segment inventories, like Hawaiian (Elbert and Pukui 1979). Yip's theory predicts that speakers of this language are incapable of perceiving the difference between [s] and [k], since their language does not have this opposition. This is difficult to reconcile with the common finding that language users appear to be capable of perceiving non-native segments with evident ease, and not infrequently incorporate new sounds into their phonological inventories as 'marginal' phonemes.

Likewise, by adhering to the notion of phonetic salience, Yip is forced to take the improbable view that salience is determined on a language-specific basis. While for Cantonese speakers the phonetic salience of post-consonantal stops falls below the required perceptual threshold, speakers of Dutch, in which the phonological form of the English loanword *lift* is [lɪft], have apparently no trouble hearing them. Once more, to give a more extreme example, Hawaiian English does not parse [s] in initial consonant clusters in English loans. Yip's theory will have it that the pre-consonantal [s] is salient for the speakers of many languages but not for speakers of Hawaiian. In addition, it is not immediately clear how the same set of PARSE(salient) constraints can create these language-specific effects, or, if they can, how this subgrammar is prevented from (partly) duplicating the regular constraint hierarchy. In the next section, we will argue that Yip's model must be taken one step further—one which will allow us to get rid of the problems related to salience and the perceptual scan.

5.3 Loanword Phonology: OT All the Way

In our discussion we will attempt to separate the isues involved. First, we deal with the question of what the representation of the loanword is when it is first processed by the grammar. Second, we recapitulate Prince and Smolensky's treatment of (native) segment inventories in OT. Next, we show how that treatment can be applied to the adaptation of foreign segments to native segments without the need for extra machinery beyond that required for characterizing the native segment inventory. Fourth, we will discuss the consequences of Constraint Demotion's not being active in loan phonology for the underlying representation of loanwords. Fifth, we show how phonetic salience can be dispensed with in an OT analysis.

5.3.1 *The Issue of the Input*

Instead of Silverman's (1992) assumption that the input to the Perceptual parse is an unanalysed acoustic signal, we propose that language users analyse speech signals in terms of a universal phonological vocabulary, which is of course much larger than the subset that is incorporated in their native language. Under this view, both Dutch and Cantonese speakers perceive the final [t] in *lift*, but only speakers of Dutch allow it to survive the demands of their constraint grammar. Similarly, speakers of both Cantonese and Dutch allow *club* to enter their phonology as an input form with [b], but reject the parsing of [+voice] for slightly different reasons: Dutch cannot tolerate it in the coda, and Cantonese cannot tolerate it at all.

A comparison with first-language acquisition will be useful. What we propose is essentially the way perception works in child language as viewed by Smolensky (1996), who argues that during the earlier stages of first-language acquisition children analyse the input, an overt form, with the same constraint hierarchy that they use for production. Paradoxically, even if production leads to only one possible output, say [ta], for all underlying forms, an overt input form like [kæt] will be faithfully analysed as /kæt/, and—in the ideal case of an efficient child language learner—be stored as such as the underlying form. The paradox that pronounced forms obey the phonological markedness constraints, while perceived forms apparently flout these constraints and instead obey the faithfulness constraints, is solved by the fact that perceived forms and pronounced forms face different classes of competitors. While in production [kæt] competes with [ta], [ka], [skæti], etc. to lose to [ta], as shown in (7), in perception [kæt] has no competitors at all, since the form is given as an overt form. The game now is to find the best underlying form: the competition is thus between /ta/, /ka/, /kæt/, /skæti/, etc. In (8), we see that the phonological markedness constraints judge all instances of the overt form [kæt] as equally bad, and the faithfulness constraints can thus decide the winner: /kæt/, which will be stored in the lexicon (or recognized if it was already there).

(7) Input forms	Output forms	Markedness	Faithfulness
/kæt/	[kæt]	*!	
☞ /kæt/	[ta]		***
/kæt/	[skæti]	*!	**

(8) Input forms	Output forms	Markedness	Faithfulness
☞ /kæt/	[kæt]	*	
/ta/	[kæt]	*	*!**
/skæti/	[kæt]	*	*!*

Language acquistion can now be seen in terms of the demotion of phonological markedness constraints: whenever the structural description that results as optimal in the perception parse is less harmonic than the output of that structural description by the production parse (as is the case in (7) and (8)), relevant constraints are demoted by the Constraint Demotion algorithm (cf. Tesar and Smolensky 1995) to make the perception parse the more harmonic. Accordingly, production will become more faithful. The important difference between first-language acquisition and loan phonology, then, is that Constraint Demotion does not (usually) take place in the latter. As a result, the constraint hierarchy will not be adapted to make production conform to the perception, causing the drastic structural changes that we often see in loans. The consequences for the underlying representations of loanwords will be discussed below.

5.3.2 *Characterizing the Native Segment Inventory*

By way of prelude to our discussion of how segmental adjustments in loans are accounted for in OT we briefly recapitulate the way Prince and Smolensky (1993) characterize native segments inventories. The example they give happens not to be particularly suitable for loanword adaptations, but the emphasis here is on the mechanics. They describe segment inventories as resulting from the interaction of faithfulness constraints (Parse and Fill) and anti-association constraints that forbid the parsing of segmental material to the feature tree. In Yidiɲ, palatalisation occurs as a secondary articulation on the coronal consonants [d,n], which thus contrast with [d^y,n^y]; however, there are no palatalised versions of the simplex labials and velars [b,g,m,ŋ]. In order to express universal markedness differences in place of articulation, Prince and Smolensky assume the harmony scale in (9a), according to which the association of an articulator Coronal to a place node is more harmonic (less marked) than the association of any other articulator, like Labial. The assumption is that (9a) is true both for consonantal articulations, i.e. associations to C-Place, and vocalic associations, i.e. associations to V-Place, which latter associations create secondary articulations when combined in the same segment with C-Place associations (Clements 1993). The harmony scale (9a) translates into the constraint hierachy (9b), which ranks 'anti-association constraints' forbidding unmarked articulations below those forbidding marked articulations.

(9) a. Coronal unmarkedness: harmony scale: PL/Cor > PL/Lab
b. Coronal unmarkedness: dominance hierarchy: *PL/Lab >> *PL/Cor

The crucial constraints that are needed by the side of (9b) are given in (10) and (11).

(10) PARSE(feature): An input feature must be parsed

(11) FILL(place): A place node must not be empty

The constraints in (9b), (10), and (11) can of course be violated and will lead to different outputs depending on the way they are ranked. In (12), an example of an input like [d^y] is given. The notation Cor′ indicates a feature which should associate to a V-Place node, i.e. a secondary articulation.

(12) {PL,Cor,Cor′}	*PL/Lab	PARSE(feat)	*PL/Cor	*[f′
☞ a. [Cor Cor′]			* *	
b. [Cor′ Cor]			* *	*!
c. [Cor]⟨Cor′⟩		*!	*	
d. [Cor′]⟨Cor⟩		*!	*	*
e. []⟨Cor Cor′⟩		*!*		

Before discussing the interactions of the first four constraints, we clarify the difference between candidates (a) and (b). The input {PL,Cor,Cor′} in (12) lists the place node, plus two as yet unassociated features Cor and Cor′. In order to distinguish labialised coronals ([d^w]) from palatalised labials [b^y]), Prince and Smolensky assume that features that characterize secondary articulations come with a marker for secondary articulation, f′. Constraint *[f′, given in (13), would ensure that an input {PL,Lab,Cor′} ends up as [b^y], instead of leaving the interpretation as [b^y] and [d^w] undecided. Although in our example the issue is vacuous (since both features are coronal), constraint *[f will select candidate (a) in preference to candidate (b). (Square brackets indicate the parsing of a feature into C-Place and V-Place, respectively.)

(13) *[f′ : f′ (secondary articulator) must not be parsed as the primary one

Tableau (12) shows that because Parse(feature) is ranked above *PL/Cor, candidate (a) is favoured over candidate (e), in which neither feature is parsed, and over candidates (c) and (d), in which one feature is left unparsed.

In order to ban palatalised labials, the constraint *PL/Lab is ranked above Parse(feature), as shown in (14), where the input is {PL,Lab,Cor′}. The candidate that best satisfies the constraints is (c), in which {Cor′} is parsed in C-Place, leading to [d]. (The Yidiɲ inventory does not include voiceless plosives.) The association of the secondary articulator Cor as the primary one (a violation of the lowest constraint) avoids a violation of one of the two topmost constraints. Without going into all the details it is clear that the relative ranking of the constraints Parse and the anti-association constraints adequately provides a description of the segment inventory of Yidiɲ.

(14)	{PL,Lab,Cor′}	*PL/Lab	Parse(feat)	*PL/Cor	*[f′
	a. [Lab Cor′]	*!		*	
	b. [Lab]⟨Cor′⟩	*!	*		
☞	c. [Cor′]⟨Lab⟩		*	*	*
	d. []⟨Lab,Cor′⟩		*!*		

Finally, in order to prevent the favouring of an empty place node over the parsing of at least one feature in inputs without {Cor}, Fill(place) must dominate *PL/Lab, as shown in (15).

(15)	{PL,Lab,Lab′}	Fill(place)	*PL/Lab	Parse(feat)	*PL/Cor	*[f′
	a. [Lab Lab′]		*!*			
☞	b. [Lab]⟨Lab′⟩		*	*		
	c. []⟨Lab Lab′⟩	*!				

As said before, the predictions that this particular set of data and assumptions makes in the context of loan phonology, such that an input $[p^y]$ should turn up as [d] in Yidiɲ loans, are not at issue here.

5.3.3 *Segmental Adaptations in Loan Phonology*

We now turn to a demonstration that the Perceptual level argued for by Silverman and Yip can be dispensed with on the basis of the adaptation of French front rounded vowels in Mauritian Creole (MC). In (16), we give the vowel inventory of MC, which lacks front rounded vowels. The vowel inventory of French, which does contain front rounded vowels, is given in (17).

(16) MC vowel system

i		u
e		o
	a	

(17) French vowel system

i	y		u
e	ø		o
ε	œ	a	ɔ

French loans containing front rounded vowels are adapted in MC with front unrounded vowels. By the logic of the Perceptual Hypothesis (1), Silverman and Yip would claim that the contrast is simply undetectable for MC speakers, who are believed to perceive front rounded vowels as front unrounded vowels. Our own assumption is that the structural description resulting from the perception parse of a front rounded vowel is that of a front rounded vowel, and since the form has no competitors, it will be stored as such in the lexicon. In the production parse, an input form containing the front rounded vowel is evaluated by the constraint hierarchy of MC so as to produce a front unrounded vowel. The existence of front rounded vowels in French means that both coronal and dorsal vowels may have a labial articulation. We will assume that if vowels have a double articulation, the two articulations are unordered. We also assume the following anti-association constraints, which specifically hold for the association of articulators to the V-Place node in the feature geometry (cf. Clements 1993, Jacobs 1998): *V-Place/Lab, *V-Place/Cor, *V-Place/Dor, *V-Place/Dor-Lab, *V-Place/Cor-Lab, *V-Place/Dor-Cor. In addition, there are the familiar constraints Parse (feature) and Fill(place). Depending on the relative ranking of these constraints, different vowel segment inventories will result. The ranking that must be assumed for French is given in (18).

(18) Vowel articulation ranking in French

Fill(Place) >> *V-Place/Dor-Cor, *V-Place/Lab >> Parse(feature) >> *V-Place/Cor, *V-Place/Dor, *V-Place/ Cor-Lab, *V-Place/Lab-Dor.

The effect of this ranking is of course that in French only vowels will surface that have either a Cor ([i,e,ε]), a Dor ([a]), a Cor-Lab ([y,ø,œ)] or a Dor-Lab ([u,o,ɔ]) articulation. All other possible articulations for vowels will be excluded by the relative ranking of the constraint Parse(feature) with the anti-association constraints. For MC, the only possible complex articulation for vowels is Lab-Dor (back, rounded vowels). Therefore, the MC ranking is minimally different from (18) in that *PL/Cor,Lab must rank above Parse(feature), as shown in (19).

(19) Vowel articulation ranking in MC

Fill(Pl) >> *V-Pl/Dor-Cor, *V-Pl/Cor-Lab, *V-Pl/Lab >>
Parse(feature) >> *V-Pl/Cor, *V-Pl/Dor, *V-Pl/Lab-Dor

The correct prediction is of course that for an input form containing both a Cor and Lab articulation, as in French loans with front rounded vowels, like *plumeau* [ply'mo] 'duster' and *cheveux* [ʃə'vø] 'hair', the optimal output is a plain coronal vowel, as in MC *plimo* [plimo] and *seve* [seve], respectively.

(20) {V-Pl, Lab,Cor}	FILL(Place)	*V/Dor-Cor, *V/Cor-Lab, *V/Lab	PARSE(f)	*V/Lab-Dor	*V-/Cor	*V-/Dor
a. [Cor, Lab]		*!				
b. ⟨Cor⟩[Lab]		*!	*			
c. [ ]⟨Cor, Lab⟩	*!		* *			
☞ d. [Cor]⟨Lab⟩			*		*	

In this section we have seen that the Perceptual level can be dispensed with in loan phonology. There is one single constraint hierarchy, which has different effects in production and perception. In the next section we will consider the consequences of the fact that Constraint Demotion is no longer active.

5.3.4 *The Underlying Representation of Loanwords*

If foreign inputs are faithfully parsed, are they also faithfully stored in the lexicon, in the way that first-language learners store new native inputs? When speakers are aware of the fact that they are dealing with a loanword, this may indeed well be the case, but of course loanwords often are restructured, and stored in an adapted shape in the lexicon.[1] In Optimality Theory, such restructuring follows as an automatic consequence of the organization of the grammar. To return to the example of Yidiɲ, the optimal output form of an input form containing {Lab, Cor'}, as shown in (14), only has a Cor-articulation. In other words, an input containing only {Cor} yields the same output as an input containing a complex articulation {Lab, Cor'}. Similarly, as shown in tableau (15), an input {Lab, Lab'} will yield the same output as an input {Lab}. It is improbable, however, that the underlying forms of any language will actually instantiate

[1] Valdman (1973) reports the reaction by a Haitian Creole-speaking maid who attended evening literacy classes to her teacher's pronunciation of *oeuf* 'egg' as [ze]: she decided to leave the class. Although she herself pronounced it that way, she was aware that her bilingual employers realised it as [zø]. In terms of the discussion here, this nicely illustrates that the structural description arrived at in the perception parse indeed contains the front rounded vowel, which, however, leaves the production parse as unrounded. The fact that not all lexical items are adapted at once can be illustrated with the two forms [plym] 'pen', 'feather' and [plim] 'feather', both from French [plym] *plume* 'pen', 'feather', as distinguished by some speakers.

this baroque range of theoretically possible inputs. Prince and Smolensky (1993: 192) therefore propose the Lexicon Optimization Principle, according to which only one of the many theoretically possible underlying forms leading to equivalent outputs will be stored, the one that incurs the fewest violation marks during the evaluation: 'The items in the Yidiɲ lexicon will not be filled with detritus like feature sets {PL, Cor, Lab′} or {PL, Lab, Lab′}. Since the former surfaces just like {PL, Cor} and the latter just like {PL, Lab}, and since the parses associated with these simpler inputs avoids the marks *PARSE(feature) incurred by the more complex counterparts, the needlessly complex inputs will never be chosen for underlying forms by the Yidiɲ learner'.

Tableau (21) makes the point explicit for MC. An input with only {V-Pl, Cor} will of course, given the hierarchy in (19), yield the same phonetic output as the input form {V-Pl, Cor, Lab} in (20). Compared to the optimal output candidate in (20), the optimal output candidate in (21) has one violation mark less, and will therefore be selected as the actual input by the language learner to be used whenever the word is pronounced.

(21) {V-Pl, Cor}	FILL(V-Place)	*V-Pl/Dor-Cor, *V-Pl/Cor-Lab, *V-Pl/Lab	PARSE(f)	*V-Pl/Lab-Cor, *V-Pl/Dor, *V-Pl/Cor
[ ]⟨Cor⟩	*!			
☞ [Cor]				*

The difference between first-language acquisition and loan phonology is thus that in child phonology Constraint Demotion will optimize harmony by changing the hierarchy, while in loan phonology Lexicon Optimization will optimize harmony by changing the lexical representations. Put differently, in loan phonology it is the production parse that wins and creates changes in the lexicon, whereas in child phonology it is the comprehension/perception parse that wins and creates changes in the constraint hierarchy. We schematize the entire process from the foreign word to the adapted underlying representation in (22).

A question that remains to be answered is whether OT can handle alternative solutions to the adaptation problem. For instance, what if there were a language which is identical to MC except that it turns front rounded vowels into back rounded vowels instead of to front rounded ones? Tunica is apparently an example of a language that borrowed French rounded front vowels as back rounded vowels (Haas 1947). Haas provides only a handful of examples, among which is *déjeuner*, pronounced as [tesuni]. The situation in Haitian Creole (Valdman 1973) is slightly more complicated. Words like *brûler* [bryle] and *adieu* [adjø] are realized as [bule] and [adjo]. Other words, like *mur* and *(les) yeux* are realised with front vowels, [mi] and [ze]. The adaptation of front rounded as back rounded vowels, instead of front unrounded ones, occurred at an earlier stage of Haitian Creole. The question arises how cases like Tunica and

(22)

foreign word
↓
UNIVERSAL PHONOLOGICAL PARSER
↓
fully specified, unadapted loanword
↓
CONSTRAINT HIERARCHY
↓
faithful underlying form
↓
CONSTRAINT HIERARCHY
↓
adapted output form
↓
LEXICON OPTIMIZATION
↓
adapted underlying form

older Haitian Creole should be dealt with.

In (23), which is a copy of (20) with the ranking of *V/Lab-Dor and *V/Cor inverted and the output candidate (e) added, we see that the reversal of two constraints produces the desired effect. The interesting thing is that in the absence of the evidence of loans, it would not have been possible to decide how the constraints *V/Lab-Dor and *V/Cor are ranked. Loanword phonology, much in the same way as reduplicative morphology (cf. McCarthy and Prince 1993), can thus provide evidence of how these otherwise seemingly unranked constraints are in fact ranked. The appearance of [o] for [ø] in older Haitian Creole or of [e] for [ø] in MC may thus be seen as another instance of the 'emergence of the unmarked' (McCarthy and Prince 1994).

(23) {V-Pl,Lab,Cor}	FILL(Place)	*V/Dor-Cor, *V/Cor-Lab, *V/Lab	PARSE(f)	*V/Cor	*V-/Dor–Lab	*V-/Dor
a. [Cor, Lab]		*!				
b. ⟨Cor⟩[Lab]		*!	*			
c. []⟨Cor, Lab⟩	*!		* *			
d. [Cor]⟨Lab⟩			*	*!		
☞ e. [Dor, Lab]			*		*	

Tableau (23) simply says that back rounded vowels are less marked than front vowels. Statistically, this is unexpected—reranking in line with (17) is to be expected and indeed is what happened in the evolution of Haitian Creole. Tableau (24) shows that the implication of the constraint hierarchy in (23) is not that an ordinary coronal vowel is turned into a dorsal one.

(24) {V-Pl,Cor}	FILL(Place)	*V/Dor-Cor, *V/Cor-Lab, *V/Lab	PARSE(f)	*V/Cor	*V/Dor-Lab	*V/Dor
☞ [Cor]				*		
[Dor]			*!			*

5.3.5 *Dealing With Nonsalient Segments*

Lastly, we turn to the question of the non-salient sounds in the input, which according to Silverman and Yip fail to get a hearing, so to speak, because they fall below some threshold of phonetic salience and are excluded by means of a pre-grammatical weeding of the input. There is no doubt that these nonsalient segments will indeed be phonetically nonsalient to speakers of languages that do not accommodate them. However, the fact that this nonsalience is apparently language-specific, as in the example of the English segments that are nonsalient for the purposes of Cantonese, but are readily accommodated in Dutch, suggests that their fate is determined by the grammar. The crucial prediction is that underlying forms are not treated differently from structural representations that arise from the parsing of foreign words. Concretely, the prediction is that a hypothetical underlying form /lipt/ in Cantonese should not be treated differently from a hypothetical /lipt/ which results from the parsing of the English word *lipped.* Because of the virtual absence of phonological adjustments in the native vocabulary, this prediction cannot be tested in the case of Cantonese, but it would be a trivial matter to give numerous examples illustrating this point. Importantly, the postulation of a constraint PARSE(salient), as proposed by Yip (1993), does not make this prediction.

Having said this, it is not immediately obvious how the non-parsing of [t] in *lift* should be accounted for. Since Cantonese disyllabic words contain stop-stop sequences, such as [syt.ka] 'cigar', we cannot rely on sonority-based constraints to exclude forms like *[lip.ti] for *lift.* A specific anti-association constraint forbidding the parsing of stem-final, postconsonantal plosives must then exist. Presumably, such a constraint is part of a range of constraints in the CODACONDITION family, within which different languages choose different cutoff points (cf. English, which allows stop-[t] codas, but not stop-[k] or stop-[p] codas, etc.).

(25) *Ct: Do not parse stemfinal, postconsonantal stops

Moreover, in order to be able to account for the different treatment of coda-[f] and coda-[s] in Cantonese, we will refine Yip's Faithfulness by making use of Correspondence Theory (McCarthy and Prince 1995). In Correspondence Theory, input-output faithfulness, or I-O Faithfulness, is divided into a number of constraints. MAX-IO (every segment of the input has a correspondent in the output) and DEP-IO (every segment of the output has a correspondent in the input) are constraints which prohibit deletion and insertion, and replace PARSE(segment) and FILL, respectively, while IDENT(f) (corresponding segment in the output is identical in feature with segment in the input) replaces PARSE(feature).

Just as in the case of Mauritian Creole and Yidiɲ, we will assume that every segment of a language is defined by an appropriate ranking of faithfulness constraints and anti-association constraints. This is illustrated for the voiced/voiceless obstruents in Cantonese in (26). In order to exclude voiced obstruents, we have to rank IDENT(+voice) for obstruents lower than the anti-association constraint for [+voice] for obstruents.

(26) /bʌs/	OK-σ	MAX-IO	DEP-IO	MinWd	*–son +voice	IDENT (–son +voice)
[pas]	*!			*		* *
[bas]	*!			*	*	*
☞ [pa.si]			*			* *
[ba.si]			*		*!	*
[ba⟨s⟩]		*!		*	*	
[pa⟨s⟩]		*!		*		o

Let us now show how the different treatment of coda-[f] and coda-[s] in Cantonese can be accounted for. In (28) and (29) we will take as examples *waste* and *lift* and assume, contrary to Yip (1993: 275) and Silverman (1992: 325), that [t] is present in the input. It is not some language-specific notion of saliency that will take care of not parsing post-consonantal [t], but the high-ranking of constraint (25). Also, in order to make sure that an input [s] is parsed, but not an input [f]—or, put differently, why we get [wei.si], but not [li.fi]—we have to revise the ranking of the IDENT constraints for [f] and [s]. Instead of listing the features defining [f] and [s], respectively (we follow Yip in assuming that the feature [strident] can only be present in coronal fricatives), we will simply refer to these constraints as IDENT(f) and IDENT(s). In order to obtain [lip] rather than [lit] as the optimal ouput for underlying

/lɪft/, we assume the two constraints in (27), which state that [p] is a better coda than [t].

(27) *V-t >> *V-p

It should be noticed that in both tableaus (28) and (29) we have omitted purely for considerations of space the constraint MinWd. Its ranking, right below Dep-IO, does not affect the outcome.

(28) /lɪft/	OK-σ	Id(s)	*Ct	Max-IO	Id(t)	*V-t	Dep-IO	Id(p)	*V-p	Id(f)
☞ [lip⟨t⟩]				*					*	*
[lif⟨t⟩]	*!			*						
[li⟨f⟩t]				*		*!				
[li.f⟨t⟩i]				*			*!			
[lip.ti]			*!				*		*	*
[lift]	*!		*							
[lipt]			*!							*
[li.p⟨t⟩i]				*			*!			*

(29) /weist/	OK-σ	Id(s)	*Ct	Max-IO	Id(t)	*V-t	Dep-IO	Id(p)	*V-p	Id(f)
☞ [wei.s⟨t⟩i]				*			*			
[weist]	*!		*							
[weis⟨t⟩]	*!			*						
[wei⟨s⟩t]				*		*!				
[weit⟨t⟩]		*!		*		*				

Finally, it is shown in (30) that a monosyllabic input /kæt/ will still lead to an optimal output [kæt] and not [kæp] given that Id(t) is higher ranked than *V-t.

(30) /kæt/	OK-σ	Id(s)	*Ct	Max-IO	Id(t)	*V-t	Dep-IO	Id(p)	*V-p	Id(f)
☞ [kæt]						*				
[kæp]					*!				*	

It is interesting to note that Yip mentions vowel epenthesis as a possibility for the preservation of coda [f]. Besides /lift/ → [lip], /soft/ may become [sofu]. The analysis presented here can quite elegantly describe this possibility by allowing the constraint IDENT(f) to be optionally ranked: either as in (28) or higher, next to IDENT(s), as illustrated in (31).

(31) /soft/	OK-σ	ID(f)	ID(s)	*Ct	MAX-IO	ID(t)	*V-t	DEP-IO	ID(p)	*V-p
[sop⟨t⟩]		*!			*					*
[sof⟨t⟩]	*!				*					
[so⟨f⟩t]					*		*!			
☞ [so.f⟨t⟩u]					*			*		
[sop.tu]		*!		*				*		*
[soft]	*!			*						
[sopt]		*!		*						
[so.p⟨t⟩u]		*!			*			*		

5.4 Summary

Loan phonology is not a separate component of the grammar. Phonological adjustments that are made by the borrowing language must be accounted for by the same constraint hierarchy that characterizes the native phonology. A crucial issue in loan phonology concerns the nature of the input to the grammar. We have argued that it is incorrect to claim, as does Silverman (1992), that prior to the processing of foreign words by the native grammar, the segments of the word are vetted for phonetic salience. Neither is it the case that the input consists of a raw acoustic signal. The language user's universal segment parser will assign a phonological representation to the foreign word in the same way that the language-learning child assigns a phonological representation to the words of his or her native language (even though he or she might not be able to pronounce it even remotely faithfully). In the case of the loanword adopter, this representation may, and typically will, include segmental and phonotactic configurations that are ill-formed in his or her own language. Upon production, the language's constraint hierarchy will cause the form to be adjusted to the native grammar in the same way that any native underlying form would. Integration of the loanword in the native vocabulary is achieved by Lexicon Optimization, which will cause the distance between the underlying form and the surface form to be minimized in favour of the produced, adjusted form.

We have argued that Yip's OT account of loanword phonology, which follows Silverman (1992) in including a Perceptual parse which causes all non-native segments to be replaced with native segments, is incorrect. Again, the native grammar characterizes what a well-formed segment is, and that same grammar must see to it that any incoming segment that violates it is 'replaced' with one that does not. In fact, loanword phonology can in some cases reveal rankings in the grammar that for the purposes of the native phonology are not crucially ranked.

5.5 References

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