# 100 Loanword Phonology

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## 1 Introduction

"Loanwords" are words borrowed from one language to another. These borrowed words usually undergo "adaptation" processes to conform to the structural constraints of the borrowing language phonology. Such adaptation affects all facets of phonological structure, reflecting the segmental, phonotactic, suprasegmental and morphophonological restrictions of the borrowing language. The patterns that emerge in loanword adaptation often reveal aspects of native speakers' knowledge that are not necessarily obvious in data of the native language and, as a result, loanword data can inform our analysis of the native phonology (Hyman 1970, Holden 1976, Ahn & Iverson 2004, Kawahara 2008, Wetzels 2009, Chang forthcoming, among others). In this respect, loanword adaptation can be considered a real-life *Wug test* (Berko 1958) which can enable us to probe into the grammatical knowledge of speakers in ways that native data alone cannot. Conversely, however, such emergent patterns in loanword adaptation present a learnability puzzle (cf. Broselow 2009): if a loanword pattern is underdetermined by the native phonology, where does the pattern come from? Also, what type of representation does the adaptation process refer to as it searches for licit forms in the borrowing language that most closely match the foreign language input? Is it an abstract phonological representation, a detailed phonetic representation, or a combination of the two? Are there any universal preferences for certain types of repair over others (e.g. epenthesis over deletion, or retention of a vocalic feature over a consonantal feature)? These are some of the major recurring questions in recent studies in loanword phonology and we will address them in this chapter.

This chapter is organized as follows. §100.2 examines various types of emergent patterns in loanword adaptation which pose a potential learnability puzzle, as well as examining proposed explanations for such emergent patterns. §100.3 provides a survey of instances of segmental adaptation and the levels of representation they refer to. §100.4 examines phonotactic adaptations.[1]

[1] There is a growing body of research on supra-segmental adaptation, which is not dealt with in this chapter due to limitations of space. Readers should refer to Y. Kang (forthcoming) for a recent review of this topic.

## 2 Emergent patterns in loanwords

Research on loanword phonology intensified with the advent of constraint-based models of phonology, such as the theory of Constraints and Repair Strategies (Paradis 1988) and Optimality Theory (Prince & Smolensky 1993) in particular, largely due to their use of output constraints which could motivate the adaptation process even when particular processes themselves had no precedents in the native phonology (Yip 1993, Paradis & LaCharité 1997, Broselow 1999, Jacobs & Gussenhoven 2000). In addition, the principle of *Richness of the Base* in Optimality Theory naturally allows for, and perhaps even requires, an analysis of novel input forms which are not attested in native learning data (cf. Smolensky 1996, CHAPTER 76: RICHNESS OF THE BASE), making the theory more amenable to the study of loanword adaptation phenomena. However, it has also been noted that constraint-based models only resolve one aspect of the puzzle (i.e. why an adaptation takes place at all), while leaving many other questions unanswered (Golston & Yang 2001, Peperkamp 2005, Broselow 2009). The puzzling emergent patterns in loanword adaptation identified in the literature can be classified into five categories.

1. The TOO-MANY-SOLUTIONS PROBLEM: The *too-many-solutions* problem (Steriade 2001), or *differential faithfulness* (Broselow 2009), refers to how, given an offending structure in the foreign input, there is almost always more than one logically possible repair strategy, yet adaptation often converges on a specific strategy even when speakers have no apparent evidence for that process in their native language. For example, Hawaiian does not have a voiced stop /b/, and thus, as it is unattested in native phonology by definition, there is no direct evidence from the native phonology as to how such an illicit segment should be repaired. Yet English /b/ is systematically adapted as /p/ (*boulder* → [polu'kaː]) and not /m/, /w/ or any other segment of the Hawaiian inventory (Adler 2006). Similarly, a repair for a phonotactic constraint violation presents a wide range of logically possible choices. For example, when an onset cluster ($C_1C_2V$) is borrowed into a language which bans complex onsets, the structural requirements of the native language can be satisfied by the deletion of a consonant (> $C_2V$ or $C_1V$), an option found in French loanwords in Vietnamese (*crème* → [kem]), or by the epenthesis of a vowel in front of the cluster (> $vC_1C_2V$) or inside the cluster (> $C_1vC_2V$). The epenthesis repair is found in Japanese (*Christmas* → [kurisumasu]) and Hawaiian (*Christmas* → [kalikimaki]), among other languages, and these examples also illustrate some of the different possibilities in the quality of the epenthetic vowel (Broselow 2006). How, given all these options, do adapters converge on a specific repair strategy?
2. DIVERGENT REPAIR: Even more puzzling is the fact that the repair chosen sometimes seems to contradict the native repair strategy – a situation referred to as *divergent repair* by Kenstowicz (2005) and as *ranking reversal* by Broselow (2009; see also CHAPTER 71: CONSPIRACIES). For example, Thai requires the final syllable of a word to be heavy. This requirement is satisfied by glottal stop insertion in native words, as in /pʰrá/ → [pʰrá?] 'monk', but by vowel lengthening in English loans, as in *coma* → [kʰōːmâː]. In native Korean, a restriction against a sequence of an obstruent + nasal is repaired by nasalization, as

in /kuk-mul/ [kuŋmul] 'soup', but epenthesis is the dominant repair option employed for English loanwords, as in *picnic* → [pʰikʰɨnik] (see Peperkamp *et al.* (2008: 156) for more examples of divergent repairs).

3. Unnecessary repair: Moreover, there are cases where adaptation takes place even when there is no apparent illicit structure in need of repair – a situation referred to as *unnecessary repair* by Peperkamp (2005). For example, Korean allows voiceless stops in coda position, but English voiceless stops are variably adapted with vowel epenthesis, as in *cut* → [kʰʌtʰɨ] ~ [kʰʌt] (Y. Kang 2003). Also, an English cluster of a coronal stop + [w] is adapted with epenthesis in Korean (*twin* → [tʰɨwin], *[tʰwin]) (H. Kang 2006), even though such clusters are allowed in Korean. In Hmong, /ʒ/ in French loanwords is adapted as /j/, despite the fact that /ʒ/ is a phoneme in Hmong (/ʒo.zɛf/ *Joseph* → /jɔ̀.sè/, */ʒɔ̀.sè/) (Golston & Yang 2001). Also, in French loanwords in Japanese and Korean, an epenthetic vowel is added "unnecessarily" following word-final nasals (French [kan] *Cannes* → Japanese [kannu], *[kan] (Shinohara 1997, Peperkamp *et al.* 2008); French [kom] *comme* → Korean [kʼommɨ], *[kʼom] (H. Kang 1996)).
4. Differential importation: Yet another type of puzzling emergent pattern is *differential importation*. Importation refers to a situation where a structure not attested in native phonology is exceptionally allowed in loanwords. While such importation in and of itself is not a problem from a learnability perspective, the fact that only certain structures, but not others, are imported requires an explanation (Holden 1976, Itô & Mester 1995, 1999, 2001, Davidson & Noyer 1997, Broselow 2009). Given foreign input with two types of novel structures which are both equally unattested in the native data, why is one structure readily allowed into the language but not the other? For example, in Hawaiian, the fully nativized form of the English word *truck* is [kəˈlakə]. Also possible is a "less Hawaiian" variant [təˈlakə], where English /t/ remains unadapted. But the variant *['krakə], where the complex onset is retained, but /t/ is adapted as /k/, is judged to be impossible (Adler 2006). In other words, the restriction against /t/ is more easily relaxed than the restriction against an onset cluster. In Russian, the requirement that only palatalized consonants occur before /e/ is often violated in adaptation, but the process of reducing unstressed /o/ and /e/ is more likely to be upheld (Holden 1976).
5. Retreat to the unmarked: While importation is a situation where native constraints are relaxed in the loanwords, allowing a wider range of output structure in the loanword stratum than in the native stratum, we also find the opposite situation, i.e. that loanwords conform to *stricter* structural requirements than the native phonology, such that the foreign input is transformed to an unmarked form, even when there is a seemingly more faithful licit form available in the language. Kenstowicz (2005) refers to such cases as *retreat to the unmarked*. Pitch accent assignment in Japanese and Korean exhibits an emergence of a default accent assignment pattern – the most general pattern being to accent the penultimate syllable in Kyungsang Korean (Kenstowicz & Sohn 2001, Lee 2009) and the antepenultimate one in Tokyo Japanese (Shinohara 2000, Kubozono 2006). Similarly, tone assignment in loanwords in White Hmong (Golston & Yang 2001), Thai (Kenstowicz & Suchato 2006), Tibetan (Hsieh & Kenstowicz 2008), Taiwanese (Hsieh 2006), Mandarin (Wu 2006) and Vietnamese (Barker 1969) is based on the segmental

composition of the input. The "retreat to the unmarked" is also found in the segmental domain. In Hungarian, word-final voiceless obstruents in monosyllabic loanwords are geminated, in an apparent requirement for syllables to be heavy (e.g. *shock* → [sokk], *[sok]), but "Hungarian does not have a requirement for syllables to be heavy" and this is a case of "a peripheral stratum of the lexicon introducing a requirement which is not a part of the core-stratum" (Kertész 2003).[2] In Thai, English word-initial voiceless stops are generally adapted as aspirated stops, retaining the aspiration of the input (e.g. English [p$^h$]*in* → Thai [p$^h$in], [t$^h$]*eam* → [t$^h$iːm], [k$^h$]*one* → [k$^h$oːn]). The only exceptions are when there is an unaspirated stop in the same word, as in [p$^h$]*eg* → [pek], *[p$^h$ek], and [k$^h$]*ook* → [kuk], *[k$^h$uk], indicating a preference for a non-aspiration harmony – a generalization not present in the native phonology (Kenstowicz & Suchato 2006). The retreat to the unmarked in many of these cases is particularly puzzling, because there is no clear evidence for the "unmarked" status of the resulting structure in the native data.

We now turn to explanations for emergent patterns in loanword phonology in the literature, which can be grouped into five broad categories, which are not necessarily mutually exclusive.[3]

1. NATIVE PHONOLOGY: The first possibility is that the adaptation pattern is indeed a reflection of language-specific facts of the native phonology – the loanword pattern only appears to be novel. For example, it has been proposed that in segmental adaptation, the choice regarding which feature to preserve and which feature to sacrifice is informed by the status of the features in the native phonology (Hancin-Bhatt 1994, Clements 2001, Herd 2005, among others; see §100.3.1 for further discussion). Rose and Demuth (2006) propose that the choice of the epenthetic vowel quality in English and Afrikaans loanwords in Sesotho is predictable from the contrastive feature specifications of the native phonology. The native phonology generalizations that affect loanwords can also take the form of covert statistical generalizations. Zuraw (2000) demonstrates that the variable application of nasal substitution in loanwords in Tagalog is a direct reflection of statistical tendencies in the native lexicon. It has also been argued that the default accentuation in loanwords in Tokyo Japanese has a direct correlate in native phonology as a covert default in the lexicon as a whole (Kubozono 2006). Luke and Lau (2008) show that in recent English loans in Cantonese, verbs are generally truncated to become monosyllabic,

[2] Consonant gemination in loanwords is a widespread phenomenon, found in Japanese (Katayama 1998, Shinohara 2004, Kato 2006, Kubozono *et al.* 2008), Italian (Repetti 1993, 2006, 2009), Finnish (Karvonen 2005), Maltese and Egyptian Arabic (Hafez 1996) and Kannada (Sridhar 1990). While some writers analyze gemination in loanwords as the emergence of the unmarked (Repetti 1993, Shinohara 2004, Kubozono *et al.* 2008, among others), others argue that the gemination is motivated by the preservation of the input structure and does not necessarily result in less markedness of the output (Kato 2006, Repetti 2006). Repetti (2006), in fact, refers to the gemination in loanwords in Italian as a case of the emergence of "marked" structures. Under these alternative interpretations, consonant gemination can be categorized as a case of (seemingly) unnecessary repair ((iii) above), rather than a retreat to the unmarked.

[3] Another possibility not listed here is to posit a separate set of principles or constraints governing loanword adaptation (Paradis & LaCharité 1997). Such approaches may be considered a type of UG approach if we assume that UG contains a separate set of principles for loan adaptation.

whereas nouns tend to be bisyllabic, and this pattern conforms to lexical statistics in native words. Walter (2006) argues that gender assignment in Arabic loanwords in Spanish also mirrors phonological generalizations and statistical tendencies in the native lexicon.

2. DEFAULT SETTING OF UG: However, many emergent patterns in loanwords still elude explanations based on covert generalizations in native phonology. Some attribute these emergent patterns to default settings of Universal Grammar. Default accentuation in Northern Kyungsang Korean exhibits a case of this retreat to the unmarked – a pattern which does not appear otherwise to be motivated in the native phonology and which must thus be attributed to UG (Kenstowicz & Sohn 2001). Uffmann (2006) resorts to a universal markedness hierarchy to account for the epenthetic vowel quality in loanwords in Shona, Sranan, Samoan and Kinyarwanda. In their influential work on the lexical stratification of Japanese, Itô and Mester (1995, 1999, 2001) argue that the differential importation of foreign features in loanwords reveals covert constraint rankings from the initial state of UG that lie latent in the native phonology (also see Shinohara 2000, 2004).[4] Similarly, Davidson *et al.* (2004) argue that the differing rates in the correct L2 production of foreign clusters reveal a covert ranking in the initial state of UG. Analyses that resort to the universal hierarchy of perceptual similarity (*P-map*) to account for adaptation patterns can also be grouped into this category (Fleischhacker 2005, Shinohara 2006, Kawahara 2008). We will return to this P-map-based approach below.
3. ADAPTATION AS PERCEPTION: The next possibility is that a seemingly puzzling adaptation in fact takes place during the perception of foreign input and not in the computation of the production grammar (Silverman 1992, Peperkamp & Dupoux 2003, Peperkamp *et al.* 2008, Boersma & Hamann 2009, Calabrese 2009). Based on findings that the perception of foreign sounds is constrained by the segmental and structural constraints of the native language (Massaro & Cohen 1983, Werker & Tees 1984, Dupoux *et al.* 1997, Dupoux *et al.* 1999), it is argued that most, if not all, of the adaptation in fact takes place during the perception of foreign input. This approach breaks away from the assumption that the input to the production grammar in loanword adaptation faithfully retains the phonetic and/or phonological structure of the source language input (cf. Jacobs & Gussenhoven 2000, LaCharité & Paradis 2005). This view provides a solution to many puzzling adaptations, such as *unnecessary repair* or *divergent repair*, where the adaptation pattern seems to contradict the production grammar of the borrowing language.[5]

   While some propose that perceptual adaptation is one of many steps in adaptation (e.g. Silverman 1992, Kenstowicz 2003, Broselow 2009), others propose that "*all* loanword adaptations are phonetically minimal transformations that

[4] Crawford (2007, 2008) argues that the different degree of nativization is grammar-external (i.e. the apparent differential adaptation is a reflection of differing transmissibility of foreign features as they spread from bilingual to monolingual populations). Davidson (2007) also shows how foreign structures can initially be introduced by bilingual speakers and evolve further during transmission to the monolingual population.

[5] Under this view, the burden of explanation for the adaptation pattern is passed on to the perception module and the question of learnability is still not fully resolved – i.e. why is the novel foreign input perceived the way it is? Some cases of perceptual adaptation have a comparable precedent in the native language, but not all.

apply during speech perception" [emphasis original] (Peperkamp 2005; see also Peperkamp *et al.* 2008 and Boersma & Hamann 2009).[6] Peperkamp *et al.* (2008: 132) state:

> [D]ue to the automatic character of perceptual assimilation and the primacy of perception over production, [our psycholinguistic model] only allows for a limited number of loanword adaptations that are not due to distortions during speech perception.

Boersma and Hamann (2009) take the strict view that perception is largely bound by native output constraints, so that a structure that violates native constraints cannot be perceived faithfully. Peperkamp *et al.* (2008), on the other hand, allow for the possibility that foreign structures may be correctly perceived, leading to importation rather than adaptation. Overall, this approach makes the strong empirical prediction that adaptation is tightly correlated with perception. See CHAPTER 104: PERCEPTUAL EFFECTS for further discussion.

4. PERCEPTUAL SIMILARITY: Steriade (2001) proposes that speakers possess knowledge of perceptual similarity between strings of sounds (the P-map), which is utilized in loanword adaptation (see Yip 2002, 2006, Y. Kang 2003, Kenstowicz 2003, 2007, Fleischhacker 2005, Kawahara 2006, Miao 2006, Shinohara 2006, Kang *et al.* 2008, among others, for the application of P-map constraints to loanword adaptation).[7] The perceptual similarity approach, similar to the adaptation-as-perception approach, places an emphasis on perceptual factors and phonetic details in accounting for adaptation patterns. However, the former differs from the latter in that perceptual factors are incorporated into grammatical constraints which can be ranked with respect to other grammatical constraints. As a result, the P-map dictates that the repair be as perceptually minimal as possible, but does not necessarily dictate whether adaptation has to actually take place; this is determined by the relative ranking of P-map-based faithfulness constraints with respect to native structural constraints (Steriade 2007). In other words, this approach allows for the possibility that foreign input is faithfully perceived, yet can nevertheless be adapted to adhere to native phonotactic constraints. For example, Kabak and Idsardi (2007) examined Korean speakers' perception of English consonant clusters that violate phonotactic restrictions in Korean and found that some clusters that undergo adaptation in loanwords, such as [gm] and [km], were correctly perceived as distinct from their counterparts with an epenthetic vowel, i.e. [gʊm] and [kʊm] respectively. This contrasts with the adaptation-as-perception view, where the connection between perception and adaptation is much tighter. Yip (2002: 10) notes:

> [R]eference to perceptual salience within the phonology proper resolves the paradox that quite subtle non-native distinctions are clearly perceived, but nonetheless less salient segments are more likely to be sacrificed than highly salient ones.

[6] Peperkamp (2005) and Peperkamp *et al.* (2008) acknowledge the possibility that some adaptation processes may be due to non-perception-related factors (e.g. cases of "retreat to the unmarked").

[7] The knowledge of the P-map is largely universal, and therefore this approach can be categorized under the UG approach. However, Steriade (2001: 243) also leaves open the possibility that the specifics of the P-map can differ according to language-specific experiences, and Y. Kang (2003), for example, employs the P-map model, but assumes that some aspects of the P-map can be language-specific.

A strict interpretation of the P-map, as presented in Steriade (2008), predicts a strong correspondence between native repair and loan repair, since the P-map hierarchy affects both native and loanword phonology. However, cases of divergent repair, discussed above, contradict this strict interpretation. Y. Kang (2003), Kenstowicz (2005) and Yip (2006), on the other hand, propose loanword-specific mapping constraints, variously named BE SIMILAR, MATCH, MIMIC, or Output–Output faithfulness constraints, which are distinct from native Input–Output constraints (see CHAPTER 66: MARKEDNESS AND FAITHFULNESS CONSTRAINTS). These constraints require preservation of the source language information, and – depending on the relative ranking of these constraints with respect to native markedness and faithfulness constraints – importation ($F_{loan}$ » M » $F_{native}$), retreat to the unmarked ($F_{native}$ » M » $F_{foreign}$), or divergent repair ($F1_{loan}$ » $F2_{loan}$, while $F2_{native}$ » $F1_{native}$) can occur (Kenstowicz 2005).

Yip (2006) also notes that adaptation by perception alone is too deterministic to account for the range of variation attested in data. For example, a single language, such as Mandarin, can show different adaptation strategies for illicit codas in English loanwords, namely epenthesis in Mainland Mandarin (*Friedman* → [fu.li.tə.man]) and deletion in Taiwanese Mandarin (*Friedman* → [fu.li.man]). Similarly, Adler (2006) reports variation between deletion and epenthesis in English loanwords in Hawaiian. In such cases, perception underdetermines adaptation and the ranking of grammatical constraints determines the final outcome. Broselow (2009) and Peperkamp *et al.* (2008), concerned with the unconstrained nature of these loanword-specific mapping constraints which can be freely ranked across languages, argue that adaptation is actually much more constrained by perceptual factors than is predicted by loanword-specific faithfulness constraints.

5. GRAMMAR-EXTERNAL FACTORS: Finally, it has been proposed that sociolinguistic or grammar-external factors affect the pattern of (non-)adaptation, especially where aspects of loanword phonology are underdetermined by grammatical factors. First of all, the rate of importation has been shown to positively correlate with the level of bilingualism in the community (Haugen 1950, Paradis & LaCharité 1997, 2008, 2009, Heffernan 2007, Friesner 2009a). The level of bilingualism has also been argued to determine the mode of adaptation: the higher the level of bilingualism, the more likely the adaptation will refer to phonological representations over phonetic representations of the input language (Heffernan 2007).[8] The channel of borrowing (i.e. spoken *vs.* written) and the related influence of orthography have also been proposed to affect the adaptation pattern (Dohlus 2005, Smith 2006, Vendelin & Peperkamp 2006, Detey & Nespoulous 2008, Friesner 2009a). It is also proposed that adapters look to orthography, especially when other factors underdetermine the adaptation pattern and the adapters are uncertain about the "correct" pattern (Y. Kang 2009). For example, in 1930s Korean, non-preconsonantal /s/ in English loanwords was variably adapted as lax /s/ or tense /s'/, the latter written as geminate <ss> in Korean orthography. Whether the English /s/ was written with a single or double <s> had a significant effect on the choice between the two adaptation patterns.

[8] See Paradis and LaCharité (2008, 2009) for arguments against this view that the mode of adaptation is dependent on the level of bilingualism.

## 3 Segmental adaptation

When the foreign input contains a non-native segment, the segment is replaced with the "closest" sound in the native language. The main problem here is how to define the "closest" sound. For example, when a front rounded vowel ([–back, +round]) is borrowed into a language that lacks such vowels, the vowel undergoes transformation. The French high rounded vowel [y] is adapted as [u] in White Hmong (Golston & Yang 2001), preserving the rounding feature of the input, as [i] in Mauritian Creole (Jacobs & Gussenhoven 2000), Fula, Kinyawaranda and Lingala (Paradis 2006), preserving the backness feature of the input, and variably as [u] or [i] in Moroccan Arabic (Paradis 2006), Egyptian Arabic (Hafez 1996). The same vowel is adapted as [ju] in Japanese (Dohlus 2005), preserving both the backness and rounding features of the input segment, but creating a bisegmental structure. Such diverse substitution indicates that there is no universal metric of similarity that all languages follow in segmental adaptation. How then is similarity determined in segmental adaptation? A related key issue in the literature on loanword phonology, and segmental adaptation in particular, is the level of representation that the similarity calculation refers to. This question can be examined in two parts: the nature of the *borrowing* language representation (§100.3.1) and the nature of the *input* language representation (§100.3.2).

### *3.1 Borrowing language representation*

As for the level of representation of the *native* language which acts as a sieve for the foreign language input, it has been hypothesized that phonological features in the input form that are underlyingly contrastive in the native phonology are preferentially preserved over features that are redundant and non-contrastive in the native phonology (Clements 2001, Herd 2005, Dresher 2009, among others). For example, in all Indo-Aryan languages that maintain a contrast between dental and retroflex stops, English alveolar stops ([+anterior, –distributed]) are consistently adapted as retroflex stops ([–anterior, –distributed]), rather than as dental stops ([+anterior, +distributed]) (Lehiste 1988, Arsenault 2009). For example, English *taxi* and *soda* are adapted as /ʈæksi/ and /soɖa/, respectively, in Hindi. The observed adaptation preserves the [–distributed] feature of the English input while sacrificing the [+anterior] feature. Arsenault (2009) proposes that this is due to the fact that [distributed] is a phonologically active feature in these host languages and [anterior] is not.

Similarly, Clements (2001) discusses the adaptation of English consonants to Hawaiian and proposes that substitution preserves the contrastive feature specification of the native language, which is determined by the composition of the native inventory, as well as a universal hierarchy of feature accessibility. Herd (2005) applies Clements's (2001) model to the adaptation of English consonants in other Polynesian languages. For example, both Hawaiian and New Zealand Maori lack sibilants, and English sibilants /s z ʃ ʒ/ are adapted to /h/ in New Zealand Maori, but the same English sibilants map to /k/ in Hawaiian, despite the fact that both /k/ and /h/ are available in both languages.[9] According to Herd

[9] Adler's (2006) elicitation data, however, show that sibilants are variably adapted as /k/, /h/ or null (i.e. are deleted) in Hawaiian.

(2005), the crucial difference between Hawaiian and New Zealand Maori is that in Hawaiian /h/ contrasts with /ʔ/ and, as a result, /h/ is contrastively specified for [+spread glottis], thereby creating a mismatch with English sibilants, while in New Zealand Maori /h/ does not contrast with another glottal sound and therefore is unspecified for [+spread]. At the same time, in New Zealand Maori, /t/ and /k/ contrast and /k/ is contrastively specified for [Dorsal], which creates a mismatch with English sibilants. Similarly, Hancin-Bhatt (1994) and Brown (2000) claim that features that play a higher contrastive function in the L1 are more likely to be preserved in the modification of foreign sounds in L2 production.

An alternative view is that phonetically salient input characteristics are preferentially preserved over less salient characteristics and that the abstract phonological status of those characteristics – i.e. whether they are underlyingly contrastive or not – is not particularly relevant (Brannen 2002, Hsieh & Kenstowicz 2008, Lin 2008, Steriade 2008, Hsieh *et al.* 2009). Given that phonologically contrastive features tend to be phonetically salient and that there is also a degree of indeterminacy in phonological analyses of contrastiveness, the two views often converge on the same predictions, but not always (see Y. Kang 2008a for more discussion on this issue).

It has also been claimed that the saliency of a given feature is not invariant across contexts; rather, depending on other features co-occurring within the same segment and the neighboring segmental contexts, the saliency of features can vary. For example, Brannen (2002) proposes that the English interdental fricative /θ/ is adapted differently in European French and Quebec French, mapping to /s/ in European French and to /t/ in Quebec French. The crucial difference between the two dialects is that in European French the coronal fricative /s/ has a dental place of articulation, while in Quebec French /s/ is alveolar, a phonetic detail that is not contrastive in either of the dialects. On the basis of these findings, Brannen (2002) argues that adaptation is sensitive to non-contrastive, but phonetically salient, features, such as stridency and minor place of articulation features. The adaptation of English vowels in Mandarin (Lin 2008) is another case where non-contrastive features of the borrowing language are preferentially preserved at the cost of contrastive features. In Mandarin non-high vowels, height is contrastive but backness is not – it is predictable from the context (Duanmu 2000). If the phonological status of these features directly influences the segmental adaptation, we would expect height to be preserved and backness to be sacrificed when the input vowel has to be modified due to phonotactic or semantic restrictions. However, contrary to this prediction, Lin's (2008) survey finds that when English vowels are adapted in Mandarin, vowel height is routinely altered, but backness is fairly consistently preserved (on the relation between backness and vowel height see also CHAPTER 19: VOWEL HEIGHT). A similar tendency is also found in English loanwords in Cantonese (Yip 2002).

Proponents of perceptual similarity assume that there is a quasi-universal hierarchy of featural salience such that "certain features are inherently more salient than others" (Brannen 2002). For example, Steriade (2008) states that "stricture differences ([sonorant], [continuant], [consonantal]) play the major role in generating dissimilarity judgments, in contrast to voicing and place."[10] This hierarchy

[10] Clements's feature hierarchy (2001: 80, repeated below) also predicts quasi-universal tendencies in selective feature preservation, although in his model, only features that are contrastive in the native language are relevant in loanword adaptation: [coronal] > [sonorant] > [labial] > [dorsal] > [strident] > [nasal] > [posterior] > [lateral] > [voice].

is compatible with the adaptation pattern found in Selayarese (Broselow 1999) and Mandarin (Miao 2006). In Selayarese, the coda position is restricted to glottal stops and velar nasals, and potential violations of the coda restriction in loanwords from Bahasa Indonesian are repaired by changes in place of articulation, but never by changes in nasality or continuancy. Also, in a comprehensive examination of segmental adaptation in English, German and Italian loanwords in Mandarin, Miao (2006) concludes that segmental adaptation obeys the following hierarchy: IDENT(Manner) » IDENT(Major Place) » IDENT(Place) » IDENT (Voice/Aspiration). Brannen (2002), on the other hand, provides a slightly different hierarchy to account for the adaptation of English dental fricative in various languages: Turbulence (strident/mellow) > Major Articulators (Labial/Coronal) > Airflow (stop/continuant) and Location (Lip/Dental/Alveolar) > Minor Articulators (Laminal/Apical). It remains to be seen to what extent the claim of universal hierarchy holds true, either as an absolute principle or as a general tendency, in view of the full body of data.

Finally, the adaptation-as-perception view claims that segmental adaptation is also a result of L1 speech perception applied to the foreign acoustic input (Silverman 1992, H. Kim 2008, 2009, Peperkamp *et al.* 2008, Boersma & Hamann 2009). H. Kim (2008, 2009) proposes that segmental adaptation is due to L1 feature-driven perception. Foreign input is mapped to a phonological category via perceptual mapping of the acoustic signal to relevant featural representations. The concept of "feature" in her model is somewhat more abstract than what is assumed in the other studies discussed above. For example, a [tense] feature can be signaled by a combination of acoustic correlates, such as duration and pitch of the adjacent vowel, and the same feature can be signaled by different combinations of acoustic correlates depending on the context within which it occurs.

As mentioned above, the adaptation-as-perception view predicts a very strong correlation between perception and adaptation. The strongest view, where all foreign segments are obligatorily transformed to native sounds (Silverman 1992, Boersma & Hamann 2009, among others) has difficulty accounting for how some foreign contrasts can be easily perceived (Best 1994), and some foreign segments are adopted without adaptation (i.e. imported). Also, the view that all adaptation occurs during perception is unable to explain cases where adapters can perceive the foreign contrast but nevertheless adapt it to a native segment. Also, there are cases where the perception results do not match the adaptation results. For example, Brannen (2002) shows that [f] is the segment that is most likely to be confused with [θ] by French speakers, yet [t] or [s] is the consonant of choice in the adaptation of English [θ].

## *3.2 Input language representation*

With respect to the input to the adaptation process, some argue that the input is the phonological representation of the source language, devoid of redundant phonetic details (Paradis & LaCharité 1997, Shinohara 2004, LaCharité & Paradis 2005). This view, referred to here as the "phonological input" view, predicts uniform adaptation of a source language phoneme across different contexts (i.e. phonemic uniformity). Others assume that the input is the acoustic representation of the source language, including all subphonemic phonetic details of the source language sounds (Silverman 1992, Yip 1993, Peperkamp 2005, Iverson & Lee 2006, Peperkamp *et al.* 2008). The latter view, referred to here as the "phonetic input" view, predicts that

a given phoneme of the source language can be adapted differently in different segmental contexts depending on its surface phonetic characteristics in the input language.

Empirical research accumulated over the years, however, shows that adaptations of both types are amply attested. The range of possibilities is well illustrated by the different adaptation of English voiceless stops in languages with aspiration contrasts in voiceless stops. English voiceless stops vary in aspiration depending on the context. The "phonological input" view predicts that the adaptation should be uniform, regardless of position, barring modifications due to phonotactic restrictions. The "phonetic input" view, on the other hand, predicts adaptation to aspirated and unaspirated stops, depending on the allophonic realization of the English input stops. An example of adaptation based on "phonological input" is found in Korean, where English voiceless stops are consistently adapted as aspirated, even in contexts where the English input is unaspirated, as in [t$^h$]*oy s*[t]*ory* → [t$^h$oi sɨt$^h$ori].[11] Examples of adaptation based on "phonetic input" are found in Cantonese (Silverman 1992, Yip 1993) and Thai (Kenstowicz & Suchato 2006). In Thai, English voiceless stops are adapted as aspirated in word-initial position, but as unaspirated following /s/. In word-medial position and elsewhere, the adaptation varies between aspirated and unaspirated stops, with the aspirated adaptation being more likely in pretonic position.

Burmese and Mandarin present a mixed picture. In Burmese, voiceless stops are adapted as unaspirated voiceless stops in most contexts, as in *Poland* → [pou.lã], except in English word-initial TR sequences, where the stop is adapted as aspirated, as in *cream* → [k$^h$ə.jĩ] (Chang 2009). In Mandarin, the majority pattern is to adapt English voiceless stops as aspirated stops regardless of the input aspiration as in [p$^h$]*izza* → [p$^h$itsa] ~ [p$^h$isa] and *hi*[p]*ies* → [sip$^h$iɛ̯] (Paradis & Tremblay 2009). However, the aspirated adaptation is proportionately much more likely to occur when the English input stop is aspirated (88.8%) than when it is unaspirated (78.8%), indicating some influence of the phonetic information.

Additional examples of segmental mapping based on phonological *vs.* phonetic input found in the literature are listed in (1).

(1) a. *Phonetic input*

*Thai:* English /v/ is mapped to /w/ in the onset and to /p/ in the coda (Kenstowicz & Suchato 2006).

*Jahai:* Malay /k/ is generally adapted as /k/, but as /ʔ/ word-finally, reflecting the allophonic realization of /k/ in the Malay input (Burenhult 2001).

*Fon:* French /r/ is mapped to /ʁl/ word-initially, to /l/ in non-initial prevocalic position, and is deleted in preconsonantal or word-final position (Gbéto 2000, as discussed in Kenstowicz 2003).

*Korean:* English /s/ is adapted as /s'/ in prevocalic or word-final position and as /s/ elsewhere (S. Kim & Curtis 2002, Ahn & Iverson 2004, Davis & Cho 2006, Y. Kang 2008c).

*1930s Korean:* English voiced stops /b d g/ are mapped to tense stops /p' t' k'/ word-initially and as lax stops /p t k/ elsewhere (Y. Kang 2008b).

[11] See Oh (2004) and Kenstowicz (2005) for alternative analyses.

*Yanbian Korean:* Mandarin unaspirated voiceless stops/affricates /p t k ts tɕ ʈʂ/ are mapped to tense stops/affricates /p' t' k' c'/ word-initially, but to lax stops/affricates /p t k c/ elsewhere (Ito & Kenstowicz 2009).
*Korean:* Japanese voiceless stops are adapted as lax stops word-initially, but as lax or tense stops in word-medial position, depending on the place of articulation (Ito *et al.* 2006).
*Hawaiian:* English /t d/ is mapped to /k/ in general but the adaptation varies between /k/ and /ʔ/ word-finally (Adler 2006).
*Palauan:* Palauan lacks /g/ as a phoneme. Japanese /g/ is adapted as /k/ word-initially but as /ŋ/ word-medially, reflecting the allophonic variation of Japanese /g/ (Takahashi 2006).

b. *Phonological input*
*Thai:* English voiced stops are adapted as voiced word-initially, where they are significantly devoiced, and hence voiceless adaptation may be expected under the phonetic adaptation view (Kenstowicz & Suchato 2006).
*Korean:* English non-morphemic /z/ is consistently adapted as /c/, even in contexts where /z/ is significantly devoiced and is better matched by /s/ or /s'/ (Y. Kang 2009).
See LaCharité & Paradis (2005) for more examples.

The empirical evidence overwhelmingly suggests that loanword adaptation is not completely based on phonetic or phonological representation; rather, both types of adaptations are attested, oftentimes within a single contact situation, leading many to conclude that the adaptation process can refer to both phonological and phonetic (as well as morphological,[12] semantic and orthographic) details of the source language (Y. Kang 2003, 2009, Adler 2006, Kenstowicz & Suchato 2006, Smith 2006, Friesner 2009a, b, Chang forthcoming, among others).

It seems reasonable to assume that adapters have some knowledge of the input language phonology, which is accessible in adaptation – contra the view that the input to adaptation is an unstructured acoustic signal (Silverman 1992). At the same time, simply the fact they know phonology does not mean that it is the only aspect they pay attention to (Y. Kang 2008a, Chang forthcoming) – contra Paradis and LaCharité (2009). From this perspective, a more appropriate question is not whether loanword adaptation is phonological or phonetic, but rather what factors make one type of adaptation more likely than the other. For example, aspects of the contact situation, such as the level of bilingualism or the spoken *vs.* written channel of borrowing, have been proposed as factors that help shape the adaptation pattern (Dohlus 2005, Rose & Demuth 2006, Smith 2006, Heffernan 2007, Y. Kang 2008c, 2009).

## 4 Phonotactic adaptation

I now turn to adaptation due to phonotactic restrictions. Here again, we are faced with the "too-many-solutions" problem and many seemingly puzzling emergent adaptation patterns. In §100.4.1, I will examine the claim that epenthesis is the

[12] See Repetti (2006, 2009), Y. Kang (2009) and Friesner (2009b) for discussion on the role of morphological information in the input language in adaptation.

generally preferred adaptation over deletion (Paradis & LaCharité 1997, Shinohara 2006). In §100.4.2, I will examine co-occurrence restrictions where the adaptation forces the preservation of certain features over others.

## *4.1 Epenthesis* vs. *deletion*

Paradis and LaCharité (1997) propose the *Preservation Principle*, which dictates that the input material be preserved as much as possible, unless the cost of preservation is too extreme (see also CHAPTER 78: STRUCTURE PRESERVATION and CHAPTER 41: VOWEL EPENTHESIS). In other words, epenthesis should generally be preferred over deletion. In this section, I will provide a survey of word-initial and word-final cluster adaptations to examine whether epenthesis is indeed the preferred option overall.

### *4.1.1 Word-initial clusters*

As for word-initial onset clusters, a survey of available cases indeed shows that epenthesis is the predominant choice of repair. Epenthesis-only adaptation is found in Burmese (Chang forthcoming), Egyptian Arabic (Hafez 1996), Farsi (Shademan 2003), Fijian (Schütz 1978), Fula (Paradis & LaCharité 1997), Hindi (Singh 1985), Huave (Davidson & Noyer 1996), Inuktitut (Pollard 2008), Japanese (Katayama 1998),[13] Kikuyu (Mwihaki 2001), Korean (H. Kang 1996, among others), Samoan (Cain 1986), Sesotho (Rose & Demuth 2006) and Shona (Uffmann 2006), among others. For example, Inuktitut does not allow consonant clusters, and onset clusters are repaired by epenthesis as in *(Santa) Claus* → [kalasi] and *Scotia* → [sikusa] (Pollard 2008).

There are far fewer languages that only employ a deletion strategy in word-initial clusters and many of them are creole languages where only /s/ + stop clusters are repaired (see also CHAPTER 39: SC CLUSTERS). In the English-based creole Sranan, /s/-nasal clusters are retained without adaptation, as in *smoke* → [smoko], but /s/-stop clusters are repaired by /s/-deletion *speak* → [piki] (Alber & Plag 2001). A similar pattern is found in Dutch-based Negerhollands (e.g. *stop* → [top] ~ [stop]; Sabino 1990, cited in Alber & Plag 2001), English-based Krio (e.g. *spoon* → [pun]) and Guyana (e.g. *story* → [tɔri]; Tinelli 1981, cited in Fleischhacker 2005), and an older stage of English-based Belizean Creole (e.g. *skirt* → [koːti]; Greene 1999, cited in Fleischhacker 2005). The only non-creole language where deletion repair is reported to the exclusion of epenthesis for word-initial clusters is Finnish, where all consonants, except for the one immediately preceding the vowel, are deleted (e.g. Swedish *strand* → [ranta] 'shore', Russian *gramatika* → [raːmattu] 'bible'). English loans found in "Finglish" (Finnish as spoken by the Finns who migrated to America) also employ the deletion strategy, as in *street* → [riːti] ~ [triːti] and *blanket* → [lɛnketti] ~ [plɛnketti] (Karttunen 1977). However, in most deletion-only cases, importation of clusters is the prevalent option along with deletion.[14]

[13] According to Smith (2006), deletion repair is marginally found even in word-initial clusters in Japanese, but these forms exist as a part of doublets with a variant with epenthesis.

[14] As Fleischhacker (2005) points out, the deletion of /s/ is potentially problematic for theories of loanword adaptation that appeal to perceptual factors (i.e. the adaptation-as-perception view and the perceptual similarity view), since /s/ is arguably one of the most salient consonants and is argued to be preferentially preserved in most other contexts (cf. Steriade 2001, Shinohara 2006).

Several languages use a deletion strategy in combination with epenthesis word-initially. Polynesian languages that lack /s/ in their inventory delete /s/ in /s/-initial clusters while all other clusters are repaired by epenthesis. Examples include Maori (*frock* → [poraka], *Scotsman* → [ko:timana]; Harlow 2004, Herd 2005) and Tahitian (*president* → [peretiteni], *stocking* → [totini]; Geraghty & Tent 2004a, Herd 2005). In Hawaiian, initial clusters are generally adapted with epenthesis, as in *blessing* → [pele'kine] but for /s/-initial clusters, there is variation between epenthesis and /s/ deletion, as in *speak* → [kə'pikə] ~ ['pikə] (Adler 2006). Adler (2006) attributes the Hawaiian pattern to the fact that /s/ is not a segment of Hawaiian and retaining it requires additional steps of repair in violation of the Threshold Principle of Paradis and LaCharité (1997). However, note that this explanation does not extend to the deletion of /s/ in the creole languages discussed above. For example, in Sranan, the language not only has /s/, but it preferentially preserves /s/ in non-initial position, as in *sister* → [sisa] *[sita]; *haste* → [hesi], *[heti] (Alber & Plag 2001).

Other languages that show a combination of deletion and epenthesis strategies preferentially preserve /s/-initial clusters while obstruent–liquid clusters may be simplified via deletion of C2 (liquid) (cf. Fleischhacker 2005). In Cantonese, deletion and epenthesis repairs are both attested, and the variation is conditioned by the bisyllabic word requirement, as shown in *freezer* → [fisa] *vs. cream* → [kejlim] (Silverman 1992, Yip 1993). Interestingly, it is only the obstruent + liquid clusters that allow deletion (of the liquid); /s/-initial clusters undergo epenthesis rather than deletion. Mandarin shows a similar asymmetry between cluster types (Miao 2006). Vietnamese is another case where the repair varies between deletion and epenthesis for obstruent + liquid clusters (French *gramme* → [gam] ~ [garam]) (Barker 1969, Andrea Hoa Pham, personal communication).

In Thai, /s/-initial clusters are adapted with epenthesis (*style* → [sata:j]), but obstruent + liquid clusters are often adapted with deletion of the liquid (*plastic* → [pattik]) (Gandour 1979).[15] A similar asymmetry is found in Contemporary Saramaccan (Aceto 1996, cited in Fleischhacker 2005).

Finally, in Telugu, the repair varies between epenthesis and deletion, regardless of the type of cluster, and deletion targets a liquid in obstruent + liquid clusters (*glass* → [gasu] ~ [galasu]) and /s/ in /s/-initial clusters (*station* → [teʃənu] ~ [isteʃənu]) (Broselow 1992, cited in Fleischhacker 2005). Languages that employ deletion repair in word-initial clusters are summarized in Table 100.1.

### *4.1.2 Word-final coda consonants and clusters*

Compared to word-initial position, repairs for coda clusters (e.g. NoCoda or CodaCondition violation) in word-final position are more variable and it is not clear whether epenthesis is cross-linguistically the preferred strategy over deletion in this position (see also CHAPTER 35: FINAL CONSONANTS). Examples of languages that choose epenthesis as the repair of choice for word-final coda restrictions include Japanese (Katayama 1998), Kikuyu (Mwihaki 2001), Korean (H. Kang 1996) and Sesotho (Rose & Demuth 2006). On the other hand, there are languages that systematically choose deletion for repair, such as Vietnamese (Barker 1969), Burmese (Chang 2009), Thai (Kenstowicz & Suchato 2006) and White Hmong (Golston &

[15] Kenstowicz and Suchato (2006) report that obstruent–liquid clusters are allowed in Thai and therefore remain unadapted.

**Table 100.1** Languages that show deletion repair in word-initial clusters.

| | */s/-C* | *Obstruent–Liquid* | *Languages* |
|---|---|---|---|
| Deletion only | **/s/ deletion** ~ importation | *n/a* | Sranan, Negerhollands, Krio, Guyanese Creole, Belizean Creole |
| Epenthesis and deletion | **C1 deletion** ~ importation | **C1 deletion** ~ importation | (older) Swedish, Russian, and English loans in Finnish |
| | **/s/ deletion** ~ epenthesis | Epenthesis (CC > CvC) | Hawaiian, Maori, Tahitian |
| | Epenthesis (sC > s<u>v</u>C) | Epenthesis ~ **C2 deletion** | Cantonese, Mandarin, Vietnamese |
| | Epenthesis (sC > s<u>v</u>C) | importation ~ **C2 deletion** | Contemporary Sarammacan, Thai |
| | Epenthesis (sC > <u>v</u>sC) ~ **/s/ deletion** | Epenthesis (CC > CvC) ~ **C2 deletion** | Telugu |

Yang 2001).[16] Some examples from White Hmong include *cake* → [kʰê], French *Adam* [adam] → [ʔàdà]. Notable is the fact that all languages listed above that choose deletion repair in coda position have a strong preference for monosyllabic morphemes. But note that even these languages do not systematically prefer deletion for onset clusters. For example, Burmese chooses epenthesis for word-initial clusters but debuccalization and deletion for word-final clusters, as in *Christ* → [kʰə.ɾɪʔ] (Chang 2009).

Yet another group of languages show both epenthesis and deletion depending on the segmental composition of the offending structure. These languages include Cantonese (Silverman 1992), Fijian (Schütz 2004, Shinohara 2006, Kenstowicz 2007), Hawaiian (Adler 2006), Inuktitut (Pollard 2008), Hawaiian Japanese (Higa 1970, Smith 2006), Mandarin (Miao 2006), Maori (Harlow 2004), Marshallese (Shinohara 2006) and Yoruba (Shinohara 2006). Examples from Fijian, *east* → ['isi], *wolf* → [ˌo'liva], illustrate the variability of repair patterns.

The question then is what factors contribute to the choice between epenthesis and deletion in coda position. The theory of P-map proposes that, all things being equal, consonants with more salient perceptual cues are more likely to be retained than those with less salient cues (Steriade 2008; see Shinohara (2006) and Fleischhacker (2005) in particular for the application of the P-map theory for variable deletion in onset and coda clusters, respectively. See also Miao (2006) for a detailed examination of onset and coda repair patterns for different segmental types in Mandarin).

[16] Golston and Yang (2001) state that "syllable-final consonants are categorically deleted in White Hmong." While the majority of relevant data available in Golston and Yang (2001) indeed show deletion of word-final coda consonants, there are some exceptional forms showing final epenthesis (French [lyk] *Luke* → [lù.kà]).

As for grammar-external factors, Smith (2006) demonstrates that English loanwords in Japanese are systematically adapted with epenthesis in the homeland variety, with deletion attested only sporadically, but deletion is much more prevalent in Hawaiian Japanese. She attributes the difference to the different channel of borrowing: the homeland variety is more influenced by the written input and is thus more likely to preserve the input material, while the Hawaiian variety is more influenced by the aural input and is more prone to perceptual adaptation. Miao (2006) proposes a similar explanation to account for why coda deletion is much more frequent in English loanwords than in German loanwords in Mandarin.[17]

The choice in the specific location and the quality of the epenthetic segment also often lacks a straightforward precedent in native phonology (see Fleischhacker 2005 for a P-map-based account of the location of the epenthetic vowel in word-initial clusters). Different strategies for determining the quality of the epenthetic segment include default insertion, vowel harmony, and consonantal assimilation (cf. de Lacy 2006, Uffmann 2006). The specific patterns of vowel epenthesis have been examined in detail in various languages, e.g. Farsi (Shademan 2003), Fijian (Kenstowicz 2007), Hindi (Singh 1985), Inuktitut (Pollard 2008), Kikuyu (Mwihaki 2001), Korean (Oh 1992, Heo 2006, K. Kim 2009), Mandarin (Miao 2006), Cook Island Maori (Kitto & de Lacy 1999), Samoan (Uffmann 2006), Sesotho (Rose & Demuth 2006), Selayarese (Broselow 1999), Shona (Uffmann 2006), Sranan (Uffmann 2006), Yoruba (Pulleyblank 1988, Akinlabi 1993). Here again, explanations proposed for the choice of epenthetic vowel and its location are very diverse, from the spreading of (contrastively marked) features determined by native phonology (Akinlabi 1993, Pollard 2008, K. Kim 2009) to the emergence of the unmarked (Lombardi 2002, Uffmann 2006), perceptual similarity (Y. Kang 2003, Kenstowicz 2007, Steriade 2008) and epenthesis by misperception (Dupoux *et al.* 1999, Kabak & Idsardi 2007). See CHAPTER 41: VOWEL EPENTHESIS.[18]

## *4.2 Co-occurrence restrictions*

Languages may also impose restrictions on possible combinations of vowels and consonants, and such restrictions can induce adaptation of the foreign input. Again, we are faced with the too-many-solutions problem. In the case of segmental adaptation discussed in §100.3, the features that compete for preservation are all consonantal features or all vocalic features, but in the case of sequential co-occurrence restrictions, vocalic and consonantal features are pitted against each other. Here I will discuss a few such examples.

In Inuktitut, vowels are allophonically retracted next to a uvular consonant, as in /tiriganniq/ [tirigannɪq] 'fox' and /pirurtuq/ [pirurtʊq] 'fruits' (Denis & Pollard 2008). Therefore, on the surface, a sequence of a retracted vowel and a

[17] Miao (2006) also notes that loans used in commercial brand names are more likely to show deletion than other loans.

[18] Consonantal epenthesis is also a common repair for a vowel-initial word or vowel hiatus in languages that require onsets. Examples of consonantal epenthesis in loanwords are found in Egyptian Arabic (Hafez 1996), Burmese (Chang forthcoming), Jahai (Burenhult 2001) and White Hmong (Golston & Yang 2001), among others.

non-uvular consonant cannot occur. Thus, when the English input contains illicit sequences such as /ɪk/, there are at least two logically possible repairs to bring the foreign input in line with native phonotactics: change the vowel quality to [ik] or change the place of articulation of the dorsal consonant [ɪq]. Actual data suggest that the consonantal place remains stable; the vowel quality changes, as in *six* → [siksi], *[sɪqsi] (based on Pollard 2008). This seems like a case of straightforward maintenance of contrastive features of the native language, since in Inuktitut, the distinction between tense and lax vowel is allophonic, but the contrast between velar and uvular places of articulation is phonemic.

French and Spanish loanwords in Moroccan Arabic, on the other hand, show the opposite pattern (Kenstowicz & Louriz 2009). In Moroccan Arabic, the vowels /i a u/ are allophonically lowered and/or retracted to [e ɑ o] when adjacent to emphatic (= pharyngealized) consonants, as in [sif] 'sword' *vs.* [sˤef] 'summer'. In other words, the contrastive distinction in Moroccan Arabic is the emphatic *vs.* non-emphatic distinction in consonants, whereas the vowel quality difference is an allophonic property. In actual adaptations, mid vowels of French and Spanish are adapted as their corresponding mid vowels in Moroccan Arabic, but with an emphatic version of the adjacent consonants, as in French *taupe* [top] → Moroccan Arabic [tˤobˤbˤ-ɑ] 'rat (FEM)', retaining the allophonic distinction of the native language over a contrastive distinction. The adaptation of the English sequences [ɑn] and [æŋ] in Mandarin, as examined by Hsieh *et al.* (2009), presents a similar pattern. In Mandarin, the backness of a low vowel is predictable from the context; specifically, it is front before /n/, but is back before /ŋ/, a restriction referred to as "rhyme harmony" by Duanmu (2000). English, on the other hand, allows the free combination of low vowels and nasal codas, including [ɑn] and [æŋ], which violates the phonotactic constraints of Mandarin. Surprisingly, in loanword adaptation, the backness of the vowel is preferentially preserved over the place of articulation of the nasal consonants ([ɑn] → [ɑŋ], [æŋ] → [an]), despite the fact that the place feature of a nasal consonant is contrastive and the backness of a low vowel is not in Mandarin. Some representative examples are *monsoon* [mɑnsun] → *mang.xun* [mɑŋ.ɕyn] and *bank* [bæŋk] → *ban.ke* [pan.kʰɤ]. They attribute this pattern to the perceptual saliency of vowel place contrasts over that of consonantal nasal place contrasts, which are known to be perceptually not very salient (Jun 2004, Steriade 2008).

While the place feature of a consonant seems vulnerable in the Mandarin and the Moroccan Arabic examples, consonantal manner features such as [nasal] seem to be more stable than vowel features. Burmese (Chang 2009) provides a relevant example. In Burmese, only glottal stops are allowed in coda position and coda nasals are adapted as nasalization on the preceding vowel, as in *champagne* → [ʃàpɛ̃ĩ]. However, not all Burmese vowels have a nasalized counterpart. When English words contain a vowel that lacks a nasal counterpart in Burmese, such as [ɛ ɔ i u], followed by a nasal coda, further adaptation is necessary. In such cases, the vowel quality is changed to allow nasalization, rather than failing to preserve nasality, as shown in *November* → [noùvĩ̀bà], *[noùvɛ̃̀bà]. This indicates that preservation of the input nasality takes precedence over preservation of the input vowel quality. However, the limited number of cases examined in the literature does not allow us to conjecture on any cross-linguistic generalizations.

## 5 Conclusion

The study of loanwords has played an important role in the development of phonological theories in recent years, and loanword phonology presents a rich empirical ground for examining many topical questions in the field of phonology. The issues that the study of loanwords bears upon, directly or indirectly, include the role of output constraints *vs.* processes, the phonetics–phonology interface (more specifically, the role of perceptual factors in shaping phonological patterns), the role of native phonological contrasts in phonological processes, the productivity of stochastic generalizations and the role of innate *vs.* acquired knowledge.

At the same time, loanword adaptation is conditioned by many extragrammatical factors, such as the role of orthography, the channel of borrowing, the degree of bilingualism, etc. The diverse nature of the contact situation poses an interesting challenge and yet also presents a natural locus of interface between theoretical phonology and sociolinguistics. It has been pointed out that some of the disagreements in the debate on the nature of loanword phonology stem from differing assumptions on what is classified as a loanword (cf. Rose & Demuth 2006); some linguists focus on on-line adaptations (by monolinguals or bilinguals), while others focus on established loanwords that are sanctioned by norms of the community. While these two endpoints likely exhibit slightly different patterns of adaptation and varying degrees of variability, we expect the two to be related in a systematic way – the output of the initial on-line adaptation serves as the input for a successive chain of speakers in the rest of the community, eventually leading to the establishment of norms. Some researchers are already addressing the question of how loanwords are transformed over time, in order to provide a more comprehensive and dynamic picture of loanword phonology (Poplack & Sankoff 1984, Crawford 2007, 2008, Davidson 2007, Y. Kang 2008b, Y. Kang *et al.* 2008, Friesner 2009a).

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## REFERENCES

Aceto, Michael. 1996. Early Saramaccan syllable structure: An analysis of complex onsets from Schumann's 1978 manuscript. *Journal of Pidgin and Creole Languages* 11. 23–44.

Adler, Allison N. 2006. Faithfulness and perception in loanword adaptation: A case study from Hawaiian. *Lingua* 116. 1024–1045.

Ahn, Sang-Cheol & Gregory K. Iverson. 2004. Dimensions in Korean laryngeal phonology. *Journal of East Asian Linguistics* 13. 345–379.

Akinlabi, Akinbiyi. 1993. Underspecification and the phonology of Yoruba /r/. *Linguistic Inquiry* 24. 139–160.

Alber, Birgit & Ingo Plag. 2001. Epenthesis, deletion and the emergence of the optimal syllable in creole: The case of Sranan. *Lingua* 111. 811–840.

Arsenault, Paul. 2009. Coronal features and retroflexion in Dhivehi and other Indo-Aryan languages. *Toronto Working Papers in Linguistics* 30. 17–33.

Barker, Milton. 1969. The phonological adaptation of French loanwords in Vietnamese. *Mon-Khmer Studies Journal* 3. 138–147.

Berko, Jean. 1958. The child's learning of English morphology. *Word* 14. 150–177.

Best, Catherine T. 1994. The emergence of native-language phonological influences in infants: A perceptual assimilation model. In Judith C. Goodman & Howard C. Nusbaum (eds.), *The development of speech perception: The transition from speech sounds to spoken words*, 167–224. Cambridge, MA: MIT Press.

Boersma, Paul & Silke Hamann. 2009. Loanword adaptation as first-language phonological perception. In Calabrese & Wetzels (2009), 11–58.

Brannen, Kathleen. 2002. The role of perception in differential substitution. *Canadian Journal of Linguistics* 47. 1–46.

Broselow, Ellen. 1992. The structure of fricative-stop onsets. Unpublished ms., State University of New York, Stony Brook.

Broselow, Ellen. 1999. Stress, epenthesis, and segment transformation in Selayarese loans. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* 25. 311–325.

Broselow, Ellen. 2006. Loanword phonology. In Keith Brown (ed.), *Encyclopedia of language and linguistics*, vol. 7. 2nd edn., 286–290. Oxford: Elsevier.

Broselow, Ellen. 2009. Stress adaptation in loanword phonology: Perception and learnability. In Paul Boersma & Silke Hamann (eds.), *Phonology in perception*, 191–234. Berlin & New York: Mouton de Gruyter.

Brown, Cynthia A. 2000. The interrelation between speech perception and phonological acquisition from infant to adult. In John Archibald (ed.), *Second language acquisition and linguistic theory*, 4–65. Oxford: Blackwell.

Burenhult, Niclas. 2001. Loanword phonology in Jahai. *Lund University Department of Linguistics Working Papers* 48. 5–14.

Cain, Horst. 1986. *A lexicon of foreign loan-words in the Samoan language.* Cologne: Böhlau Verlag.

Calabrese, Andrea. 2009. Perception, production and acoustic inputs in loanword phonology. In Calabrese & Wetzels (2009), 59–114.

Calabrese, Andrea & W. Leo Wetzels (eds.). 2009. *Loan phonology*. Amsterdam & Philadelphia: John Benjamins.

Chang, Charles B. 2009. English loanword adaptation in Burmese. *Journal of the Southeast Asian Linguistics Society* 1. 77–94.

Chang, Charles B. Forthcoming. Phonetics vs. phonology in loanword adaptation: Revisiting the role of the bilingual. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* 34.

Clements, G. N. 2001. Representational economy in constraint-based phonology. In T. Alan Hall (ed.), *Distinctive feature theory*, 71–146. Berlin & New York: Mouton de Gruyter.

Crawford, Clifford. 2007. The role of loanword diffusion in changing adaptation patterns: A study of coronal stops in Japanese borrowings. *Working Papers of the Cornell Phonetics Laboratory* 16. 32–56

Crawford, Clifford. 2008. An evolutionary account of loanword-induced sound change in Japanese. *University of Pennsylvania Working Papers in Linguistics* 14. 56–80.

Davidson, Lisa. 2007. The relationship between the perception of non-native phonotactics and loanword adaptation. *Phonology* 24. 261–286.

Davidson, Lisa, Peter Jusczyk & Paul Smolensky. 2004. The initial and final states: Theoretical implications and experimental explorations of Richness of the Base. In Kager *et al.* (2004), 321–368.

Davidson, Lisa & Rolf Noyer. 1997. Loan phonology in Huave: Nativization and the ranking of faithfulness constraints. *Proceedings of the West Coast Conference on Formal Linguistics* 15. 65–79.

Davis, Stuart & Mee-Hui Cho. 2006. Phonetics versus phonology: English word final /s/ in Korean loanword phonology. *Lingua* 116. 1008–1023.
de Lacy, Paul. 2006. *Markedness: Reduction and preservation in phonology*. Cambridge: Cambridge University Press.
Denis, Derek & Mark Pollard. 2008. An acoustic analysis of the vowel space of Inuktitut: Evidence for allophony. Paper presented at Inuktitut Linguistics Workshop, University of Toronto.
Detey, Sylvain & Jean-Luc Nespoulous. 2008. Can orthography influence second language syllabic segmentation? Japanese epenthetic vowels and French consonantal clusters. *Lingua* 118. 66–81.
Dohlus, Katrin. 2005. Phonetics or phonology: Asymmetries in loanword adaptations – French and German mid front rounded vowels in Japanese. *ZAS Papers in Linguistics* 42. 117–135.
Dresher, B. Elan. 2009. *The contrastive hierarchy in phonology.* Cambridge: Cambridge University Press.
Duanmu, San. 2000. *The phonology of Standard Chinese.* Oxford: Oxford University Press.
Dupoux, Emmanuel, Kazuhiko Kakehi, Yuki Hirose, Christophe Pallier & Jacques Mehler. 1999. Epenthetic vowels in Japanese: A perceptual illusion? *Journal of Experimental Psychology: Human Perception and Performance* 25. 1568–1578.
Dupoux, Emmanuel, Christopher Pallier, Núria Sebastián-Galles & Jacques Mehler. 1997. A destressing "deafness" in French? *Journal of Memory Language* 36. 406–421.
Fleischhacker, Heidi. 2005. Similarity in phonology: Evidence from reduplication and loan adaptation. Ph.D. dissertation, University of California, Los Angeles.
Friesner, Michael L. 2009a. The social and linguistic predictors of the outcomes of borrowing in the speech community of Montreal. Ph.D. dissertation, University of Pennsylvania.
Friesner, Michael L. 2009b. The adaptation of Romanian loanwords from Turkish and French. In Calabrese & Wetzels (2009), 115–130.
Gandour, Jackson. 1979. Tonal rules for English loanwords in Thai. In T. L. Thongkum, P. Kullavanijaya, P. V. Panupong & K. Tingsabadh (eds.), *Studies in Tai and Mon-Khmer phonetics and phonology in honour of Eugénie J. A. Henderson*, 94–105. Bangkok: Chulalongkorn University Press.
Gbéto, Flavien. 2000. Les emprunts linguistiques d'origine européenne en Fon (Nouveau Kwa, Gbe: Bénin). Cologne: Rüdiger Köppe Verlag.
Geraghty, Paul & Jan Tent. 2004a. From lowlands to islands: Dutch loans in Polynesia. In Geraghty & Tent (2004b). 99–143.
Geraghty, Paul & Jan Tent (eds.). 2004b. *Borrowing: A Pacific perspective*. Canberra: Australian National University.
Golston, Chris & Phong Yang. 2001. White Hmong loanword phonology. In Caroline Féry, Antony Dubach Green & Ruben van de Vijver (eds.), *Proceedings of HILP* 5, 40–57. Potsdam: University of Potsdam.
Greene, Laurie A. 1999. *A grammar of Belizean Creole: Compilations from two existing United States dialects.* New York: Peter Lang.
Hafez, Ola. 1996. Phonological and morphological integration of loanwords into Egyptian Arabic. *Égypte/Monde Arabe*, première série 27–28. 383–410.
Hancin-Bhatt, Barbara Jean. 1994. Segment transfer: A consequence of a dynamic system. *Second Language Research* 10. 241–269.
Harlow, Ray. 2004. Borrowing and its alternatives in Māori. In Geraghty & Tent (2004b), 145–169.
Haugen, Einar. 1950. The analysis of linguistic borrowing. *Language* 26. 210–231.
Heffernan, Kevin. 2007. The role of phonemic contrast in the formation of Sino-Japanese. *Journal of East Asian Linguistics* 16. 61–86.
Heo, Younghyon. 2006. Postpalatal epenthesis in Korean and Japanese: the role of contrast. In William O'Grady, Jong-Yurl Yoon, Jae-Young Han, Ponghyung Lee, Hae-Yeon Kim,

Sung-Hoon Hong, Seunghye Chung & Fernando Torres (eds.), *Inquiries into Korean Linguistics II*, 157–165. Seoul: Taehaksa.
Herd, Jonathon. 2005. Loanword adaptation and the evaluation of similarity. *Toronto Working Papers in Linguistics* 24. 65–116.
Higa, Masanori. 1970. The sociolinguistic significance of borrowed words in the Japanese spoken in Hawaii. *University of Hawaii Working Papers in Linguistics* 2. 125–140.
Holden, Kyril. 1976. Assimilation rates of borrowings and phonological productivity. *Language* 52. 131–147.
Hsieh, Feng-fan. 2006. High infidelity: The non-mapping of Japanese accent onto Taiwanese tone. *MIT Working Papers in Linguistics* 52. 1–27.
Hsieh, Feng-fan & Michael Kenstowicz. 2008. Phonetic knowledge in tonal adaptation: Mandarin and English loanwords in Lhasa Tibetan. *Journal of East Asian Linguistics* 17. 279–297.
Hsieh, Feng-fan, Michael Kenstowicz & Xiaomin Mou. 2009. Mandarin adaptations of coda nasals in English loanwords. In Calabrese & Wetzels (2009), 131–154.
Hyman, Larry M. 1970. The role of borrowing in the justification of phonological grammars. *Studies in African Linguistics* 1. 1–48.
Ito, Chiyuki & Michael Kenstowicz. 2009. Mandarin loanwords in Yanbian Korean I: Laryngeal features. *Onin Kenkyuu* [Phonological Studies] 12. 61–72.
Ito, Chiyuki, Yoonjung Kang & Michael Kenstowicz. 2006. The adaptation of Japanese loanwords into Korean. *MIT Working Papers in Linguistics* 52. 65–104.
Itô, Junko & Armin Mester. 1995. Japanese phonology. In John A. Goldsmith (ed.) *The handbook of phonological theory*, 817–838. Cambridge, MA & Oxford: Blackwell.
Itô, Junko & Armin Mester. 1999. The phonological lexicon. In Natsuko Tsujimura (ed.), *The handbook of Japanese linguistics*, 62–100. Malden, MA & Oxford: Blackwell.
Itô, Junko & Armin Mester. 2001. Covert generalizations in Optimality Theory: The role of stratal faithfulness constraints. *Studies in Phonetics, Phonology, and Morphology* 7. 273–299.
Iverson, Gregory & Ahrong Lee. 2006. Perception of contrast in Korean loanword adaptation. *Korean Linguistics* 13. 49–87.
Jacobs, Haike & Carlos Gussenhoven. 2000. Loan phonology: Perception, salience, the lexicon and OT. In Joost Dekkers, Frank van der Leeuw & Jeroen van de Weijer (eds.), *Optimality Theory: Phonology, syntax, and acquisition*, 193–210. Oxford: Oxford University Press.
Jun, Jongho. 2004. Place assimilation. In Bruce Hayes, Robert Kirchner & Donca Steriade (eds.), *Phonetically based phonology*, 58–86. Cambridge: Cambridge University Press.
Kabak, Baris & William J. Idsardi. 2007. Perceptual distortions in the adaptation of English consonant clusters: Syllable structure or consonantal contact constraints? *Language and Speech* 50. 23–52.
Kager, René, Joe Pater & Wim Zonneveld (eds.). 2004. *Constraints in phonological acquisition*. Cambridge: Cambridge University Press.
Kang, Hyunsook. 1996. English loanwords in Korean. *Studies in Phonetics, Phonology, and Morphology* 2. 21–47.
Kang, Hyunsook. 2006. An acoustic study of the perceptual significance of F2 transition of /w/ in English and Korean. *Speech Sciences* 13. 7–21.
Kang, Yoonjung. 2003. Perceptual similarity in loanword adaptation: English postvocalic word-final stops in Korean. *Phonology* 20. 219–273.
Kang, Yoonjung. 2008a. Interlanguage segmental mapping as evidence for the nature of lexical representation. *Language and Linguistics Compass* 2. 85–100.
Kang, Yoonjung. 2008b. Tensification of voiced stops in English loanwords in Korean. *Harvard Studies in Korean Linguistics* 12. 179–192.
Kang, Yoonjung. 2008c. The adaptation of English /s/ in Korean. In John Whitman, Ponghyung Lee, Chang-Kook Suh, Sungdai Cho, Yeun-Jin Jung, Jae Young Chung &

Jeong-Im Han (eds.), *Inquiries into Korean Linguistics III*, 1–14. Seoul: Hankook Munhwasa.

Kang, Yoonjung. 2009. English /z/ in 1930s Korean. *Simon Fraser University Working Papers in Linguistics* 2.

Kang, Yoonjung. Forthcoming. Tutorial overview: Suprasegmental adaptation in loanwords. *Lingua*.

Kang, Yoonjung, Michael Kenstowicz & Chiyuki Ito. 2008. Hybrid loans: A study of English loanwords transmitted to Korean via Japanese. *Journal of East Asian Linguistics* 17. 299–316.

Karttunen, Frances. 1977. Finnish in America: A case study in monogenerational language change. In Ben Blount & Mary Sanches (eds.), *The social dimensions of language change*, 173–184. New York: Academic Press.

Karvonen, Daniel. 2005. Word prosody in Finnish. Ph.D. dissertation, University of California, Santa Cruz.

Katayama, Motoko. 1998. Optimality Theory and Japanese loanword phonology. Ph.D. dissertation, University of California, Santa Cruz.

Kato, Sachiko. 2006. Loanword adaptation in Japanese: Consonant gemination of English loanwords. *MIT Working Papers in Linguistics* 52. 105–137.

Kawahara, Shigeto. 2006. A faithfulness ranking projected from a perceptibility scale: The case of [+voice] in Japanese. *Language* 82. 536–574.

Kawahara, Shigeto. 2008. Phonetic naturalness and unnaturalness in Japanese loanword phonology. *Journal of East Asian Linguistics* 17. 317–330.

Kenstowicz, Michael 2003. The role of perception in loanword phonology: A review of *Les emprunts linguistiques d'origine européenne en Fon*. *Studies in African Linguistics* 32. 95–112.

Kenstowicz, Michael 2005. The phonetics and phonology of loanword adaptation. In S.-J. Rhee (ed.), *Proceedings of ECKL 1: Proceedings of 1st European Conference on Korean Linguistics*, 17–32. Seoul: Hankook Publishing Co.

Kenstowicz, Michael 2007. Salience and similarity in loanword adaptation: A case study from Fijian. *Language Sciences* 29. 316–340.

Kenstowicz, Michael & Nabila Louriz. 2009. Reverse engineering: Emphatic consonants and the adaptation of vowels in French loanwords into Moroccan Arabic. *Brill's Annual of Afroasiatic Languages and Linguistics* 1. 41–74.

Kenstowicz, Michael & Hyang-Sook Sohn. 2001. Accentual adaptation in North Kyungsang Korean. In Michael Kenstowicz (ed.), *Ken Hale: A life in language*, 239–270. Cambridge, MA: MIT Press.

Kenstowicz, Michael & Atiwong Suchato. 2006. Issues in loanword adaptation: A case study from Thai. *Lingua* 116. 921–949.

Kertész, Zsuzsa. 2003. Vowel harmony and the stratified lexicon of Hungarian. *The Odd Yearbook* 7. 62–77.

Kim, Hyunsoon. 2008. Loanword adaptation between Japanese and Korean: Evidence for L1 feature-driven perception. *Journal of East Asian Linguistics* 17. 331–346.

Kim, Hyunsoon. 2009. Korean adaptation of English affricates and fricatives in a feature-driven model of loanword adaptation. In Calabrese & Wetzels (2009), 155–180.

Kim, Kyumin. 2009. Coronals in epenthesis in loanwords in comparison to velars. *Toronto Working Papers in Linguistics* 30. 53–67.

Kim, Soohee & Emily Curtis. 2002. Phonetic duration of English /s/ and its borrowing into Korean. In Noriko M. Akatsuka & Susan Strauss (eds.), *Japanese/Korean Linguistics 10*, 406–419. Palo Alto: CSLI.

Kitto, Catherine & Paul de Lacy. 1999. Correspondence and epenthetic quality. In Catherine Kitto & Carolyn Smallwood (eds.), *Proceedings of AFLA VI: The Sixth Meeting of the Austronesian Formal Linguistics Association*, 181–200. Toronto: Department of Linguistics, University of Toronto.

Kubozono, Haruo. 2006. Where does loanword prosody come from? A case study of Japanese loanword accent. *Lingua* 116. 1140–1170.
Kubozono, Haruo, Junko Ito & Armin Mester. 2008. Consonant gemination in Japanese loanword phonology. Paper presented at the 18th International Congress of Linguistics, Seoul.
LaCharité, Darlene & Carole Paradis. 2005. Category preservation and proximity versus phonetic approximation in loanword adaptation. *Linguistic Inquiry* 36. 223–258.
Lee, Dongmyung. 2009. The loanword tonology of South Kyungsang Korean. Ph.D. dissertation, Indiana University.
Lehiste, Ilse. 1988. *Lecture notes on language contact.* Cambridge, MA: MIT Press.
Lin, Yen-Hwei. 2008. Variable vowel adaptation in Standard Mandarin loanwords. *Journal of East Asian Linguistics* 17. 363–380.
Lombardi, Linda. 2002. Coronal epenthesis and markedness. *Phonology* 19. 219–251.
Luke, Kang-kwong & Chaakming Lau. 2008. On loanword truncation in Cantonese. *Journal of East Asian Linguistics* 17. 347–362.
Massaro, Dominic W. & Michael M. Cohen. 1983. Phonological context in speech perception. *Perception and Psychophysics* 34. 338–348.
Miao, Ruiqin. 2006. Loanword adaptation in Mandarin Chinese: Perceptual, phonological and sociolinguistic factors. Ph.D. dissertation, State University of New York, Stony Brook.
Mwihaki, Alice. 2001. Consonant–vowel harmony: Evidence from the phonotactics of loanword adaptation. *Poznan Studies in Contemporary Linguistics* 37. 139–145.
Oh, Mira. 1992. Palatal consonants, labial consonants, and vowel epenthesis in Korean loanword phonology. *Linguistic Journal of Korea* 17. 141–161.
Oh, Mira. 2004. English stop adaptation as Output-to-output Correspondence. *Onin Kenkyuu* 7. 165–172.
Paradis, Carole. 1988. Towards a theory of constraint violations. *McGill Working Papers in Linguistics* 5. 1–43.
Paradis, Carole. 2006. The unnatural /Cju/ (< foreign /Cy/) sequence in Russian loanwords: A problem for the perceptual view. *Lingua* 116. 976–995.
Paradis, Carole & Darlene Lacharité. 1997. Preservation and minimality in loanword adaptation. *Journal of Linguistics* 33. 379–430.
Paradis, Carole & Darlene LaCharité. 2008. Apparent phonetic approximation: English loanwords in old Quebec French. *Journal of Linguistics* 44. 87–128.
Paradis, Carole & Darlene LaCharité. 2009. English loanwords in Old Quebec French: Fewer bilinguals does not mean a great increase in naive phonetic approximation. *Langues et linguistique* 32. 82–117.
Paradis, Carole & Antoine Tremblay. 2009. Nondistinctive features in loanword adaptation: The unimportance of English aspiration in Mandarin Chinese phoneme categorization. In Calabrese & Wetzels (2009), 211–224.
Peperkamp, Sharon. 2005. A psycholinguistic theory of loanword adaptation. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* 30. 341–352.
Peperkamp, Sharon & Emmanuel Dupoux. 2003. Reinterpreting loanword adaptations: The role of perception. In M. J. Solé, D. Recasens & J. Romero (eds.), *Proceedings of the 15th International Congress of Phonetic Sciences*, 367–370. Barcelona: Causal Productions.
Peperkamp, Sharon, Inga Vendelin & Kimihiro Nakamura. 2008. On the perceptual origin of loanword adaptations: Experimental evidence from Japanese. *Phonology* 25. 129–164.
Pollard, Mark G. 2008. Epenthetic vowel quality in English loanwords in Inuktitut. M.A. thesis, University of Toronto.
Poplack, Shana & David Sankoff. 1984. Borrowing: The synchrony of integration. *Linguistics* 22. 99–135.
Prince, Alan & Paul Smolensky. 1993. *Optimality theory: Constraint interaction in generative grammar*. Unpublished ms., Rutgers University & University of Colorado, Boulder. Published 2004, Malden, MA & Oxford: Blackwell.

Pulleyblank, Douglas. 1988. Vocalic underspecification in Yoruba. *Linguistic Inquiry* 19. 233–270.
Repetti, Lori. 1993. The integration of foreign loans in the phonology of Italian. *Italica* 70. 182–196.
Repetti, Lori. 2006. The emergence of marked structures in the integration of loans in Italian. In Randall S. Gess & Deborah Arteaga (eds.), *Historical Romance linguistics: Retrospective and perspectives*, 209–235. Amsterdam & Philadalphia: John Benjamins.
Repetti, Lori. 2009. Gemination in English loans in American varieties of Italian. In Calabrese & Wetzels (2009), 225–240.
Rose, Yvan & Katherine Demuth. 2006. Vowel epenthesis in loanword adaptation: Representational and phonetic considerations. *Lingua* 116. 1112–1139.
Sabino, Robin. 1990. Towards a phonology of Negerhollands: An analysis of phonological variation. Ph.D. dissertation, University of Pennsylvania.
Schütz, Albert J. 1978. English loanwords in Fijian. In Albert J. Schütz (ed.), *Fijian language studies: Borrowing and pidginization* (Bulletin of the Fiji Museum No. 4), 1–50. Suva, Fiji: Fiji Museum.
Schütz, Albert J. 2004. English loanwords in Fijian. In Geraghty & Tent (2004b), 253–294.
Shademan, Shabnam. 2003. Epenthetic vowel harmony in Farsi. M.A. thesis, University of California, Los Angeles.
Shinohara, Shigeko. 1997. Analyse phonologique de l'adaptation japonaise de mots étrangers. Thèse de doctorat, Université Paris III.
Shinohara, Shigeko. 2000. Default accentuation and foot structure in Japanese: Evidence from Japanese adaptations of French words. *Journal of East Asian Linguistics* 9. 55–96.
Shinohara, Shigeko. 2004. Emergence of universal grammar in foreign word adaptations. In Kager *et al.* (2004), 292–320.
Shinohara, Shigeko. 2006. Perceptual effects in final cluster reduction patterns. *Lingua* 116. 1046–1078.
Silverman, Daniel. 1992. Multiple scansions in loanword phonology: Evidence from Cantonese. *Phonology* 9. 289–328.
Singh, Fajendra. 1985. Prosodic adaptation in interphonology. *Lingua* 67. 269–282.
Smith, Jennifer L. 2006. Loan phonology is not all perception: Evidence from Japanese loan doublets. In Timothy J. Vance & Kimberly A. Jones (eds.), *Japanese/Korean Linguistics 14*, 63–74. Palo Alto: CLSI.
Smolensky, Paul. 1996. The initial state and "Richness of the Base" in Optimality Theory. Unpublished ms., Johns Hopkins University, Baltimore. (ROA-154.)
Sridhar, Shikaripur N. 1990. *Kannada*. London: Routledge.
Steriade, Donca. 2001. Directional asymmetries in place assimilation: A perceptual account. In Elizabeth Hume & Keith Johnson (eds.), *The role of speech perception in phonology*, 219–250. San Diego: Academic Press.
Steriade, Donca. 2007. Perceptual repair and syllable structure: A reply to Kabak and Idsardi. Unpublished ms., MIT.
Steriade, Donca. 2008. The phonology of perceptibility effects: The P-map and its consequences for constraint organization. In Kristin Hanson & Sharon Inkelas (eds.), *The nature of the word: Studies in honor of Paul Kiparsky*, 151–180. Cambridge, MA: MIT Press.
Takahashi, Shoichi. 2006. Topics in Palauan loanword phonology. *MIT Working Papers in Linguistics* 52. 165–200.
Tinelli, Henri. 1981. *Creole phonology.* The Hague: Mouton.
Uffmann, Christian. 2006. Epenthetic vowel quality in loanwords: Empirical and formal issues. *Lingua* 116. 1079–1111.
Vendelin, Inga & Sharon Peperkamp. 2006. The influence of orthography on loanword adaptations. *Lingua* 116. 996–1007.
Walter, Mary Ann. 2006. Grammatical gender via lexical statistics: The case of Arabic-to-Spanish loanwords. *MIT Working Papers in Linguistics* 52. 201–225.

Werker, Janet F. & Richard C. Tees. 1984. Phonemic and phonetic factors in adult cross-language speech perception. *Journal of the Acoustical Society of America* 75. 1866–1878.
Wetzels, W. Leo. 2009. Nasal harmony and the representation of nasality in Maxacalí: Evidence from Portuguese loans. In Calabrese & Wetzels (2009), 241–270.
Wu, Hsiao-hung Iris. 2006. Stress to tone: A study of tone loans in Mandarin Chinese. *MIT Working Papers in Linguistics* 52. 227–253.
Yip, Moira. 1993. Cantonese loanword phonology and Optimality Theory. *Journal of East Asian Linguistics* 2. 261–291.
Yip, Moira. 2002. Necessary but not sufficient: Perceptual influences in loanword phonology. *Journal of the Phonetic Society of Japan* 6. 4–21.
Yip, Moira. 2006. The symbiosis between perception and grammar in loanword phonology. *Lingua* 116. 950–975.
Zuraw, Kie. 2000. Patterned exceptions in phonology. Ph.D. dissertation, University of California, Los Angeles.