

## **Loanword Phonology**

Yoonjung Kang and Hironori Katsuda  
*University of Toronto Scarborough*

### **Abstract**

When words are borrowed from one language to another, they undergo transformation to conform to the borrowing language's sound patterns. In this sense, loanword adaptation is considered to be a real-life Wug test (Berko 1958) that probes the borrowing language's phonology in ways that native data alone cannot, and loanwords have played an important role in phonological theorizing. A robust understanding of loanword adaptation that meaningfully constrains possible adaptations is an important enterprise in and of itself and it also informs phonological theories. Research in recent decades has uncovered many empirical generalizations and identified a variety of factors that shape adaptation. The current chapter builds on earlier overviews by Kang (2010a, 2011) with extensions to include new developments in the last 15 years. Readers should refer to these earlier works for further examples that could not be included in the current chapter. We begin by providing an overview of the types of emergent patterns in loanword adaptation which pose a potential learnability puzzle (§2). In the next two sections, we review how loanwords have played a role in motivating phonological grammars, focusing on the nature of borrowing language (L1) phonological representations (§3) and what levels of source language (L2) representation are relevant for adaptation (§4), drawing mostly from cases of segmental and phonotactic adaptations. We then turn to an overview of suprasegmental adaptations in the next section (§5). §6 concludes the chapter.

### **Keywords**

loanwords, features, suprasegmental, segmental, syllable structure

## **1 Introduction**

When words are borrowed from one language to another, they undergo transformation to conform to the borrowing language's sound patterns. In this sense, loanword adaptation is considered to be a real-life Wug test (Berko 1958) that probes the borrowing language's phonology in ways that native data alone cannot, and loanwords have played an important role in phonological theorizing. A robust understanding of loanword adaptation that meaningfully constrains possible adaptations is an important enterprise in and of itself and it also informs phonological theories. Research in recent decades has uncovered many empirical generalizations and identified a variety of factors that shape adaptation. The current chapter builds on earlier overviews by Kang (2010a, 2011) with extensions to include new developments in the last 15 years. Readers should refer to these earlier works for further examples that could not be included in the current chapter. We begin by providing an overview of the types of emergent patterns in loanword adaptation which pose a potential learnability puzzle (§2). In the next two sections, we review how loanwords have played a role in motivating phonological grammars, focusing on the nature of borrowing language (L1) phonological representations (§3) and what levels of source language (L2) representation are relevant for adaptation (§4), drawing mostly from cases of segmental and phonotactic adaptations. We then turn to an overview of suprasegmental adaptations in the next section (§5). §6 concludes the chapter.

## 2 Emergent patterns in loanwords

Loanwords often undergo processes that have no precedents in the borrowing language phonology, and adaptation is often more naturally expressed as a repair of output constraint violations rather than an outcome of rewrite rules of the native language (Yip 1993; Paradis and LaCharité 1997; Broselow 1999; Jacobs and Gussenhoven 2000) (see WBCTP0070). For this reason, research on loanword phonology has intensified in recent decades with the advent of constraint-based models of phonology, such as the theory of Constraints and Repair Strategies (Paradis 1988) and Optimality Theory (Prince and Smolensky 1993). However, there are many emergent patterns in loanword adaptation that do not straightforwardly follow from the borrowing language phonology, presenting a learnability puzzle of one type or another (Broselow 2009). These puzzling patterns can be categorized into the following five types:

- (a) The *too-many-solutions* problem (Steriade 2001), or *differential faithfulness* (Broselow 2009): 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. Most segmental adaptation would serve as an example: by definition foreign segments have no corresponding segments in the native phonology, and hence no evidence for any applicable process.
- (b) Divergent repair: The repair chosen sometimes contradicts the native repair strategy – a situation referred to as *divergent repair* by Kenstowicz (2005) and as *ranking reversal* by Broselow (2009; see also chapter 70: conspiracies). 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* → [p<sup>h</sup>ik<sup>h</sup>inik].
- (c) Unnecessary repair: Sometimes 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). In French loanwords in Japanese, an epenthetic vowel is added “unnecessarily” following word-final nasals (French [kan] *Cannes* → Japanese [kannu], \*[kan] (Shinohara 1997; Peperkamp *et al.* 2008).
- (d) Retreat to the unmarked: Loanwords sometimes impose stricter structure 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*. In Thai, English word-initial voiceless stops are generally adapted as aspirated stops, retaining the aspiration of the input (e.g. English [p<sup>h</sup>]in → Thai [p<sup>h</sup>in], [t<sup>h</sup>]eam → [t<sup>h</sup>iim], [k<sup>h</sup>]one → [k<sup>h</sup>oon]). The only exceptions are when there is an unaspirated stop in the same word, as in [p<sup>h</sup>]eg → [pek], \*[p<sup>h</sup>ek], and [k<sup>h</sup>]ook → [kuk], \*[k<sup>h</sup>uk], indicating a preference for a non-aspiration harmony – a generalization not present in the native phonology (Kenstowicz and Suchato 2006). In some cases, loanwords and native words impose disjunctive sets of restrictions (Jurgec 2010).

- (e) Differential importation: Importation refers to a situation where a structure not attested in native phonology is exceptionally allowed in loanwords. The puzzle is that some foreign structures are exceptionally allowed in loanwords while others undergo adaptation, even though they are equally unattested in native phonology (Holden 1976; Itô and Mester 1995; 1999, 2001; Davidson and Noyer 1997; Broselow 2009). 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).

To address the puzzling loanword adaptation patterns, a wide range of proposals have been put forward, which are not necessarily mutually exclusive.

## 2.1 Native Phonology

The first possibility is that the adaptation pattern indeed reflects language-specific facts of the native phonology, and the loanword pattern only appears to be novel because native phonology may not manifest itself by enforcing the same phonological processes to the source language input. Native phonology influence can take the form of language-specific feature representations, segmental and phonotactic generalizations constraining interlanguage perception of foreign forms, statistical tendencies in phonotactic generalization, or rule applications, among others. For example, it has been proposed that the contrastive status of the features in the native phonology determines which features are preserved and which are sacrificed during segmental adaptation (Clements 2001; see §3.1 for further discussion) and informs the choice of the epenthetic vowel quality in English and Afrikaans loanwords in Sesotho (Rose and Demuth 2006).

In some instances, the importation and subsequent nativization of foreign sounds are gradually influenced by phonological constraints in the native language. For example, Japanese phonology includes a constraint known as Lyman's Law, which prohibits the occurrence of two voiced obstruents within the same morpheme (Itô and Mester 1986). Although voiced geminates, not found in native Japanese vocabulary, can be introduced through borrowing, they tend to undergo devoicing if another voiced obstruent is present in the same morpheme ([reddo] 'red' but [batto] 'bad'), reflecting a gradient pressure to conform to Lyman's Law (Nishimura 2003; Kawahara 2006, 2008, 2012).

It has also been argued that seemingly unpredictable loanword patterns follow the same statistical, not categorical, generalizations in native phonology. The statistical tendency may concern morpho-phonological alternations as in the case of nasal substitution in Tagalog (Zuraw 2000) or static generalizations of the lexicon, as proposed for the loanword accentuation in Tokyo Japanese (Kubozono 2006). Another example of the latter type comes from Ozburn and Akinbo (2024), who find that rounding harmony is unexpectedly active in epenthetic vowels in loanwords and turns out to be a statistically significant tendency in the native lexicon. Statistical tendencies are, by definition, not categorical and may only become observable to the analysts through corpus-based quantitative studies. Therefore, their links to loanword patterns may be strengthened by independent experimental support demonstrating the productivity of the relevant native generalizations (Zuraw 2000).

## 2.2 Default setting of Universal Grammar

Not all emergent patterns in loanwords can be explained by generalizations in native phonology. Some attribute these emergent patterns to default or unmarked settings of Universal Grammar (UG). This has been proposed for pitch accent assignment in English loanwords in Northern Kyungsang Korean (Kenstowicz and Sohn 2001) and in French loanwords in Tokyo Japanese (see Shinohara 2000, 2004). Uffmann (2006) resorts to a universal markedness hierarchy to account for the epenthetic vowel quality in loanwords in Shona, Sranan, Samoan, and Kinyarwanda. Similarly, Cohen (2013) argues that a productive vowel harmony system influences the selection of epenthetic vowels of Modern Hebrew loanwords, even though vowel harmony is absent in the native phonology, attributing this phenomenon to the default settings of UG. 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). 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; Yun 2016). We will return to this P-map-based approach below (see §3 for further discussion).

## 2.3 Adaptation as L1-based (mis)perception

The next possibility is that a seemingly puzzling adaptation, in fact, takes place not in the computation of the production grammar, but during the perception of foreign input, which itself is constrained by the segmental and structural constraints of the native language (Silverman 1992; Peperkamp and Dupoux 2003; Peperkamp et al. 2008; Boersma and Hamann 2009; Calabrese 2009). 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. The most famous case study of adaptation as perception is the perceptual illusion experienced by Japanese listeners, who perceive an epenthetic vowel in consonant clusters when there's hardly any vocalic signal (eb[u]zo in Dupoux et al. 1999).

Subsequent perception studies revealed, however, that segmental sequences with epenthetic vowels are not always those perceptually most similar to, or confusable with, their corresponding sequences without such vowels (Kabak and Idsardi 2007; Monahan et al. 2009; Whang 2019, Daland et al. 2019). Instead, these sequences represent the most likely parse of the input acoustic signal based on the native phonology, including underlying-to-surface mappings, phonological alternations, and phonotactic likelihood (Boersma and Hamann 2009, Wilson and Davidson 2013; Durvasula and Kahng 2015; Guevara-Rukoz et al. 2017, Durvasula et al. 2018, Daland et al. 2019, Whang 2021). Under this view, adapters utilize their prior knowledge of the native phonological grammar to uncover the most probable native structure through reverse engineering of native processes. For example, since the high central vowel /i/ is frequently devoiced or deleted in Korean phonetic forms, Korean adapters interpret the voiceless release of an English word-final stop as a high central vowel, as in the adaptation of English [k<sup>h</sup>ʌt<sup>h</sup>] to Korean /k<sup>h</sup>ʌt<sup>h</sup>i/ 'hair cut' (Kang 2003; Boersma and Hamann 2009).

Wilson and Davidson (2013) demonstrated that Bayesian inference correctly predicts native English speakers' (nonnative perception and) production of Russian consonant clusters. Given the acoustic properties of Russian phonetic forms (such as burst duration, amplitude, and prevoicing) and the phonotactic probability of potential English phonological forms, the model could accurately predict if and where an epenthetic vowel would be inserted. A similar approach has been proposed to model the choice of epenthetic vowel quality (Durvasula and Kahng 2015; Guevara-Rukoz et al. 2017; Durvasula et al. 2018; Whang 2021). Under this view, we do not expect loanword adaptation to recapitulate native phonological processes. Instead, we expect the reverse of native processes: vowels inserted during loanword adaptation are precisely those most likely to be deleted or reduced in native phonological processes and to appear in the given phonotactic context. These approaches suggest that perceptual categorization of segments integrates the listeners' phonotactic knowledge of what segment is most likely to occur in the context, contrasting with the view that perceptual adaptation of segments and phonologically-driven phonotactic repairs occur in separate stages (Silverman 1992 and Kabak and Idsardi 2007). Additionally, fine-grained phonetic details of the stimulus, such as burst amplitude and release duration, play a significant role in perceptual adaptation (Dupoux et al. 2011; Davison and Shaw 2012; Wilson et al. 2014).

Alternatively, the P-map approach (Steriade 2007) suggests that speakers use their knowledge of perceptual similarity between sound strings, a concept that also informs loanword adaptation by emphasizing perceptual factors and phonetic details, similar to the adaptation-as-perception approach (see Y. Kang 2003; Fleischhacker 2005; Miao 2006; Kenstowicz 2007; Yun 2016, among others, for the application of P-map constraints to loanword adaptation). Unlike the latter, P-map incorporates these perceptual factors into grammatical constraints that can be ranked relative to other grammatical constraints. Consequently, the P-map requires that repairs be as perceptually minimal as possible, but whether adaptation occurs depends on the ranking of P-map-based faithfulness constraints relative to native structural constraints. This P-map-based approach will be revisited later (§3).

## 2.1 Grammar External Factors

The implicit premise of the current discussion is that loanword patterns should be predictable from the phonology and phonetics of either L1 or L2, UG, or a combination of them. However, at least some aspects of adaptation may be underdetermined by grammar. For example, Shinohara et al. (2011) examined Korean speakers' perception of plosives in Japanese, French, English, and Chinese, finding that their perception only partly matches the adaptation in existing loanwords. They attributed this discrepancy to factors such as the influence of orthography and regularization stemming from loanword-specific conventions established by the government. De Jong and Cho (2012) compared a corpus of English loanwords in Korean with a corpus of perceptual responses to English productions by Korean speakers, focusing on the adaptation of obstruents. They found that the adaptation patterns in loanwords are largely reflected in their perception. However, there are some cases where perception alone cannot explain the patterns. They demonstrate that these patterns tend to occur when perception is unstable and argue that they reflect a variety of factors, mostly significantly the regularization into a specific form over time, as well as some historical, lexical, and sociocultural effects. Yip (2006) highlights this issue, arguing that the perception-based adaptation view, which aims to constrain and explain possible adaptation patterns, is too

deterministic to account for the range of variation attested in data. For example, a single language like Mandarin can exhibit different adaptation strategies for illicit codas in English loanwords, depending on the variety: Mainland Mandarin typically uses epenthesis (*Friedman* → [fu.li.tə.man]), while Taiwanese Mandarin often employs deletion (*Friedman* → [fu.li.man]).

Sociolinguistic or grammar-external factors have been proposed to influence the patterns of (non-)adaptation, particularly where aspects of loanword phonology are underdetermined by grammatical factors. Firstly, the rate of importation has been shown to positively correlate with the level of bilingualism in the community (Haugen 1950; Paradis and LaCharité 1997; Heffernan 2007; Friesner 2009a; Aktürk-Drake 2017). Recent experimental studies also suggest that various factors, such as the prestige of the source language, the level of bilingualism of the interlocutors (Lev-Ari and Peperkamp 2014; Lev-Ari et al. 2014), conversation topics, and the association of speakers and words with the source language and its cultural context (Hashimoto 2019), influence the frequency at which foreign sounds are imported. 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).<sup>1</sup>

The channel of borrowing (i.e., spoken vs. written) and the related influence of orthography have also been proposed to affect the adaptation patterns (Dohlus 2005; Smith 2006; 2009; Vendelin and Peperkamp 2006; Detey and Nespoulous 2008; Friesner 2009a; Daland *et al.* 2015; Hamann and Colombo 2017; Alenazi 2023). Adapters may rely on orthography, particularly when other factors do not clearly determine the adaptation pattern (Y. Kang 2009; Daland *et al.* 2015). For example, Y. Kang (2009) argues that the variable adaptation of non-preconsonantal /s/ in English loanwords as lax /s/ or tense /s'/ (the latter written as geminate <ss> in Korean orthography) in 1930s Korean was influenced by whether the English /s/ was written with a single or double <s>. Daland *et al.* (2015) suggest that the influence of orthography on loanword adaptation becomes particularly significant when perceptual cues are limited, indicating that orthography plays a greater role in adapting unstressed vowels than stressed vowels in English.

### 3 Loanwords and native phonological grammar and representations

Loanwords often serve as crucial evidence in validating the processes and constraints phonologists propose for the borrowing language. For example, loanwords played a prominent role in the so-called “abstractness controversy” (Kiparsky 1968; Hyman 1970). In his article “*The role of borrowings in the justification of phonological grammars*,” Hyman (1970) uses borrowings to support the abstract underlying phonemes /ɛ/ and /ɔ/ in Nupe. The analysis posits rules that palatalize and labialize a preceding consonant before front and back rounded vowels, respectively, followed by a rule that lowers [ɛ] and [ɔ] to merge with [a]. This creates three-way surface contrasts of /Ca/ > [Ca], /Cɛ/ > [Cʲa], and /Cɔ/ > [C<sup>w</sup>a]. Yoruba loanwords recapitulate the proposed derivational paths (Yoruba [tōrē] > Nupe [t<sup>w</sup>ārīā] ‘to give a gift’), supporting the proposed abstract phonemes that are never realized in the surface as such. In this analysis, a crucial auxiliary hypothesis is that “foreign sounds are perceived in terms of underlying form” (Hyman 1970, p.19).

---

<sup>1</sup> See Paradis and LaCharité (2008, 2009) for arguments against this view that the mode of adaptation is dependent on the level of bilingualism.

While loanwords in Nupe were shown to support abstract underlying forms and related rules, loanwords have also been invoked to support the surface-oriented phonological generalizations. As discussed in the previous section, borrowings often undergo processes that have no precedents in the L1 phonology. Smolensky (1996) highlights loanword adaptation as a crucial piece of evidence supporting the principle of Richness of the Base in Optimality Theory, which stipulates that the analysis must generate all and only licit output structures without restricting possible underlying forms. He notes that in the initial state of an Optimality Theoretic grammar, structural constraints are prioritized over faithfulness constraints when there is no learning data to resolve their conflicts. Such initial rankings (e.g., NoCoda >> FAITHFULNESS) ensure that borrowings with a marked foreign structure undergo adaptation (/CVC/ → [CV] or [CVCV]), even when the native phonology lacks relevant underlying forms or alternations to guide learners in prioritizing structural constraints over faithfulness constraints.

On the other hand, in a recent contribution to the abstractness debate, Gouskova (to appear) uses evidence from loanwords to support the need for the morpheme structure constraints (see WBCTP0086) in Optimality Theory, distinct from surface constraints, to address the gapped inventory problem in Russian (Halle 1959). Russian has /tʃ/ but not its voiced counterpart \*/dʒ/. However, [dʒ] occurs as an allophone of /tʃ/ due to voicing assimilation (/notʃ bi/ [nodʒ bi] ‘night IRR.’). Therefore, a ban on \*/dʒ/ cannot merely be a surface generalization. In loanword adaptation, /dʒ/ is rendered as /dz/, a heterorganic cluster, and is realized as [tʃ] word-finally due to final devoicing, instead of \*[tʃ], which would have been a phonetically closer match to [dʒ] (English *image* → [imidz̥a] ‘GEN. SG.’, [imitʃ], \*[imitʃ] ‘NOM.SG.’). She proposes that /dʒ/ is mapped to /dz/ due to an underlying morpheme structure constraint against \*/dʒ/, which is distinct from the constraint governing the surface distribution of [dʒ]. Relatedly, LaCharité and Paradis (2005) argue that segmental mapping in loanwords occurs at the underlying phonemic level, not the phonetic level. Evidence of this includes the adaptation of English /h/ in Quebec French, where /h/ is omitted (*hamburger* → [ambəɾgə]), despite [h] being an optional allophonic variant of /ʃ/ and /ʒ/ in loanwords (*shop* → [həp]).

Loanwords have also contributed to the development of feature theories. It has been proposed that when foreign segments are adapted to native segments, features that are underlyingly contrastive in the native phonology are preferentially preserved over features that are redundant and non-contrastive (Clements 2001; Herd 2005; Dresner 2009). The contrastive feature specification of the native language is determined by the composition of the native inventory along with a universal hierarchy of feature accessibility (Clements 2001) or the phonological activity in the language (Dresner 2009). For example, English sibilant fricatives /s ʃ z ʒ/ are adapted to /k/ in Hawaiian (*September* → [kepakemapa]), rather than [h], an option found in New Zealand Māori (Clements 2001). Herd (2005) suggests that a key distinction between Hawaiian and New Zealand Māori is that in Hawaiian, /h/ is contrastively specified for [+spread glottis] due to its contrast with /ʔ/, leading to a mismatch with English sibilants. In contrast, New Zealand Māori does not specify /h/ for [+spread glottis] because it lacks a contrasting glottal sound.

Distinctive features are also evoked to account for some cases of differential importation. For example, Martin *et al.* (2022) observe that Dutch has a gap in the otherwise symmetrical obstruent voicing contrasts at the velar place (\*/g/ vs. /k/), though the voiced variant exists as an allophone,

similar to the Russian voicing gap discussed above. Unlike in Russian, words with /g/ are variably borrowed with [g] introducing marginal contrasts between /g/ and /k/, filling the gap in the inventory. The principle of feature economy promotes importations that fill such gaps and maximize the contrastiveness of [voice] (Clements 2003). Additionally, it has been proposed that cue constraints, which map auditory form to surface form, operate based on distinctive features rather than segments (Boersma and Hamann 2009). The feature-based mapping provides a more accurate account of segmental importation; new foreign segments are more likely to be imported when they fill a gap in the otherwise symmetrical inventory and can be expressed as a new combination of existing features in the native inventory (Yazawa *et al.* 2023).

At the same time, there are many cases of adaptation where non-contrastive but salient phonetic features are retained, sometimes at the expense of contrastive features. This is unexpected if borrowing is mediated by contrastive features or filtered by an underlying morpheme structure constraint before it is fed through the rest of phonological derivation. For example, Hsieh *et al.* (2009) observe that in Mandarin, the backness of the low vowel /a/ is not contrastive: it appears as front [æ] before /n/ and as back [ɑ] before /ŋ/. When English sequences [an] and [æŋ] are borrowed, Mandarin preserves the non-contrastive allophonic vowel to maintain the native rhyme harmony, at the expense of the contrastive coda nasal (*monsoon* [mansun] → mang.xun [mɑŋ.ɛyn] \*[mæn.sun], *bank* [bæŋk] → ban.ke [pæn.kʰɿ] \*[pɑŋ.kʰɿ]). Hsieh *et al.* (2009) argue that this occurs because the vowel distinction is phonetically more salient compared to the coda nasal place distinction. Kenstowicz and Louriz (2009) report another case of faithful adaptation of allophonic vowels in Moroccan Arabic, this time involving a change in the contrastive pharyngeal feature instead of the allophonic vowel (French to Moroccan Arabic: *taupe* [top] → [tʰobʕbʕ-ɑ] \*[tubb-a] ‘rat (fem)'). Kiparsky (2018) cites the Mandarin case above to support the *l-phonemic level*, equivalent of the word level in *Lexical Phonology* (see WBCTP0094) or *Stratal OT* (Kiparsky 2000), as a linguistically significant level of representation. Unlike the structuralists’ phonemic level, the *l-phonemic level* can incorporate non-contrastive allophonic segments that support lexical contrasts with enhanced phonetic distinctiveness, yet it does not include postlexical allophones. He suggests that the *l-phonemic level* most effectively captures phonological universals and is also the level where loanword adaptation operates, allowing the introduction of “marginal contrasts” or “quasi-contrasts” (Hall 2013; Ladd 2006) into the language, often through borrowing.

Loanwords have also played a significant role in the framework of phonetically grounded phonology (Hayes *et al.* 2004). The proposal is motivated by the observation that phonological patterns are often conditioned by phonetic details that standard phonological representations and distinctive features are too coarse to capture. In particular, Steriade’s (2001) P-map hypothesis is motivated by the observation that output constraints and unconstrained faithfulness constraints predict *too many solutions* (see WBCTP0070), while in reality, attested phonological processes are much more limited. This issue is similarly observed in loanword adaptation. The P-map hypothesis posits that the ranking of faithfulness constraints is influenced by speakers’ perceptions of the similarity between strings of segments, leading to favoring input-output mappings that are perceptually less divergent in both native phonological alternations and loanword adaptation. For example, in English loanwords in Cantonese, coda clusters are repaired by deleting the final consonant when it is a perceptually weak stop (*lift* → [lip] \*[liptʰi]), but by inserting a vowel if the final consonant is a perceptually salient sibilant (*tips* → [tʰipsi] \*[tʰip]) (Steriade 2001).



Additionally, P-map related perceptual constraints help explain the typological asymmetry in how repairs are implemented. Segmental deletion is rarely used to repair illicit word-initial or onset clusters but is more frequently employed for word-final or coda clusters (Kang 2011; Yun 2016). In contrast, epenthesis (or prosthesis) is the favored and often the unique strategy for addressing onset clusters in many languages (Kang 2011; Yun 2016). For example, Inuktitut breaks up English onset clusters with an epenthetic vowel ((*Santa Claus* → [kalasi] and *Scotia* → [sikusa]) (Pollard 2008). However, no language relies solely on cluster simplification (i.e., repair by deletion) for illicit onset clusters; rather, deletion typically occurs alongside epenthesis or as one option among other repair strategies. For example, in Cantonese adaptations of English loanwords, epenthesis and deletion conspire to repair initial clusters, producing bisyllabic outputs (*freezer* → [fisa] vs. *cream* → [kejlim]) (Silverman 1992; Yip 1993). In Telugu, deletion is a possible repair of onset clusters but so is epenthesis (*glass* → [galasu] ~ [gasu]) (Broselow 1992). In "Finglish," a Finnish variety spoken in America, deletion coexists with importation (i.e., no repair) (*street* → [ri:ti] ~ [tri:ti]) (Karttunen 1977). Finally, Dutch loanwords in Indonesian exhibit a general disfavor towards deletion for initial clusters, while also demonstrating a preference for a bisyllabic output. In monosyllabic words, initial and final clusters typically undergo vowel epenthesis and vowel paragoge, respectively (/krax/ → [kərah] ‘collar’ and [lamp] → [lampu] ‘lamp’), ensuring a bisyllabic result. In contrast, in polysyllabic words, while final clusters are often addressed through deletion ([kurant] → [koran] ‘newspaper’), initial clusters tend to remain unrepaired, even though deletion could simplify the cluster while maintaining a bisyllabic output ([protəst] → [protes], \*[potes] ‘protest’) (Batais 2013).

Finally, loanwords also inform the treatment of lexical exceptions. Importation of foreign features creates exceptions and stratification of the lexicon. 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. Zuraw (2000) demonstrates that exceptionality and regularity form a continuum, and exceptions themselves can be patterned. Whether a particular word undergoes nasal substitution or not is unpredictable and must be “listed” in the lexicon. However, the underlying statistical tendencies can still be tracked and encoded as covert rankings of grammatical constraints. These rankings become relevant when novel words, such as new borrowings, which have no listed forms in the lexicon, are introduced into the grammar. Jurgec and Bjorkman (2018) examine cases of non-local Morphologically Derived Environment Effects (MDEE), whereby exceptional lexical features that are allowed in morphologically less complex structures are regularized in more complex morphological structures. Loanwords present a range of test cases for probing the typology of MDEEs. For example, English loanwords in Dutch allow a foreign segment [ɹ] in bare forms or forms with inflectional suffixes, but not when a derivational suffix is added (e.g., *Op[ɹ]ah*, ‘Oprah’; *Op[ɹ]ah-s* ‘PL’; *Op[r]ah-tje*, \**Op[ɹ]ah-tje* ‘DIM’). Jurgec and Bjorkman (2018) suggest that constraints can be indexed not only to specific morphemes but also to morphological domains such as stems or words, allowing the indexed feature of morphologically complex forms to be compositionally calculated from its components. For the case of Dutch [ɹ], the domain of indexed faithfulness is “stem,” and this constraint only blocks the regularization of [ɹ] if all component morphemes within the relevant stem are exceptionally indexed. An inflectional suffix does not impact the exceptionality of loanword root because it falls outside the stem, whereas a derivational suffix, which falls within the stem, does ([[Op $\underline{\text{a}}$ h]<sub>L</sub>]<sub>stem</sub> -s]<sub>word</sub> vs. [[Op $\underline{\text{r}}$ ah]<sub>L</sub> -tje]<sub>stem</sub>]<sub>word</sub>).

These are some examples of how loanwords are employed to justify phonological models and representations of various degrees of abstraction. It may seem as if loanwords could be all things to all theories, and examples could be found to justify the relevance of any level of representation. It is quite possible that the same freedom of analysis afforded to phonologists is also available to speaker-turned-adapters and all these different levels of representation could play a role in adaptation, with different adaptation routes being more likely in certain linguistic or sociolinguistic contexts than others.

#### 4 Loanwords and source language representations

This section explores how the representation of the source language influences loanword adaptation. Some argue that loanword adaptation is mainly phonological, based on the phonological representation of the source language without redundant phonetic details (Paradis and LaCharité 1997; LaCharité and Paradis 2005). Others contend that the input is the acoustic representation of the source language, including all subphonemic phonetic details of the source language sounds. This view is central to the adaptation-as-perception approach (Silverman 1992; Yip 1993; Peperkamp 2005; Peperkamp *et al.* 2008, Boersma & Hamann 2009) and to theories that consider perceptual similarity as grammatical constraints (Y. Kang 2003; Fleischhacker 2005; Miao 2006; Kenstowicz 2007; Yun 2016, among others). Empirical evidence overwhelmingly suggests that loanword adaptation incorporates both phonetic and phonological elements, often within the same contact situation, suggesting that the adaptation process may involve both phonological and phonetic (as well as morphological<sup>2</sup>, semantic, and orthographic) details of the source language (Y. Kang 2003, 2009; Adler 2006; Kenstowicz and Suchato 2006; Smith 2006, 2009; Friesner 2009a, 2009b; Chang 2008, among others). Adapters likely possess some knowledge of the input language phonology, which influences adaptation—challenging the view that adaptation solely depends on an unstructured acoustic signal (Silverman 1992). However, knowing phonology does not mean it is the only aspect they consider during adaptation (Y. Kang 2008a; Chang 2008), opposing the perspective of Paradis and LaCharité (2009). Thus, a more appropriate question is not whether loanword adaptation is phonological or phonetic but what factors determine the likelihood of one type over the other. For example, factors such as the level of bilinguals<sup>3</sup> and whether the borrowing is spoken or written have been proposed to significantly influence adaptation patterns (Dohlus 2005; Rose and Demuth 2006; Smith 2006, 2009; Heffernan 2007; Y. Kang 2008b, 2009).

Research shows that interlanguage perception itself is plastic and can change conditioned by the listeners' knowledge of L2 (Bundgaard-Nielsen *et al.* 2011; Kwon 2017; Nomura and Ishikawa 2018; Kang and Schertz 2021). More proficient L2 listeners tend to map the phonological categories of the input language more uniformly, often glossing over allophonic or subphonemic phonetic details of the input. For example, Kwon (2017) found that late bilinguals are more likely to map an English released coda stop to an extra vowel, whereas early bilinguals' mappings are less sensitive to the release characteristics of the English input, a non-contrastive detail in English.

---

<sup>2</sup> See Repetti (2006, 2009), Y. Kang (2009), and Friesner (2009b) for discussion on the role of morphological information in the input language in adaptation.

<sup>3</sup> However, note that Aktürk-Drake (2014), in an analysis of Arabic and Swedish loanwords in Turkish, argues that the input for loanword adaptation is always phonetic in nature, even for bilingual borrowers.

The transition of adaptation from phonetic to phonological also takes place at the level of the community (Haugen 1950; Heffernan 2007). For example, English affricate is variably adapted with [w] in Korean, reflecting the lip rounding of the English rhotic in early stages of borrowing. However, over the course of a century, the use of [w] has declined. Kang (2010b) interprets this as non-contrastive input phonetic details yielding to pressures for community-level regularization and uniform realization of input language phonemes. This shift is possible only when the adapters possess an awareness of the phonemes in the input language.

An example of how borrowers' knowledge of the source language influences loanword adaptation can be seen in the preservation of phonemic contrasts. In Korean adaptations of English words, affricates are variably adapted with <j> in orthographic form, even though the contrastive status of post-affricate /j/ is a topic of controversy. Despite normative rules against it, the variant with <j> persists in the adaptation of English affricates, resisting regularization. This usage helps to differentiate English /dʒ/ from /z/, both of which map to the Korean affricate /c/, with the former being written with <j> sometimes signaling the contrast in place, if not in manner (Kang 2013). The post-affricate /j/ likely represents a case of incomplete neutralization, where the difference between /c<sup>(h)</sup>j/ and /c<sup>(h)</sup>/ in casual speech is nearly imperceptible, but the contrast nevertheless persists, aided by the orthography and the otherwise systematic contrast of C vs. Cj, allowing the English contrasts to be retained as quasi-contrast in adaptation. This is a case of importation that fills a phonotactic equivalent of featural gap in otherwise symmetrical contrasts (Clements 2003).

Another example can be observed in transphonologization (alongside the preservation of phonemic contrasts). Kiparsky (1973) suggests that while loanword outputs are primarily determined by perceptual assimilation, bilingual borrowers may prioritize the preservation of phonemic contrasts from the source language over perceptual similarity. For instance, Kiparsky cites Steinitz (1964), who demonstrated how the voicing contrast in Germanic languages was adapted into Finnish across different historical periods: initially, when most Finnish speakers were monolinguals, voiced and voiceless stops were neutralized to voiceless stops because Finnish lacks voiced stops (e.g., /d, t/ → /t/). Later, as bilingualism increased, the voicing contrast in the source language began to be adapted as the Finnish geminate contrast (e.g., /d/ → /t/, /t/ → /tt/). The adaptation crucially preserved the original voicing contrast by translating it into the available phonetic/phonological dimension of length in the borrowing language. Japanese loanwords in Korean provide another example, where the geminate contrast between /s/ and /ss/ in Japanese is adapted into Korean as the laryngeal contrast between lax and tense s (/s/ → /s/, /ss/ → /s'/) (Ito, Kang and Kenstowicz 2006), potentially due to an articulatory relationship between length and laryngeal features (Kochetov and Kang 2017). Similarly, in French loanwords in Vietnamese, the uvular fricative /ʁ/ in coda position following /a/ is typically adapted as a velar stop /k/, neutralizing the /k/ and /ʁ/ contrast from the source language. However, the contrast is preserved by adapting the quality of the vowel preceding the consonant: the original /ak/ sequence becomes /äk/ in Vietnamese, while the original /aʁ/ sequence is adapted as /ak/. Crucially, these distinct adaptation patterns cannot be explained by phonetically faithful adaptation because /a/ before /t/ and /p/, which have durations comparable to or shorter than /a/ before /k/, are adapted with a long [a] (Kang, Phạm, and Storme 2014).

Finally, French loanwords in Vietnamese present evidence for a more direct influence of source language phonology: adapters' knowledge of phonotactic generalizations in the source language,

though potentially imperfect, affects how loanwords are adapted. In French, the distribution of mid vowels is subject to a phonotactic restriction known as the *Loi de Position* (Féry 2003; Storme 2017), where lax vowels (/ɛ, œ, ɔ/) typically occur in closed syllables and tense vowels (/e, ø, o/) in open syllables, with some exceptions. Kang, Phạm, and Storme (2014) argue that Vietnamese speakers' (imperfect) knowledge of this restriction influences their adaptation of French mid vowels. For instance, /tenis/ 'tennis' is adapted as /tɛnɪ nitɪ/ and /kɔʁse/ 'corset' as /kɔ:kɪ seɪ/, where Vietnamese adaptations respect this phonotactic restriction even though the vowels in the outputs do not match the original French vowels.

## 5 Suprasegmental adaptation

In this section, we explore the adaptation of suprasegmental features, including tone, stress, and pitch accent. The questions previously raised for segmental adaptation also apply to suprasegmental adaptation, and can be summarized with specific relevance to suprasegmental features as follows: (i) Is the adaptation process influenced by the input prominence of the source words, or does it primarily rely on the default mechanisms of the borrowing language (retreat to the unmarked)? (ii) What factors determine the selection between these approaches? Relatedly, are there any systematic differences between established loanwords and online adaptations? (iii) If prominence is determined by the default mechanism, what is the source of this mechanism? Does it mirror patterns found in the native lexicon, align with UG preferences, or is it influenced by other factors? Given the relatively understudied nature of suprasegmental adaptation compared to segmental adaptation, this section places greater emphasis on summarizing case studies, rather than discussing by theme. However, readers will notice that emerging themes from previous sections reappear in this section.

Our review is structured to first examine instances where the borrowing languages are tone languages (§5.1), followed by pitch accent languages (§5.2), and finally, stress languages (§5.3). Within each subsection, efforts are made to adhere to the same order, namely tone, pitch accent, and then stress, for source languages.

### 5.1 Tone languages

Research on how one tone language adapts the tones of another is relatively limited (Hsieh & Kenstowicz 2008). Maddieson (1977) offers examples of how Hausa (Afro-Asiatic) words are adapted into three distinct Niger-Congo languages: Gwari, Nupe, and Kpan. In these cases, the relative pitch height of the input tones is largely preserved (Hausa to Gwari: [du<sup>H</sup>bu<sup>H</sup>.:] → [du<sup>M</sup>bu<sup>M</sup>] 'thousand', [a<sup>L</sup>kwa<sup>L</sup>:ti<sup>L</sup>] → [a<sup>L</sup>kwa<sup>L</sup>:ti<sup>L</sup>] 'box'). Please refer to Maddieson (1977) for examples of other language pairs. In a more recent study, Adomako (2018) explored the adaptation of Akan loanwords into Ga and Dangme, showing that the tonal melodies of the Akan source words are generally maintained during the borrowing process. However, Adomako also identified cases where these original tonal sequences were disregarded, even in the absence of clear tonal restrictions in the lexicons of the borrowing languages.

In contrast, by examining the adaptation of Mandarin tones into Lhasa Tibetan, Hsieh and Kenstowicz (2008) observed that the tones of the Mandarin original words are largely ignored in the process. Rather, the adaptation follows the following general patterns: non-initial syllables are

always adapted with a high tone, possibly due to a native tone sandhi process, whereas the initial syllables are given a high tone if the onset is an obstruent (note that Lhasa Tibetan lacks voiced obstruents) and a low tone if it is a sonorant (obstruent-initial: [taŋ<sup>L</sup>ʋan<sup>R</sup>] → [taŋ<sup>H</sup>õ<sup>H</sup>] ‘secretary (of a CCP committee)’, sonorant-initial: [ja<sup>H</sup>ts<sup>L</sup>] → [ja<sup>L</sup>tse<sup>H</sup>] ‘CCP member’). Hsieh and Kenstowicz argue that the lack of faithful adaptation is because the tones in Lhasa Tibetan and Mandarin are too dissimilar to be considered equivalent on both phonetic and phonological grounds. Regarding the adaptation pattern conditioned by onset consonant, they argue that it does not stem from the statistical distribution in the lexicon. Instead, they consider this a case of contrast enhancement: since tones are not used for lexical contrasts in Tibetan loanwords, they remain available to reinforce other feature oppositions, namely voicing contrast. Tibetan adaptors, either innately or through language acquisition, know how consonantal voicing relates to pitch register—where [+voice] typically leads to a lower pitch and [-voice] to a higher pitch—and they use this knowledge to enhance the contrast in voicing when assigning tones to Mandarin syllables, a process considered a form of synchronic tonogenesis.

Turning to tone languages borrowing from stress languages, extensive research has explored how tone languages adapt English stress patterns. In many languages that borrow from English, including Cantonese (Silverman 1992; Yip 2006), Yoruba (Niger-Congo) (Devonish 2002; Kenstowicz 2006), Shona (Niger-Congo) (Devonish 2002; Leben 1996; Kenstowicz 2006), Hausa (Devonish 2002; Leben 1996; Kenstowicz 2006), and Twi (Devonish 2002, based on Carter 1987), a stressed syllable is typically adapted with a variant of a high tone (Cantonese: *mótor* → [mɔ<sup>H</sup>ta<sup>MH</sup>], *buffét* → [pɔw<sup>M</sup>fey<sup>H</sup>]). This pattern is also observed in Portuguese loanwords in Kongo (Devonish 2002, based on Carter 1987).

In certain instances, the tones of adapted syllables are influenced not only by the prominence of the source language but also, to a lesser extent, by a default mechanism. A prominent example is seen in English loanwords in Mandarin.<sup>4</sup> Hsieh and Kenstowicz (2008), citing Wu (2006), illustrate that stressed syllables from English are commonly adapted with a variant of a high tone, with additional distinctions made based on onset voicing. Specifically, for disyllabic words that have initial stress, a high tone is often assigned when the stressed syllable begins with an obstruent, while a rising tone is preferred for syllables with a sonorant onset (obstruent-initial: *sálad* → [sa<sup>1H</sup>la<sup>1H</sup>], sonorant-initial: *láser* → [lei<sup>2LH</sup>sa<sup>3L</sup>]). Unlike the case of Mandarin loanwords in Lhasa Tibetan (Hsieh and Kenstowicz 2008), Wu observed the same voicing-tone correlation as a dominant trend within the native lexicon, suggesting that the patterns seen in loanwords reflect the skewed distribution in the native lexicon.

Chang (2020) further explored the role of the native lexicon, arguing that the adaptation of Mandarin tones significantly depends on the distribution of lexical tones, or tone probabilities, within the Mandarin lexicon. For example, in the case of the syllable ‘pa’, characters that carry the fourth tone (T4) appear most frequently, with a tone probability of 0.78, whereas there are no characters for the third tone (T3), resulting in a tone probability of 0. Chang’s research, supported

---

<sup>4</sup> Similar instances, where tonal assignment is influenced by both the input stress and the default mechanisms of the borrowing language, are observed in the adaptation of English and Swahili loanwords into Dholuo (Nilo-Saharan) (Owino 2003), English loanwords into Thai (Gandour 1979; Kenstowicz & Suchato 2006), and Spanish loanwords into Colapa Triqui (Scipione 2011).

by both experimental and corpus studies, reveals that these probabilities significantly dictate tone assignments, suggesting that the impact of the input stress on tone adaptation is minimal.

Glewwe (2021) delved deeper into the complexities of Mandarin tone adaptation to determine whether phonological factors continue to play a role after accounting for known non-phonological influences, such as lexical tone frequencies and standard syllables. By utilizing Maximum Entropy Harmonic Grammar (MaxEnt) (Goldwater & Johnson 2003; Hayes & Wilson 2008) to control for these non-phonological factors, she confirmed the significance of stress and consonant voicing in the adaptation process. A potentially fruitful future research direction is to develop a Bayesian model of tonal adaptation, similar to the studies on the illusory vowel effect discussed in §2.3. That is, tonal adaptation can be viewed as a form of inference to recover the underlying representation, where both top-down/phonotactic expectations (e.g., lexical tone frequencies and standard syllables) and acoustic matches (e.g., stress and consonant voicing effects) are significant.

At the same time, Glewwe found a mismatch between her corpus and experimental data. In the corpus data, consonant voicing was the dominant factor, with stress playing a lesser role, contrasting with Wu's (2006) findings. However, in the experimental data, the significance of consonant voicing vanished, making the stress or intonation of the source word the primary determinant. She argues that the difference between the corpus data and experimental data stems from the degree of variation in source forms: participants in the experiment heard a limited number of tokens for each stimulus, all with the same intonation pattern, making the stress-aligned pitch contours more salient than the onset-induced F0 perturbations. In natural speech, however, intonation patterns vary for the same English word depending on context, but F0 perturbations remain consistent, with F0 always being higher after a voiceless stop than after a voiced stop. Glewwe further extends this argument to emphasize the importance of considering broader borrowing contexts. For example, the difference between English loanwords in Cantonese, which largely follow the stress patterns of English words, and those in Mandarin can be attributed to their differing borrowing contexts: Cantonese is in direct and sustained contact with English, while Mandarin borrowings may rely more on written forms. This is another illustration that loanword adaptation cannot be equated with non-native perception alone. Perceptual similarity is just one of the factors that determines adaptation norms.

There are also many instances where the input stress has minimal impact or is predominantly overridden by default mechanisms. While these default mechanisms are sometimes driven by the phonology of the native language, in other instances, they lack a clear connection to the native phonological system. An example of the former can be seen with French and English loanwords in Vietnamese, where the unmarked tone, based on distributional patterns in the lexicon, is typically assigned: a high (or non-low) level tone (*ngang*) in syllables ending in a sonorant and a high rising tone (*sac2*) in syllables ending in a stop (Avery 1983, Pham 2003).

In some languages, tonal assignment predominantly follows default mechanisms involving transphonologization (discussed in §4), where distinct segmental and syllable structures of the source language are neutralized in the output but reflected as tonal contrasts. In White Hmong, French loanwords consistently receive a low tone ([noá] → [nɔ<sup>L</sup>he<sup>L</sup>] 'Noah'), while English loanwords are assigned a wider range of tones, primarily guided by the type of the source syllables. Typically, an open syllable or one with a nasal coda receives a low tone ([əmé.ɪkə] →

[ʔa<sup>L</sup>me<sup>L</sup>li<sup>L</sup>ka<sup>L</sup>] ‘America’), a syllable containing a tense vowel or a vowel followed by /ɹ/ is assigned a falling tone ([kek] → [k<sup>h</sup>e<sup>H</sup>l] ‘cake’), and a closed syllable ending in a voiceless consonant coda is given a rising tone ([ʃfis] → [ʔɔ<sup>L</sup>fɪ<sup>L</sup>H]) ‘office’) (Golston & Yang 2001).<sup>5</sup> Crucially, distinctions in the source syllable relevant to tonal assignment are no longer observable in the White Hmong output but are tranphonologized to the available tonal contrasts. Another example is seen in English loanwords in Lhasa Tibetan, where tone assignment is largely determined by the onset voicing of the source syllable, even though the voicing contrast is neutralized in the borrowing language (*police* → [pu<sup>H</sup>li<sup>H</sup>si<sup>H</sup>], *bottle* → [po<sup>L</sup>to<sup>H</sup>ra<sup>H</sup>]) (Hsieh and Kenstowicz 2008). This pattern aligns with the contrast enhancement observed in Mandarin loanwords in Lhasa Tibetan, as discussed above. However, in this case, we further observe that the voicing contrast referenced by Tibetan adapters pertains to the source language rather than the borrowing language. This is evident because English, unlike Mandarin, has voicing contrasts that end up being neutralized in the Tibetan output. Hsieh and Kenstowicz refer to this as covert voice-enhancement.

Some research focuses on how pitch accent is adapted into tone languages, particularly exploring the adaptation of Japanese pitch accent into Asian tone languages. Hsieh (2006), in a study of Japanese loanwords in Taiwanese Southern Min, shows that tone assignment does not consider the pitch patterns of original words but rather employs what Hsieh calls “tonal templates”, which largely depend on the rime structure of the source language. Roughly, for Japanese CV or CVO syllables, the initial syllable typically has a high or mid tone (depending on the word length), the final syllable has a mid checked tone, and other syllables carry a high tone ([susi] → [su<sup>H</sup>ei<sup>M</sup>] ‘sushi’, [kámera] → [k<sup>h</sup>a<sup>M</sup>me<sup>H</sup>la<sup>M</sup>] ‘camera’). For Japanese CVV or CVN syllables, a falling tone is assigned if there is only one such syllable in the word ([kaban] → [k<sup>h</sup>aMbaŋ<sup>H</sup>l]), whereas if there are two adjacent CVV/CVN syllables, the first one is assigned a non-lexical high rising tone (M̄H) ([kanpai] → [k<sup>h</sup>am<sup>M̄H</sup>pai<sup>H</sup>l]). Notably, there is no evidence in the native lexicon to suggest that any of these tonal patterns are default. Hsieh analyzes these complex patterns as an interaction between Taiwanese tone sandhi rules, which potentially neutralize some tonal contrasts, and the preservation of the source rime structure, within an Optimality Theoretic framework (see the original paper for complete details).

While Hsieh (2006) explicitly suggests that Taiwanese speakers *completely* ignore the pitch accent of Japanese source words, Tu and Davis (2009) and Tu (2013) offer an alternative perspective. They propose that while the specific location of the accent is not recognized, the tonal adaptation of Japanese loanwords mirrors the general pitch contours of Japanese words. A similar argument is made by Kubozono (2006) regarding the loanword accentuation of Japanese (see §5.2). As Glewwe (2021) notes, the aspects and details that adapters focus on can vary depending on the contact situation. From this perspective, adapting general pitch contours while ignoring the specific location might result from limited direct contact. Comparing online adaptations with established loanwords in this respect would be informative.

Before concluding this section, it is important to highlight a notable areal generalization: all instances of default mechanisms (retreat to the unmarked) are found in Asian tone languages. Many Southeast Asian languages are currently undergoing tonogenesis or have done so relatively recently. Additionally, even synchronically, tonal contrasts in many of these languages interact

---

<sup>5</sup> Unlike the Vietnamese examples, however, the default mechanisms at play in White Hmong lack an apparent basis in the native phonology.

closely with phonation contrasts, and the tonal inventory is often restricted based on the segmental composition of the syllables. Consequently, tonal contrasts in these languages have more complex perceptual cues (cf. Kjellin 1977; Pham 2003; Svantesson and House 2006; Brunelle 2009), unlike African tone languages, where tones are more straightforwardly correlated with F0 phonetically. Thus, in Asian languages, tones tend to be more closely tied to segmental contrasts compared to African tone languages.

## 5.2 Pitch accent languages

There is a limited body of research dedicated to the adaptation of tones into pitch accent languages. Ito and Kenstowicz (2009) revealed that Mandarin loanwords in Yanbian Korean only carry accents on either the penultimate or the final syllables, with the choice being influenced by the tones in the final two syllables of the original Mandarin word. They argue that these loanwords mirror the f0 dynamics between the end of the penultimate and the beginning of the final syllable: if f0 rises during the transition, pitch accent falls on the final syllable (LH); if f0 falls, the pitch accent falls on the penultimate syllable (HL). This finding might be surprising, given that the tones of Mandarin source words are generally disregarded in their adaptation into Lhasa Tibetan, as mentioned in §5.1 (Hsieh & Kenstowicz 2008).

In their study of English loanwords in North Kyungsang Korean, Kenstowicz and Sohn (2001) demonstrated that the assignment of pitch accents in these loanwords primarily depends on the syllable structure of the adapted words, rather than the stress patterns of the source words. Specifically, they found that a double-high accent (a high tone over the first two syllables) is often assigned to loanwords when the initial syllable is adapted as a heavy syllable, especially if it includes a long vowel (*Vénus* → [pí:nási]). If the initial syllable is light, the accent typically falls on the head of a bimoraic trochee at the right edge of the word (*América* → [amerík<sup>ha</sup>]).<sup>6</sup>

Kenstowicz and Sohn attribute the tendency for words starting with a long vowel to receive a double accent to a native constraint, while suggesting that heavy syllables attracting accent reflects the default UG setting. In contrast, H-J Kim (2012) examined the distribution of pitch accents in the native lexicon and found a statistical tendency for heavy syllables to attract accent. This tendency was further supported by experiments with novel words, where the effect was more prominently observed compared to its presence in the lexicon.

English loanwords in South Kyungsang Korean display similar patterns. Although the accent assignment in native words is largely unpredictable, offering no clear constraints, the assignment of pitch accent in loanwords is primarily determined based on the syllable structure of the adapted words (Kubozono 2007; Lee 2009). Typically, heavy syllables are more likely to attract a pitch peak (*lemon* → [remón]), and by default, the accent often falls on the penultimate syllable (*domino* → [tomíno]). Through their comparison of lexical and novel words, Do, Ito, and Kenstowicz (2014) observed analogous trends within the lexicon, indicating that loanwords may, to a certain degree, mirror the statistical tendencies present in native words.

---

<sup>6</sup> Hwang (2020) demonstrates an intergenerational change in pitch accent assignment, indicating that younger generations exhibit a reduced tendency for heavy syllables to attract accent, potentially due to a diminishing distinction in phonemic length among these speakers (see also Woo 2023 for findings that contrast with Hwang's results).



Ito (2014) observed that in Yanbian Korean, loanwords from English and Japanese generally receive an accent on one of the two final syllables, with the penultimate one often being assigned a default accent. Ito also identified the influence of syllable weight, with heavy syllables more likely to attract accent, and a certain degree of faithfulness to the prominence of the source languages, with the impact of these factors varying between loanwords from English and Japanese. Interestingly, Ito attributes the accent patterns of loanwords to the grammar of the source language, rather than to the distribution in the lexicon or UG preferences. Ito proposes that loanword adaptation is initially driven by faithfulness constraints to the source language, followed by a reanalysis with markedness constraints. During the initial stages of adaptation, loanwords are adapted as faithfully as possible to the source words, assessed by faithfulness constraints. After a significant number of loanwords are incorporated, speakers begin to analyze the location of accents phonologically, leading to the identification of relevant markedness constraints.

Finally, the suprasegmental adaptation of loanwords into Japanese has been extensively explored. Shinohara's studies (2000, 2004) on the online adaptation of French words suggest that the source prominence is typically ignored, favoring default accent patterns that mirror the Latin stress rule (i.e., placing an accent on the penultimate syllable if it is heavy, or on the antepenultimate syllable otherwise) ([travesti] → [torabésuti] 'travesty'). In contrast, the stress patterns of English words are generally preserved during the online adaptation process (*picnic* → [píkuunikku]). Shinohara suggests that the default accent patterns observed in the adaptation of French words may be influenced by UG preferences.

In contrast, studies focusing on established loanwords, particularly those borrowed from English, generally assume that their accent patterns are primarily shaped by the default accent patterns (Katayama 1998, Kubozono 2006, Ito & Mester 2016), downplaying the impact of the source stress. For example, Kubozono (2006) suggests that while loanwords tend to be accented (rather than unaccented) in an effort by Japanese speakers to replicate the pitch fall observed in isolated English words, the specific location of pitch accent is governed by a default mechanism. Kubozono further argues that the default accent patterns reflect the statistical tendencies observed within the native lexicon. Mutsukawa (2006) offers an alternative perspective, asserting that faithfulness to the source stress plays a dominant role in determining the accent patterns of loanwords.

In a more recent study, Katsuda (to appear) adopted a comprehensive approach by incorporating various factors into a MaxEnt model, statistically confirming the presence of faithfulness to source stress patterns in established loanwords. However, this influence was found to be secondary to the effects of language-internal markedness (which presumably reflects default accent patterns), a finding that diverges from Mutsukawa's (2006) claim. Similar to Glewwe's analysis of English loanwords in Mandarin, this interaction can be interpreted within the context of Bayesian inference (discussed in §2.3), where both markedness as top-down/phonotactic expectations and faithfulness as acoustic match are crucially used to recover the underlying representation.

Katsuda (to appear) further argues that the accent patterns of loanwords are not only influenced by the specific stress patterns of individual words but also by the general tendencies of English stress patterns, suggesting that Japanese speakers may internalize global stress patterns and replicate them in loanword adaptation. For example, Katsuda points out that adaptations like *Seattle* → [eíatoru] and *Tibét* → [teíbetto] cannot be fully explained by either markedness or faithfulness to

the stress patterns of the source words. Instead, these adaptations reflect the general stress patterns of English. This concept bears resemblance to the adaptation mechanism for loanwords in Yanbian Korean proposed by Ito (2014) and represents an instance of adapters' knowledge of source language phonology influencing loanword adaptation, similar to the *Loi de Position* observed in French loanwords in Vietnamese (Kang, Phạm, and Storme 2014) discussed in §4.

### 5.3 Stress languages

In stress languages, unlike tone or pitch accent languages, the distribution of stress is typically more restricted. When the prominence of the source language conflicts with the metrical constraints of the borrowing language, one approach is to disregard this original prominence and assign stress in alignment with the native stress constraints. Alternatively, conflicts could be resolved through modifications at the segmental level, such as deleting or adding sounds, to accommodate stress placement.

Many languages override the original stress of source words, opting instead to apply a default stress pattern in the specific language. This pattern is observed in the adaptation of English words across a diverse array of languages. Specifically, Finnish (Karttunen & Moore 1974; Karvonen 2005; Fenyvesi & Zsigri 2006), Hungarian (Fenyvesi & Zsigri 2006), Icelandic (Clausing 1986), and Tohono O'odham (Fitzgerald 1999) typically place stress on the initial syllable (Finnish: *vacation* → [vâke:si]). French (Peperkamp & Dupoux 2003), on the other hand, assigns stress to the final syllable (French: *walkman* → [wôkmán]). In Egyptian Arabic (Hafez 1996), the stress is placed on the final syllable if it is superheavy; otherwise, the stress is assigned to the penultimate syllable (Egyptian Arabic: *doctor* → [doktó:r], *cutout* → [katá:wet]). Refer to Kang's (2010a) review article for instances involving source languages other than English.<sup>7</sup>

Notably, while the homeland varieties of Hungarian and Finnish predominantly overlook the source stress, the American varieties of these languages exhibit a tendency to truncate segments, thereby aligning with the stress patterns of the original words (English to Am. Finnish: *garage* → [krá:tsi], English to Am. Hungarian: *excuse me* → [kjúzmi]) (Karttunen and Moore 1974; Fenyvesi and Zsigri 2006).<sup>8</sup> These cases highlight that the adaptation patterns are not necessarily uniform across a specific language pair and can vary even within the same source and borrowing language, influenced by the sociolinguistic context: in situations where there is more direct contact with the source language, the preservation of source stress is more probable.

There are other languages that resort to segmental truncation to preserve the source stress while adhering to the metrical constraints of the native language. Examples include the adaptation of Spanish loanwords in Huave (Davidson & Noyer 1997; Broselow 2009), K'ichee' (Isaacs & Wolter 2003 cited in Broselow 2009), and San Lucas Quiaviní Zapotec (Chávez-Peón 2007). These borrowing languages, all from Latin America and in contact with Spanish, share a common stress pattern where stress falls on the final closed syllable (Huave: [garabáto] → [garabát] 'hook',

---

<sup>7</sup> Examples from more recent studies include French loanwords in Urban Wolof (Diouf 2017).

<sup>8</sup> This bears resemblance to the segmental variations in English loanwords between standard Japanese and Hawaiian Japanese (Smith 2006). The former often employs epenthesis as a repair strategy, likely influenced by the prevalence of orthographic borrowings, whereas the latter tends to favor deletion repairs, possibly due to a higher incidence of auditory borrowings.

K'ichee': [atáke] → [atá:k] 'attack', San Lucas Quiavini Zapotec: [bentána] → [bentá:n] 'window'). However, at least in the case of Huave, truncated words coexist with untruncated words with non-final stress in less nativized layers of the lexicon ([médiko] → [médiko] 'doctor', [sábado] → [sábadu] 'Sunday'). Therefore, it might be the case that truncated words result from diachronic development (i.e., nativization) after those words are imported with faithful adaptation of source stress (Davidson & Noyer 1997), which might be limited to situations of intense contact.

Additionally, some languages employ vowel lengthening as a strategy to maintain the input stress while conforming to their native metrical patterns. This approach is observed in the adaptation of English loanwords into Fijian (Kenstowicz 2007; Broselow 2009) and Hawaiian (Elbert and Pukui 1979; Schüz 1994; Jones 2009), both of which are Polynesian languages. In these languages, stress is typically assigned iteratively with moraic trochee from right to left. Vowel lengthening serves not only to maintain the input stress but also to fit this pattern (English to Fijian: *cólony* → [kò:lóni], \*[kolóni]; English to Hawaiian: *rábbít* → [là:páki] \*[lapáki]).

Finally, Zuraw *et al.* (2019) observed intriguing patterns in the adaptation of English loanwords into Tongan, indicating that Tongan speakers are sensitive to the distinction between CVC and CC sequences in the source language, even though this distinction is absent in their native language. In Tongan, the primary stress falls on the penultimate mora ([fále] 'house', [fetúʔu] 'star'). The study revealed that secondary stress is more frequently placed on the initial syllable of loanwords if that syllable is non-epenthetic. For example, secondary stress is more likely to occur on the first syllable of *paragraph* ([pàlakaláfi]) than on that of *predicate* ([palètikási]). Furthermore, Zuraw *et al.* also found that the final vowel that originate from an English schwa is more likely to lengthen when the preceding syllable is epenthetic (*minister* → [minisitáa]).<sup>9</sup> They view the lengthening as a strategy to prevent primary stress from falling on an epenthetic vowel (\*[minisíta]). These cases show that borrowers' knowledge of non-native contrasts in the source language, which are neutralized in the output, play a role in loanword adaptation. This suggests that vowel epenthesis is not simply a naïve misperception of CC as CVC. Other instances of epenthetic vowels avoiding prominence are seen in English loanwords in Fijian (Kenstowicz 2007) and Japanese (Katsuda to appear) and French loanwords in Japanese (Shinohara 2000, 2004).

Based on observations in this section, we can tentatively generalize that segmental faithfulness is not compromised to preserve suprasegmental features faithfully. Stress languages typically enforce native metrical restrictions on loanwords by shifting the source stress while retaining the original segments intact, rather than aligning the original stress through the insertion or deletion of segments. For example, in Selayarese, where stress typically falls on the penultimate syllable ([sampúlo] 'ten', [balíkaʔ] 'arm'), the stress in Indonesian source words is adjusted to fit this pattern, such as [səbáb] → [sábaʔ] 'cause' and [kártu] → [karátu] 'card' (Broselow 2000). In these adaptations, the illicit codas [b] and [r] are resolved through debuccalization and vowel epenthesis. However, these coda violations could have been repaired by inserting or deleting segments while also enforcing penultimate stress, such as [səbáb] → \*[sabába]<sup>10</sup> 'cause' and [kártu] → \*[kátu] 'card'. The avoidance of vowel insertion as a repair in [sábaʔ] is particularly puzzling, especially since it is the preferred strategy for addressing coda condition violations in native words (/lamber/

<sup>9</sup> More precisely, the frequency of lengthening is greatest when the preceding syllable is epenthetic, moderate when it corresponds to an unstressed syllable in English, and absent when it matches a stressed syllable in English.

<sup>10</sup> In fact, final vowel insertion would still predict initial stress for \*[sábaba] ([bótol] > [bótolo] 'bottle').

[lámbere] ‘long’, cf. /lamber-aŋ/ [lambéran] ‘longer’) and also for word-medial coda and word-final continuants in loanwords ([bákri] → [bakári] ‘interpretation’, [tápsir] → [tapasére] ‘tarpaulin’). It appears that vowel insertion is specifically avoided as a repair for violations of metrical structure. Kang’s (2010a) survey of suprasegmental adaptations found no instances of vowel epenthesis in stress adaptation, although the survey is limited in scope and requires further validation. Similar typological gaps have been observed in non-loanword phonology, where epenthesis is never used to repair metrical constraint violations (Broselow 1982; De Lacy 2003; Blumenfeld 2006), suggesting that this restriction might extend beyond loanwords.<sup>11</sup> We observed some cases where the source stress is preserved through segmental deletion, but such deletions are limited in distribution and typically occur in contexts of community-level bilingualism where both deleted and less nativized forms coexist.

If this generalization is correct, there are several potential explanations. Kiparsky (2018) suggests that Chinese tone contrasts are not adapted into English as voicing contrasts (reverse tonogenesis) because the F0 perturbation involved in voicing contrasts is too minor and subtle in English to be included in 1-phonemic representation. If this is the case, we would expect tonal contrasts to be transphonologized as segmental/laryngeal contrasts when the consonant-induced F0 perturbation is substantial and salient. Another possible explanation is a general preference for segmental over suprasegmental faithfulness. If this is true, we would not expect the transphonologization of tone contrasts to segmental contrasts to occur, regardless of the salience of the F0 perturbation.<sup>12</sup> Indeed, recent studies suggest that violations of tonal constraints have a weaker impact than violations of segmental constraints on the acceptability judgements of Cantonese (Do & Lai 2020) and Mandarin nonwords (Gong & Zhang 2021), and on phonological distance judgements in Cantonese (Do & Lai 2021). This asymmetry may be due to perceptual or processing disadvantages of tones compared to segments (Cutler & Chen 1997; Sereno & Lee 2015; Wiener & Turnbull 2016), potentially rooted in their differing lexical predictabilities as measured by information-theoretic measures such as entropy or functional load (Do & Lai 2021).

#### 5.4 Summary

Various adaptation patterns are observed in the suprasegmental adaptation of tone languages. Some cases respect source prominence, while others completely ignore it and assign tones based on default mechanisms, yet others combine both strategies. Default mechanisms typically involve assigning tones based on the onset voicing or the syllable structure of either the source or adapted words, possibly leading to transphonologization. These mechanisms sometimes originate from statistical tendencies in the lexicon, but in other cases, they lack such a connection. Asian tone languages typically employ these mechanisms, where connection between tones and segments tends to be stronger.

Compared to tone languages, pitch accent languages tend to ignore source prominence (though there are exceptions, such as Mandarin loanwords in Yanbian Korean). They often assign pitch

---

<sup>11</sup> There are instances where a vowel is epenthesized to accommodate phrase-level intonational tunes (Roettger 2017; Rolle and Merrill 2022).

<sup>12</sup> While Ito *et al.* (2006) suggests that Japanese pitch accent is unlikely to affect laryngeal adaptation, this should be theoretically possible and perceptually plausible. More systematic investigation is needed for Japanese loans in Korean specifically and for other cases of suprasegmental adaptation more generally.

accent based on default mechanisms, typically involving the syllable structure of adapted words, which may or may not be attributed to statistical tendencies in the lexicon. However, more recent quantitatively-oriented studies have revealed at least some degree of faithfulness to the source prominence.

Unlike tone or pitch accent languages, the distribution of stress is typically more restricted. Many languages disregard source prominence and assign stress in alignment with the native stress constraints. In some cases, languages accommodate source prominence by deleting segments. However, this strategy is typically employed by language varieties in close contact with the source language, and they may include both truncated and untruncated words in the lexicon, suggesting it might result from diachronic development following the importation of the source prominence pattern. Additionally, some languages employ vowel lengthening to conform to the metrical restrictions of the borrowing language.

Our review in this section has revealed at least two important tendencies. First, as one might naturally expect, close contact between two languages typically results in a stronger effect of faithfulness to source prominence, and experiments with online adaptation might reflect this situation. This link could be more explicitly examined through additional experimental work. Second, based primarily on patterns observed in stress languages, it appears that segmental faithfulness is rarely sacrificed to faithfully preserve suprasegmental features. Future research might benefit from exploring the reasons behind this tendency.

There is a growing body of research focusing on the adaptation of suprasegmental features. Recent research increasingly utilizes more refined methodologies that integrate multiple factors, aiming to detect subtle details in the data that earlier studies might have overlooked (Ito 2014; Glewwe (2021; Katsuda to appear). Additionally, an increasing number of studies are examining the distinctions between existing loanwords and online adaptations (or nonce words), employing experimental methods (H-J Kim 2012; Chang 2020; Glewwe 2021). Research in this line will deepen our understanding of the factors that influence the decision between faithful adaptation and the use of default mechanisms. These factors include determinants of phonetic similarity (between the source language input and the borrowing language output) and social contexts that favor one approach over the other. Research that deliberately manipulate acoustic cues in stimuli, or that more directly addresses the effects of bilingualism or the mode of adaptation, would provide valuable insights.

## **6. Conclusion**

Research in loanword phonology have identified various factors that explain emergent patterns in loanwords. Over the past decade, the focus has shifted from determining which factors are relevant to understanding how they interact and how their influence varies depending on the language-contact situation, such as the level of bilingualism and the channel of borrowing. This advancement is driven by the development of phonology and phonetics as fields, alongside improved research resources, including sophisticated statistical analysis, computational modeling, and experimentation. Recognizing the multi-dimensional nature of the process, future studies will likely address nuances in loanword phonology more directly. Additionally, as we have seen, research in loanword phonology has informed phonological theories, motivating concepts that are

not evident through the examination of native phonology alone. This aspect of loanword phonology may be further strengthened as the field attracts more attention and our understanding of the phenomenon continues to improve.

### **Cross-references**

See also

WBCTP0070

WBCTP0086

WBCTP0094

### **Acknowledgements**

### **References**

- Adler, Allison N. (2006). Faithfulness and perception in loanword adaptation: A case study from Hawaiian. *Lingua* 116. 1024–1045.
- Adomako, Kwasi. (2018). The phonology of Akan loanwords in Ga and Dangme. Accra: University of Ghana, Legon PhD dissertation.
- Aktürk-Drake, Memet. (2017). Language dominance as a factor in loanword phonology. *International Journal of Bilingualism* 21(5). 584–599.
- Alenazi, Areej. (2023). Variation in loanword phonology: the case of /v/ and /tʃ/ in English loanwords into Saudi Arabic. Dissertation, University of York.
- Avery, Peter. (1983). Evidence for a laryngeal tier in Vietnamese. *Toronto Working Papers in Linguistics* 4.
- Batais, Saleh Saeed. (2013). Consonantal and syllabic repairs of Arabic and Dutch loanwords in Indonesian: A phonological account. University of Florida.
- Berko, Jean. (1958). The child's learning of English morphology. *Word* 14. 150–177.
- Blumenfeld, Lev A. (2006). Constraints on phonological interactions. Doctoral dissertation, Stanford University.
- Boersma, Paul & Silke Hamann. (2009). Loanword adaptation as first-language phonological perception. In Calabrese & Wetzels (eds.), *Loan phonology*, 11–58.
- Broselow, Ellen. (1982). On predicting the interaction of stress and epenthesis. *Glossa* 16(2). 115–132.
- Broselow, Ellen. (1999). Stress, epenthesis, and segment transformation in Selayarese loans. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* 25. 311–325.
- Broselow, Ellen. (2000). Stress, epenthesis, and segment transformation in Selayarese loans. Annual Meeting of the Berkeley Linguistics Society.
- 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.
- Brunelle, Marc. (2009). Tone perception in northern and southern Vietnamese. *Journal of Phonetics* 37(1). 79–96.
- Bundgaard-Nielsen, Rikke L., Catherine T. Best, & Michael D. Tyler. (2011). Vocabulary size is associated with second-language vowel perception performance in adult learners. *Studies in Second Language Acquisition* 33(3). 433–461.

- Calabrese, Andrea. (2009). Perception, production and acoustic inputs in loanword phonology. In Calabrese & Wetzels (eds.), *Loan phonology*, 59–114.
- Carter, Hazel. (1987). Suprasegmentals in Guyanese: Some African comparisons. In *Pidgin and Creole Languages: Essays in Memory of John E. Reinecke*, 213-263.
- Chang, Charles B. (2008). Phonetics vs. phonology in loanword adaptation: Revisiting the role of the bilingual. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* 34.
- Chang, Zhuting. (2020). Tonal adaptation of loanwords in Mandarin: Phonology and beyond. Dissertation, City University of New York.
- Clausing, Stephen. (1986). *English Influence on American German and American Icelandic*. New York: Peter Lang.
- Chávez-Peón, Mario E. (2007). Loanword phonology in San Lucas Quiaviní Zapotec (SLQZ). *Proceedings of the NWLC*, 22, 1-9.
- Clements, George N. (2001). Representational economy in constraint-based phonology. In T. A. Hall (ed.), *Distinctive feature theory*, 71–146. Berlin & New York: Mouton de Gruyter.
- Clements, George N. (2003). Feature economy in sound systems. *Phonology* 20(3). 287-333.
- Cohen, Evan-Gary. (2013). The emergence of the unmarked: Vowel harmony in Hebrew loanword adaptation. *Lingua* 131. 66-79.
- Cutler, Anne & Hsuan-Chih Chen. (1997). Lexical tone in Cantonese spoken-word processing. *Perception & Psychophysics* 59(2). 165-179.
- Daland, Robert, Mira Oh, & Syejeong Kim. (2015). When in doubt, read the instructions: Orthographic effects in loanword adaptation. *Lingua* 159. 70-92.
- Daland, Robert, Mira Oh, & Lisa Davidson. (2019). On the relation between speech perception and loanword adaptation: Cross-linguistic perception of Korean-illicit word-medial clusters. *Natural Language & Linguistic Theory* 37. 825-868.
- 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.
- Davidson, Lisa & Jason A. Shaw. (2012). Sources of illusion in consonant cluster perception. *Journal of Phonetics* 40(2). 234–248.
- De Jong, Kenneth & Mi-Hui Cho. (2012). Loanword phonology and perceptual mapping: Comparing two corpora of Korean contact with English. *Language*. 341-368.
- De Lacy, Paul. (2003). Fixed ranking and the ‘Too Many Solutions’ problem. CASTL Kick-off Conference handout.
- Detey, Sylvain & Jean-Luc Nespoulous. (2008). Can orthography influence second language syllabic segmentation? Japanese epenthetic vowels and French consonantal clusters. *Lingua* 118. 66–81.
- Devonish, Hubert. (2002). *Talking Rhythm, Stressing Tone: The Role of Prominence in Anglo-West-African Creole Languages*. Kingston: Arawak Publications.
- Diouf, Fabienne Ngone. (2017). *Urban Wolof loanword phonology*. Doctoral dissertation, Indiana University.
- Do, Youngah, Chiyuki Ito, & Michael Kenstowicz. (2014). Accent classes in South Kyengsang Korean: Lexical drift, novel words and loanwords. *Lingua* 148. 147-182.
- Do, Youngah & Ryan Ka Yau Lai. (2020). Incorporating tone in the modelling of wordlikeness judgements. *Phonology* 37(4). 577-615.
- Do, Youngah & Ryan Ka Yau Lai. (2021). Accounting for lexical tones when modeling phonological distance. *Language* 97(1). e39-e67.

- 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.
- 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, Erika Parlato, Sonia Frota, Yuki Hirose & Sharon Peperkamp (2011). Where do illusory vowels come from? *Journal of Memory and Language* 64(3). 199–210.
- Durvasula, Karthik, & Jimin Kahng. (2015). Illusory vowels in perceptual epenthesis: The role of phonological alternations. *Phonology* 32(3). 385-416.
- Durvasula, Karthik, Ho-Hsin Huang, Sayako Uehara, Quan Lue & Yen-Hwei Lin. (2018). Phonology modulates the illusory vowels in perceptual illusions: Evidence from Mandarin and English. *Laboratory Phonology Journal of the Association for Laboratory Phonology*.
- Elbert, Samuel H., & Mary Kawena Pukui. (2001). *Hawaiian Grammar*. University of Hawaii Press.
- Fenyvesi, Anna, & Gyula Zsigri. (2006). The role of perception in loanword adaptation: The fate of initial unstressed syllables in American Finnish and American Hungarian. *SKY Journal of Linguistics* 19. 131-146.
- Féry, Caroline. (2003). Markedness, faithfulness, vowel quality and syllable structure in French. *French Language Studies* 13. 247-280.
- Fitzgerald, Colleen M. (1999). Loanwords and Stress in Tohono O'odham. *Anthropological Linguistics*.
- 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 (eds.), *Loan phonology*, 115–130.
- Gandour, Jackson. (1979). Tonal rules for English loanwords in Thai. *Studies in Tai and Mon-Khmer Phonetics and Phonology in Honour of Eugénie J.A. Henderson*. 94–105.
- Glewwe, Eleanor. (2021). The phonological determinants of tone in English loanwords in Mandarin. *Phonology* 38(2). 203-239.
- Goldwater, Sharon, & Mark Johnson. (2003). Learning OT constraint rankings using a maximum entropy model. *Proceedings of the Workshop on Variation within Optimality Theory*, pp. 111–120.
- 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.
- Gong, Shuxiao & Jie Zhang. (2021). Modelling Mandarin speakers' phonotactic knowledge. *Phonology* 38(2). 241-275.
- Gouskova, Maria. (to appear). MSCs in positional neutralization: The problem of gapped inventories. *Phonology*.
- Guevara-Rukoz, Adriana, Isabelle Lin, Morii Masahiro, Yasuyo Minagawa, Emmanuel Dupoux, Sharon Peperkamp (2017). Which epenthetic vowel? Phonetic categories versus acoustic



- detail in perceptual vowel epenthesis. *The Journal of the Acoustical Society of America* 142(2). EL211-EL217.
- Hafez, Ola. (1996). Phonological and morphological integration of loanwords into Egyptian Arabic. *Égypte/Monde Arabe*, 27-28. 383-410.
- Hall, Kathleen Currie. (2013). A typology of intermediate phonological relationships. *The Linguistic Review* 30(2). 215–275.
- Halle, Morris. (1959). *The Sound Pattern of Russian*. The Hague: Mouton.
- Hamann, Silke, & Ilaria E. Colombo. (2017). A formal account of the interaction of orthography and perception: English intervocalic consonants borrowed into Italian. *Natural Language & Linguistic Theory* 35. 683-714.
- Hashimoto, Daiki. (2019). Sociolinguistic effects on loanword phonology: Topic in speech and cultural image. *Laboratory Phonology* 10(1).
- Haugen, Einar. (1950). The analysis of linguistic borrowing. *Language* 26. 210–231.
- Hayes, Bruce, Robert Kirchner, & Donca Steriade, eds. (2004). *Phonetically-based phonology*. Cambridge: Cambridge University Press.
- Hayes, Bruce, & Colin Wilson. (2008). A maximum entropy model of phonotactics and phonotactic learning. *Linguistic Inquiry* 39(3). 379-440.
- Heffernan, Kevin. (2007). The role of phonemic contrast in the formation of Sino-Japanese. *Journal of East Asian Linguistics* 16. 61–86.
- Herd, Jonathon. (2005). Loanword adaptation and the evaluation of similarity. *Toronto Working Papers in Linguistics* 24. 65–116.
- 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. 279–97.
- Hsieh, Feng-fan, Michael Kenstowicz & Xiaomin Mou. (2009). Mandarin adaptations of coda nasals in English loanwords. In Calabrese & Wetzels (eds.), *Loan phonology*, 131–154.
- Hwang, Young. (2020). Generational Tone Change in North Kyungsang Korean with a Focus on English Loanwords. Dissertation, Indiana University.
- Hyman, Larry M. (1970). The role of borrowing in the justification of phonological grammars. *Studies in African Linguistics* 1. 1–48.
- Isaacs, James, & Lynsey Wolter. (2003). Vowel length, weight and stress in K'ichee'. Talk presented at TREND, 2003.
- Ito, Chiyuki. (2014). Loanword accentuation in Yanbian Korean: A weighted-constraints analysis. *Natural Language & Linguistic Theory* 32. 537-592.
- Ito, Chiyuki, Yoonjung Kang & Michael Kenstowicz. (2006). The adaptation of Japanese loanwords into Korean. *MIT Working Papers in Linguistics* 52. 65–104.
- Ito, Chiyuki & Michael Kenstowicz. 2009. Mandarin loanwords in Yanbian Korean I: Laryngeal features. *Onin Kenkyuu* 12. 61–72.
- Itô, Junko & Armin Mester. (1986). The phonology of voicing in Japanese: Theoretical consequences for morphological accessibility. *Linguistic Inquiry* 17. 49–73.
- 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.
- Ito, Junko & Armin Mester. (2016). Unaccentedness in Japanese. *Linguistic Inquiry* 47(3). 471–526.
- 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.
- Jones, ‘Ōiwi. Parker. (2009). Loanwords in Hawaiian. In Martin Haspelmath & Uri Tadmor (eds.), *Lexical Borrowing in Cross-Linguistic Perspective: A Comparative Handbook*, 771–789. Berlin & New York: Mouton de Gruyter.
- Jurģec, Peter. (2010). Disjunctive lexical stratification. *Linguistic Inquiry* 41(1). 149-161.
- Jurģec, Peter, & Bronwyn M. Bjorkman. (2018). Indexation to stems and words. *Phonology* 35(4). 577-615.
- Kabak, Baris, & William J. Idsardi. (2007). Speech perception is not isomorphic to phonology: The case of perceptual epenthesis. *Language and Speech* 50(1). 23-52.
- 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). 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. (2010a). Tutorial overview: Suprasegmental adaptation in loanwords. *Lingua* 120. 2295–2310.
- Kang, Yoonjung. (2010b). The emergence of phonological adaptation from phonetic adaptation: English loanwords in Korean. *Phonology* 27(2). 225-253.
- Kang, Yoonjung. (2011). Loanword phonology. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, & Keren Rice (Eds.), *The Blackwell Companion to Phonology* (Vol. 4, pp. 1003-1026). Malden, MA and Oxford: Wiley-Blackwell.
- Kang, Yoonjung. (2013). L1 phonotactic restrictions and perceptual adaptation: English affricates in Contemporary Korean. *Journal of East Asian Linguistics* 22. 39-63.
- Kang, Yoonjung, Andrea Hòà Phàm, & Benjamin Storme. (2014). French loanwords in Vietnamese: The role of input language phonotactics and contrast in loanword adaptation. *Proceedings of the Annual Meetings on Phonology*.
- Kang, Yoonjung, & Jessamyn Schertz. (2021). The influence of perceived L2 sound categories in on-line adaptation and implications for loanword phonology. *Natural Language & Linguistic Theory* 39. 555-578.
- Karttunen, Frances, & Kate Moore. (1974). Finnish in America: Two Kinds of Finglish. Manuscript. University of Michigan, Ann Arbor.
- Karvonen, Daniel. (2005). Word prosody in Finnish. Ph.D. dissertation, University of California, Santa Cruz.

- Katayama, Motoko. (1998). Optimality Theory and Japanese loanword phonology. Doctoral dissertation, University of California, Santa Cruz.
- Katsuda, Hironori. (to appear). A probabilistic model of loanword accentuation in Japanese. *Phonology*.
- Kochetov, Alexei, & Yoonjung Kang. (2017). Supralaryngeal implementation of length and laryngeal contrasts in Japanese and Korean. *Canadian Journal of Linguistics/Revue canadienne de linguistique* 62(1). 18-55.
- 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.
- Kawahara, Shigeto. (2006). A faithfulness ranking projected from a perceptibility scale: The case of [+voice] in Japanese. *Language* 82(3). 536–574.
- Kawahara, Shigeto. (2008). Phonetic naturalness and unnaturalness in Japanese loanword phonology. *Journal of East Asian Linguistics* 17. 317–330.
- Kawahara, Shigeto. (2012). Lyman's Law is active in loanwords and nonce words: Evidence from naturalness judgment studies. *Lingua* 122(11). 1193-1206.
- 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. (2006). Tone loans: The adaptation of English loanwords into Yoruba. *Selected proceedings of the 35th annual conference on African Linguistics*, Vol. 13. Somerville, MA: Cascadilla Proceedings Project.
- Kenstowicz, Michael. (2007). Saliency and similarity in loanword adaptation: A case study from Fijian. *Language Sciences* 29. 316–340.
- 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 & 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 & Atiwong Suchato. (2006). Issues in loanword adaptation: A case study from Thai. *Lingua* 116. 921–949.
- Kim, Hyun-ju. (2012). Syllable structure, frequency, analogy, and phonetics: Factors in North Kyungsang Korean accentuation of novel words. State University of New York at Stony Brook.
- Kiparsky, Paul. (1968). How abstract is phonology? Indiana University Linguistics Club.
- Kiparsky, Paul. (1973). Phonological representations. In Osamu Fujimura (Ed.), *Three dimensions of linguistic theory* (pp. 1–135). Tokyo: TEC.
- Kiparsky, Paul. (2000). Opacity and cyclicity. *The Linguistic Review* 17. 351-366.
- Kiparsky, Paul. (2018). Formal and empirical issues in phonological typology. *Phonological Typology* 23. 9783110451931-003.
- Kjellin, Olle. (1977). Observations on consonant types and “tone” in Tibetan. *Journal of Phonetics* 5(4). 317-338.
- Kubozono, Haruo. (2006). Where does loanword prosody come from? A case study of Japanese loanword accent. *Lingua* 116. 1140–1170.
- Kubozono, Haruo. (2007). Loanword accent in South Kyungsang Korean: A moraic account. *ICPhS XVI*, 1185-1188.

- Kwon, Harim. (2017). Language experience, speech perception and loanword adaptation: Variable adaptation of English word-final plosives into Korean. *Journal of Phonetics* 60. 1-19.
- LaCharité, Darlene & Carole Paradis. (2005). Category preservation and proximity versus phonetic approximation in loanword adaptation. *Linguistic Inquiry* 36. 223–258.
- Ladd, D. Robert. (2006). “Distinctive phones” in surface representation. In Louis M. Goldstein, D. H. Whalen, & Catherine T. Best (eds.), *Laboratory Phonology* 8, 3–26. Berlin: Mouton de Gruyter.
- Leben, William R. (1996). Tonal feet and the adaptation of English borrowings into Hausa. *Studies in African Linguistics* 25(2). 129-154.
- Lee, Dongmyung. (2009). The loanword tonology of South Kyungsang Korean. Ph.D. dissertation, Indiana University.
- Lev-Ari, Shiri, & Sharon Peperkamp. (2014). An experimental study of the role of social factors in language change: The case of loanword adaptations. *Laboratory Phonology* 5(3). 379-401.
- Lev-Ari, Shiri, Marcela San Giacomo, & Sharon Peperkamp. (2014). The effect of domain prestige and interlocutors' bilingualism on loanword adaptations. *Journal of Sociolinguistics* 18(5), 658-684.
- Maddieson, Ian. (1977). Tone loans: A question concerning tone spacing and a method of answering it. *UCLA Working Papers in Phonetics* 36. 49-83.
- Martin, Alexander, Marieke van Heugten, René Kager & Sharon Peperkamp. (2022). Marginal contrast in loanword phonology: Production and perception. *Journal of Laboratory Phonology*.
- Miao, Ruiqin. (2006). Loanword adaptation in Mandarin Chinese: Perceptual, phonological and sociolinguistic factors. Stony Brook University dissertation.
- Monahan, Philip J., Eri Takahashi, Chizuru Nakao & Willian Idsardi (2009). Not all epenthetic contexts are equal: Differential effects in Japanese illusory vowel perception. *Japanese/Korean Linguistics* 17, 391-405.
- Nishimura, Kohei. (2003). Lyman’s Law in loanwords. MA thesis, Nagoya University.
- Nomura, Jun, & Keiichi Ishikawa. (2018). Effects of first language processes and representations on second language perception: The case of vowel epenthesis by Japanese speakers. *International Journal of Bilingualism* 22(1). 69-87.
- Mutsukawa, Masahiko. (2006). Japanese loanword phonology in Optimality Theory: The nature of inputs and the loanword sublexicon. Michigan State University.
- Osatananda, Varisa. (1996). An analysis of tonal assignment on Japanese loanwords in Thai. *Proceedings of the Fourth International Symposium on Language and Linguistics*.
- Ozburn, Avery & Samuel Akinbo. (2024). Rounding harmony and loanword epenthesis in Yoruba. Unpublished manuscript, University of Toronto.
- Owino, Daniel. (2003). Phonological nativization of Dholuo loanwords. University of Pretoria dissertation.
- Paradis, Carole. (1988). Towards a theory of constraint violations. *McGill Working Papers in Linguistics* 5. 1–43.
- 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(1). 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.

- 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.
- Pham, Andrea Hoa. (2003). *Vietnamese Tone: A New Analysis*. New York, London: Routledge.
- Owino, Daniel. (2003). Phonological nativization of Dholuo loanwords. University of Pretoria (South Africa).
- Pollard, Mark G. (2008). Epenthetic vowel quality in English loanwords in Inuktitut. M.A. thesis, University of Toronto.
- Repetti, Lori. (2006). The emergence of marked structures in the integration of loans in Italian. In Randall Gess & Deborah Arteaga (eds.), *Historical Romance linguistics: Retrospective and perspectives*, 209–235. Amsterdam & Philadelphia: John Benjamins.
- Repetti, Lori. (2009). Gemination in English loans in American varieties of Italian. In Calabrese & Wetzels (eds.), *Loan phonology*, 225–240.
- Rolle, Nicholas & John TM Merrill. (2022) Tone-driven epenthesis in Wamey. *Phonology* 39(1). 113-158.
- Rose, Yvan & Katherine Demuth. (2006). Vowel epenthesis in loanword adaptation: Representational and phonetic considerations. *Lingua* 116. 1112–1139.
- Prince, Alan & Paul Smolensky. (1993). *Optimality Theory: Constraint interaction in generative grammar*. Unpublished manuscript, Rutgers University & University of Colorado, Boulder. Published 2004, Malden, MA & Oxford: Blackwell.
- Schütz, Albert J. (1995). *The voices of Eden: A history of Hawaiian language studies*. University of Hawaii Press.
- Scipione, Ruth. (2011). *Phonetic adaptations of Spanish loanwords in Triqui*. State University of New York at Albany.
- Sereno, Joan A. & Hyunjung Lee. (2015). The contribution of segmental and tonal information in Mandarin spoken word processing. *Language and Speech* 58(2). 131-151.
- 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.* (eds.), *Constraints in phonological acquisition*, 292–320.
- Shinohara, Shigeko. (2006). Perceptual effects in final cluster reduction patterns. *Lingua* 116. 1046–1078.
- Shinohara, Shigeko, Seong-Rim Ji, Tomohiko Ooigawa & Takahito Sinya (2011). The limited role of perception in Korean loanword adaptation: The Korean three-way laryngeal categorization of Japanese, French, English and Chinese plosives. *Lingua* 121(9). 1461-1484.
- Silverman, Daniel. (1992). Multiple scansions in loanword phonology: Evidence from Cantonese. *Phonology* 9. 289–328.
- 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.

- Smith, Jennifer L. (2009). Source similarity in loanword adaptation: Correspondence Theory and the posited source-language representation. In *Phonological argumentation: Essays on evidence and motivation*, 177-199. Oxford: Oxford University Press.
- Smolensky, Paul. (1996). The initial state and “Richness of the Base” in Optimality Theory. Unpublished manuscript, Johns Hopkins University, Baltimore (ROA-154).
- 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.
- Steinitz, Wolfgang. (1964). Geschichte des finnisch-ugrischen Vokalismus. Institutum Hungaricum Universitatis Holmiensis.
- Steriade, Donca. (2007). Perceptual repair and syllable structure: A reply to Kabak and Idsardi. Unpublished manuscript, MIT.
- Storme, Benjamin. (2015). The loi de position in French. Unpublished manuscript, MIT.
- Svantesson, Jan-Olof & David House. (2006). Tone production, tone perception and Kammu tonogenesis. *Phonology* 23(2). 309-333.
- Tu, Jung-yueh, & Stuart Davis. (2009). Japanese Loanwords into Taiwanese Southern Min. *Proceedings of the Second International Conference on East Asian Linguistics*. Simon Fraser University. Available online at: <http://www.sfu.ca/gradlings/wp2.html>.
- Tu, Jung-yueh. (2013). Word prosody in loanword phonology: Focus on Japanese borrowings into Taiwanese Southern Min. Dissertation, Indiana University.
- 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.
- Whang, James. (2019). Effects of phonotactic predictability on sensitivity to phonetic detail. *Laboratory Phonology* 10.1.
- Whang, James. (2021). Multiple sources of surprisal affect illusory vowel epenthesis. *Frontiers in Psychology* 12. 677571.
- Wiener, Seth & Rory Turnbull. (2016). Constraints of tones, vowels and consonants on lexical selection in Mandarin Chinese. *Language and speech* 59(1). 59-82.
- Wilson, Colin, & Lisa Davidson. (2013). Bayesian analysis of non-native cluster production. *Proceedings of NELS*, Vol. 40(2).
- Wilson, Colin, Lisa Davidson & Sean Martin. (2014). Effects of acoustic–phonetic detail on cross-language speech production. *Journal of Memory and Language* 77. 1–24.
- Woo, Minjae. (2023). An Investigation of Vowel Length and Tone Assignment in North Kyungsang Korean Native and Borrowed Words. University of Florida.
- Wu, Hsiao-hung Iris. (2006). Stress to tone: A study of tone loans in Mandarin Chinese. *MIT Working Papers in Linguistics* 52. 227–253.
- Yazawa, Kakeru, James Whang, Mariko Kondo & Paola Escudero. (2023). Feature-driven new sound category formation: Computational implementation with the L2LP model and beyond. *Frontiers in Psychology* 2. 1303511.
- Yip, Moira. (1993). Cantonese loanword phonology and Optimality Theory. *Journal of East Asian Linguistics* 2, 261–291.
- Yip, Moira. (2006). The symbiosis between perception and grammar in loanword phonology. *Lingua* 116. 950–975.

- Yun, Suyeon. (2016). A theory of consonant cluster perception and vowel epenthesis. Dissertation, Massachusetts Institute of Technology.
- Zuraw, Kie. (2000). Patterned exceptions in phonology. Ph.D. dissertation, University of California, Los Angeles.
- Zuraw, Kie, Kathleen Chase O'Flynn, & Kaeli Ward. (2019). Non-native contrasts in Tongan loans. *Phonology* 36(1). 127-170.