“High-Interest Loans”: The Phonology of English Loanword Adaptation in Burmese

A thesis submitted

by

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to

the Department of Linguistics

in partial fulfillment of the requirements

for the degree of Bachelor of Arts with Honors

Acknowledgements

The beginnings of this thesis actually lie in the field methods course I took several semesters ago taught by Lynn Nichols, who I thank for both introducing me to such a fascinating language and teaching me techniques of collecting data from a native speaker. My eternal thanks go to Ingyin Zaw, my main Burmese informant, who, as Lynn put it once, is the "gold standard" for informants. I couldn't agree more. It's almost a shame that she had to be one of the first informants I've worked with closely. Now I'm spoiled.

I could not have written much about phonology without learning from Lisa Lavoie, Patrick Taylor, Jie Zhang, Donca Steriade, and Michael Kenstowicz. I thank Jie especially for leading my individual tutorial and pointing me towards a topic. I also need to thank Jie and Susumu Kuno for writing Lord-knows-how-many recommendations for me. Javier Martín-González and Michele Cotton deserve thanks for offering feedback on drafts at the last minute, and Karl Peet and Gülşat Aygen are simply cool people.

But the person who has had the most impact on the writing of this thesis is Bert Vaux. Over the past four years, Bert has taught me as a professor, advised me as the linguistics head tutor, and met with me as my thesis advisor countless times over the course of the year to flesh out my ideas. I thank Bert for challenging the less-than-intelligent ideas that often left my mouth, for advising me even along with so many other theses, for writing recommendation letters for me in the wee hours of the morning, and for getting me interested in linguistics in the first place.

Finally, I would like to thank my family and friends, who have kept me sane through the process of writing what I thought would be a "short" thesis. My sisters, roommates, blockmates, housemates, MIHNUETers—you all are superstars.

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Abstract

Lexical borrowing is a common process across languages. Even so, words borrowed into a language are rarely borrowed perfectly, but instead undergo modification vis-à-vis their realization in the source language from which they were borrowed. This process of modification may result from the influence of the phonology native to the borrowing language, from general principles of Universal Grammar (UG), or from a combination of the two. In recent years, loanword adaptation has been modeled in various ways (e.g., Silverman 1992, Paradis 1996, Kenstowicz 2001, Steriade 2002) that say different things about the stages of adaptation and the relative importance of factors such as the borrower's proficiency in the source language and the veridicality of cross-language speech perception.

The present study concerns the adaptation of loanwords borrowed from English into Burmese, a language that is phonologically very different from English. English loanwords undergo systematic modifications in Burmese, some reflecting aspects of native Burmese phonology and others having no correlate in Burmese phonology. This case of loanword adaptation has implications for models of loanword phonology, suggesting that Burmese loanword adaptation occurs in a two-stage process, beginning with an initial English-to-Burmese mapping that occurs on a phoneme-to-phone basis. Segmental and syllabic structure is accounted for in this way, but tone assignment appears to be governed by a combination of Burmese tone laws and principles of UG that remains to be characterized. This issue of tone assignment is left as a question for future research.

1. Introduction

1.1. Borrowings

Most languages of the world borrow words from other languages. English, for instance, borrows from other languages quite freely, and as a result, many, even most, words commonly used in English actually have foreign origins. An ordinary "native" English sentence may actually contain several borrowed words; for example, in the sentence *The mosquitoes circled around the yogurt that had spilled onto the mattress*, half of the content words are borrowings.[1] More academic language, drawing upon the significant Latinate vocabulary of English, can contain even more words originally from other languages.

Lexical borrowing, then, is a common process across languages. Even so, words borrowed into a language are rarely borrowed perfectly, but instead undergo modification vis-à-vis their realization in the source language from which they were borrowed. The phonologies of two languages are usually dissimilar enough to result in forms taken from one language being adapted in one or more ways to fit into the phonological system of the borrowing language. For one, the consonant and vowel inventories of different languages vary in the number and type of segments they contain; in addition, suprasegmental features, such as tone and stress, do not necessarily coincide in distinctiveness, and syllable structure constraints can be disparate as well. Speakers of a language that does not contain the [f] sound, such as Korean, encounter a consonant they have never had to pronounce before when they borrow foreign words containing [f], while those who speak a language with only CV syllables, such as Hawaiian, must likewise find a way to resolve the problem of consonant clusters in borrowed words. Thus, loanwords in a language tend to constitute a locus of phonological changes.

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[1] In this sentence, the following words are borrowings: *mattress* < Arabic, *yogurt* < Turkish, *mosquito* < Spanish, *circle* < Old French.

1.2. Linguistic Relevance of Loanword Phonology

The study of phonology in modern linguistics has generally proceeded by examining the sound patterns of individual languages and then comparing sound patterns cross-linguistically. Speakers' knowledge of sound structure in their language is represented as a set of markedness laws stating which structures are harmonious and well-formed and which are less so, and this information is gathered by speakers from the sound patterns present in their language, such as distribution and alternation. Linguists may also gather information about markedness by looking at typological patterns across many languages.

However, the information gathered from these two sources, patterns within a language and comparison of patterns across languages, seems inadequate to account for the true nature of the phonological system. For instance, speakers are able to learn typologically unnatural patterns in a relatively short period of time (e.g., Dell et al. 2000), so typological invalidity (i.e., unnaturalness) of a sound pattern is not an obstacle to learning phonotactic regularities (Steriade 2003a).

Moreover, speakers may also display phonological knowledge that cannot be gathered from data within their language. For example, in French, the vowel [i] is generally not permitted before other vowels and is replaced by the glide [j] in most cases, even after consonant sequences (e.g., *lier* [lje], *pierre* [pjɛʁ], *Erasmien* [eʁas.mjɛ̃], *anxieux* [ɑ̃k.sjø]). The exception is obstruent-liquid clusters, after which the vowel [i] is favored over the glide [j] (e.g., *Hanovrien* [a.no.vri.ɛ̃], *plier* [pli.e]). Either the constraint *"[j] after complex onset" or *"[j] after obstruent-liquid sequence" could account for this French pattern, but there is no disambiguating data in the French lexicon, as most complex onsets in French comprise an obstruent and liquid. Nevertheless, the derivation of adjectives out of nouns with a heterosyllabic sequence of obstruent and liquid (which is not a complex onset) proceeds uniformly: the glide is not allowed (e.g., *Ezra* [ɛz.ʁa] > *ezrien* [ɛz.ʁiɛ̃]/*[ɛz.ʁjɛ̃]). Thus, it appears that French speakers postulate the constraint

*"[j] after obstruent-liquid sequence" over the constraint *"[j] after complex onset", although there is no evidence for this particular choice in the native French lexicon (Steriade 2003a).

On the other hand, speakers may also ignore or be unable to access information that can be gathered from the native lexicon. Japanese speakers exemplify this situation in the case of past tense formation rules. This set of rules (e.g., vowel epenthesis, post-nasal voicing, nasal assimilation) used with native verbs is applied with poor accuracy to many classes of novel verbs, even though the novel verbs are phonotactically well-formed and look like native Japanese verbs. The grammar of Japanese past tense alternations, then, is apparently harder to control than is indicated by the regularity of their application in the native Japanese lexicon (Steriade 2003a). Thus, there is a dissociation between linguistic competence and performance that can be illuminated by the study of loanword phonology.

1.3. Important Issues in Loanword Phonology

There are a number of variables that are relevant when considering the phonology of loanwords. These are each considered here in turn.

1.3.1. Level of Representation of the Input and Output

A major issue in loanword phonology is the level of representation to which the input and output correspond. It remains a question whether the mapping of input to output segments is done on a phoneme-to-phoneme basis, phoneme-to-phone basis, phone-to-phoneme basis, or phone-to-phone basis. In other words, is it only information that is phonemic in the source language that is picked up upon in constructing the input to the loanword phonology, or are other phonetically relevant details included as well? And from the other perspective, do speakers only attend to information in a given string of foreign input that is phonemic in their native language? Finally, whatever the perceptual input is, is that eventually mapped onto only phonemes of the borrowing language, or are non-phonemic allophones of the borrowing language accessible as well?

In Burmese and English, for example, both aspirated and unaspirated versions of the voiceless stops exist; however, these two series of consonants are phonemic in Burmese, while aspirated stops are only allophonic in English, occurring primarily in the onset of stressed syllables. A phoneme-to-phoneme or phoneme-to-phone mapping of English input to Burmese output would therefore result in English [p^h] → Burmese [p], while a phone-to-phoneme or phone-to-phone mapping would result in English [p^h] → Burmese [p^h]. However, if the situation were reversed and English was the borrowing language, one would expect a phoneme-to-phone mapping or phone-to-phone mapping of Burmese input to English output to result in Burmese [p^h] → English [p^h], as the aspirated stop allophones of English would be accessible for adaptation here. On the other hand, a phone-to-phoneme or phoneme-to-phoneme mapping would result in Burmese [p^h] → English [p], as only the phonemic, underlyingly aspirated stops of English would be accessible in this case.

1.3.2. Source of the Input

Another variable in loanword adaptation is the source of the input. First, are words borrowed through speech or writing? If the latter, there is likely to be some, if not heavy, influence from orthographic representations. Second, who does the input come from, native speakers of the source language or speakers for whom the source language is L2 (e.g., schoolteachers with strong accents)? If the latter, there are likely to be details of the input that differ from what would be present in a native source. In addition, it should be kept in mind that the input may come from the source language directly or through an intermediate language. The shape of a loanword that comes through a chain of transmission is likely to show effects of the intermediate languages in the chain.

1.3.3. Agents of Adaptation

The agents of the adaptation obviously have a major impact on the form of loanwords, and they may be balanced bilinguals, unbalanced bilinguals, or monolinguals with no knowledge of the source language phonology. Balanced bilinguals have access

to the underlying representations of the source language, so phoneme-to-phoneme or phoneme-to-phone mapping is more likely to be possible, while monolinguals can only rely on the phonetic input of the speech signal without phonological structure.

1.3.4. Nature of the Input

Yet another issue that should be raised is what level of phonetic detail is present in the input. In other words, does the input comprise fast, casual speech, in which segments are liable to disappear in pronunciation, or slow, careful speech, in which some features may actually be exaggerated (e.g., aspiration, vowel quality)? Related to this question is the issue of perceptual salience. When a feature that is expected in the output is missing, is this because that feature was deleted or because it was not perceptually salient enough to be processed in the input in the first place?

1.3.5. Chronology

The effect of chronology must also be acknowledged. Older loanwords may look different from more recent loanwords for a number of reasons. For one, the influence of the native L1 phonology on loanwords may have been different in the past because the L1 phonology itself was different. In addition, older loanwords may have been exposed to sound changes in the language due to their longer presence in the language, and they may currently be subject to more native phonological constraints because of deeper integration into the language, residing closer to the core rather than the periphery of the lexicon (Salanova 2002a, 2002b). Other factors may change over time as well. For instance, the most common source of input may differ across two distant time periods with distinct social and educational conditions.

1.3.6. Structure of the Loanword Phonological System

Finally, we should consider that the process of loanword adaptation may result from the influence of the phonology native to the borrowing language, from general principles of Universal Grammar (UG), or from an autonomous “interlanguage” system that may combine elements of both. The structure of the grammar dealing with

loanwords will naturally have an impact on loanword adaptation. If the loanword phonology is essentially the same as the native L1 phonology, then phonological changes applied to loanwords are expected to be motivated by patterns and rules of the L1 phonology. On the other hand, if UG takes over with loanwords, then the output is expected to display the emergence of unmarked[2] features (Broselow et al. 1998, Shinohara 2000) not necessarily present in L1.

1.4. Previous Approaches

In recent years, loanword adaptation has been modeled in various ways that say different things about the stages of adaptation and the relative importance of factors such as the borrower's proficiency in the source language and the veridicality of cross-language speech perception. Summarized here are a few selected approaches.

1.4.1. Two-Stage Model (Silverman 1992)

In Silverman's (1992) model of loanword adaptation, the input is the "acoustic signal," which is processed on two levels. The first level is the Perceptual Level. This is the stage at which the as-yet non-linguistic input is parsed into segments, which are mapped onto phonemes of the native language. As Silverman puts it, this scansion is "concerned solely with providing a preliminary, perceptually based 'raw' representation for incoming forms." The second level of this model is the Operative Level, the input to which is the output of the preceding Perceptual Level. It is in this second scansion that native phonological constraints are imposed upon the input. In addition, processes that are absent from the native grammar, thus contributed by UG, may also apply at the Operative Level. It should be noted that the Perceptual Level concerns segmental phonotactics specifically, while the Operative Level focuses on syllabic and metrical structure.

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[2] But there can be exceptions to what otherwise appears to be a universal pattern. Languages in which the voicing of obstruents changes syllable-finally or word-finally overwhelmingly devoice voiced obstruents; thus, it appears voicelessness is unmarked in this situation. However, the opposite process, word-final voicing, occurs in Lezgian (Yu 2002).

A notable claim of Silverman's model is that phonological knowledge of the source language is ignored. He finds evidence from Cantonese loanwords that Cantonese speakers are unable to access the phonological representation of incoming loanwords; thus, the role of the bilingual in loanword adaptation is minimal. Since the agents of adaptation in Silverman's model do not have access to a phonological representation of foreign input, they lack knowledge of the syllable structure in foreign input and must provide their own structure for the output of the Perceptual Level.

1.4.2. Theory of Constraints and Repair Strategies (Paradis 1996)

Paradis's (1996) Theory of Constraints and Repair Strategies (TCRS) adheres to two main principles. The first is the Preservation Principle, which says that "segmental information is maximally preserved, within the limits of the Threshold Principle." The Threshold Principle states that "all languages have a tolerance threshold to segment preservation" and that "this threshold is set at two steps (or two repairs) within a given constraint domain."

The motivation behind Paradis's model is the observation that segmental deletion in borrowings is relatively rare. In the TCRS, a foreign segment that violates a phonological constraint in the native language can be repaired either by transformation, insertion of another segment, or outright deletion. However, a segment is only deleted when the number of repairs that would be necessary to preserve the segment exceeds the threshold of two repairs postulated by Paradis; only the most offending segments, those that require three or more repair steps, will be deleted. A universally strong preference for segment preservation over segment deletion is therefore predicted.

Other relevant points made by Paradis include the assumption that bilinguals, who have access to the phonology of the source language L2, are the ones chiefly responsible for introducing borrowings into a language. The claim is made that these bilingual borrowers abstract away from the phonetic details of L2 input that are non-distinctive in L1, but include the details that are distinctive in L2; in other words, they attend to

information that is phonemic vis-à-vis L1 and L2. The phonetic output of L2 is thus put through a double phonemic filter to become the input to the loanword phonology.

1.4.3. Grammar of Perception vs. Production (Kenstowicz 2001)

Kenstowicz (2001) draws a distinction between a grammar of perception and a grammar of production. In this view, certain phonological distinctions (e.g., /l/ vs. /r/) can be heard by speakers without these distinctions in L1, but they cannot be articulated, recalling the dichotomy of linguistic competence and performance. On the other hand, other distinctions will not be perceived if they occur in contexts where robust cues are absent and the perceptual system is not attuned to attend to them. In sum, perception is not as straightforward as one-to-one phonemic mapping; there are many factors that play a role in perceiving the input that should be accounted for carefully.

Here there is a direct influence of the source language on the perceptual side, in terms of the physical signal that is available to be picked up by the borrower; and in the grammar, faithfulness constraints are ranked around a fixed core of markedness constraint rankings. In this model, adaptation is governed primarily by perceptual factors (Kenstowicz 2003).

1.4.4. Perceptual Similarity and the P-Map (Steriade 2002)

Steriade's (2002) model is in the same vein as Kenstowicz (2001). In her model, perceptual factors again play the key role in adaptation, and perceptual similarity is the basis of all faithfulness constraints and some markedness constraints as well. Knowledge of perceptual similarity is formalized in the Perceptual Map, or P-Map, a component of linguistic competence that enables speakers to judge the relative similarity of any pair of sounds in any context (e.g., [p]-[b] / __N). The P-Map projects faithfulness constraints that are ranked with respect to each other on the basis of perceptual similarity. A faithfulness constraint pairing two sounds separated by a larger perceptual distance in a given context will be ranked higher than one pairing two sounds separated by a smaller perceptual distance; in this way, the fact that replacing an offending segment with a

relatively dissimilar segment is worse than replacing it with a relatively similar segment is encoded within the constraints. Note that these faithfulness constraints may ordinarily be obscured by other factors that impose upon the lexicon, whereas loanwords, which at first are free from lexical forces, provide the appropriate environment to see these faithfulness constraints in action.

1.5. Present Study

Loanword phonology has been studied extensively in recent years (e.g., Broselow 2000 in Selayarese, Lee 2001 in Korean, Burenhult 2001 in Jahai, Tonks and Demuth 2002 in Sesotho, Ussishkin and Graf 2002 in Modern Hebrew). The Burmese language, however, has not been very heavily studied, and the few sources that do comment on Burmese phonology are generally quite old or brief (Smith 1862, Armstrong et al. 1925, Stewart 1936, Cornyn 1944, Jones et al. 1953, Jones 1960, Burling 1967, Okell 1969). Although Win (1998) discusses in depth the accent of Burmese learners of English as a second language, the present study is the first that specifically concerns the adaptation of loanwords borrowed from English into Burmese.

The phonological nativization processes that are applied to English borrowings in Burmese are a rich source of data for research. The changes that a Burmese speaker imposes on English words highlight differences between the two languages and, thus, particular features of Burmese itself. Furthermore, the results of this case of loanword adaptation have implications for all of the points discussed in §1.3; they also support or contradict each of the models of adaptation described in §1.4. English loanwords undergo systematic modifications in Burmese, some which reflect native Burmese phonological processes and others that reflect static patterns of the language that do not obviously result from active phonological processes.

This study focuses on data gathered from a Burmese-English bilingual informant, a native of Burma with knowledge of some other languages and of linguistics as well. Elicitation occurred both in small-group and one-on-one sessions with the informant.

The forms elicited include personal names, country names, institution names, clothing items, accessories, foods, and technology, as well as many other categories. The majority of the data comprise words regularly used and integrated into Burmese, while some forms represent online adaptations of words recognized as English, but pronounced with Burmese phonology spontaneously. In addition, the corpus is supplemented with online adaptations of pseudowords and with data from other studies as well. During the elicitation process, the informant produced the loanword in isolation at both a slowed and normal speech rate. When necessary, the intuitions of the informant were consulted about the forms being produced; these intuitions were especially useful in distinguishing between tones and other features. Transcriptions of all forms are numbered and listed in the appendix with glosses (and explanations where relevant).

The goals of this thesis are to examine the phonological constraints of Burmese relevant to loanword adaptation by observing the strategies employed to repair borrowed input, to provide a formal analysis of this phonological system, and to offer some answers to the questions raised in §1.3 and §1.4 about the nature of loanword phonology in light of the results of this particular case of loanword adaptation.

2. Native Burmese Phonology

Before beginning to analyze the loanword corpus, it will be instructive to examine the native phonological system in order to discern patterns and constraints of Burmese that may be reflected in the adaptation of novel forms from English. Here an overview is provided of the consonants, vowels, and syllable structures of Burmese, as well as phonotactic restrictions and some phonological processes.

2.1. Segments

The Burmese language contains 34 consonants: unaspirated and aspirated voiceless stops, voiced stops, the glottal stop, three different affricates, voiced and voiceless nasals at four different places, a voiced and voiceless lateral, seven fricatives, and three glides (Win 1998).

(1) Burmese inventory of consonant phonemes[3]

	Labial	Dental	Coronal	Palatal	Velar	Glottal
Plosive	p p^h b		t t^h d		k k^h g	ʔ
Affricate				tʃ $tʃ^h$ dʒ		
Fricative		t̪θ d̪ð	s s^h z	ʃ		h
Nasal	m̥ m		n̥ n	ɲ̥ ɲ	ŋ̊ ŋ	
Lateral			l̥ l			
Flap			(ɾ)			
Approximant	w̥ w			j		

Notable gaps among the consonants that become relevant with loanwords are the lack of labial fricatives, the alveolar approximant /ɹ/, and the voiced palatal fricative /ʒ/.

[3] The interdentals are accurately described by Win (1998) as sounding "more like weak plosives than fricatives"; thus, they have been transcribed in conjunction with a dental stop as [t̪θ] and [d̪ð]. The coronal stops are alveolar, not dental, and the laterals are always light. The flap has been placed in parentheses because it is not a phoneme, but an allophone of /d/ that otherwise appears only in loanwords (Cornyn 1944).

The basic inventory of vowels consists of eight front and back vowels, oral and nasal, and eight oral and nasal diphthongs.

(2) Burmese vowel inventory

	Front	Central	Back
High	i ĩ		u ʊ̃
Mid	e		ɔ
Low		a ã	
Diphthongs	ei ẽĩ ai ãĩ au ãũ ou õũ		

In addition, the schwa [ə] occurs as an allophone of [ɪ, ɛ, a, ʊ].[4] Here, a notable gap is the absence of nasalized counterparts of the mid vowels (i.e., */ɛ̃, ɔ̃/), which becomes relevant in the adaptation of English syllables containing mid vowels and coda nasals. Burmese also lacks the low front vowel /æ/ and the diphthong /ɔɪ/ of English. Other English vowels missing from Burmese, such as the lax vowels /ɪ, ɛ, ʊ/, have close correspondents in Burmese vowel allophones not included in the chart in (2).

2.2. Tones

Tone in Burmese is related not only to pitch, but also to duration, intensity, phonation, and vowel quality (Green 2002). There are at least three different phonemic tones in Burmese, and possibly four: low, high, creaky, and glottal. The low tone has "medium duration, low intensity, and low, often slightly rising pitch"; the high tone is "sometimes slightly breathy, relatively long, high intensity, and high pitch often with a fall before a pause"; and the creaky tone has "tense or creaky phonation, medium duration, high intensity, and high, often slightly falling pitch" (Wheatley 1987). These descriptions are similar to those of Cornyn (1944), who describes the low tone as "low,

[4] [ɛ, ɪ, ʊ] are not included in the vowel chart because they appear to be allophones of their tense counterparts. Also, it should be noted that Win (1998) considers schwa to have phonemic status; however, the fact that it alternates with several full vowels and cannot stand on its own suggests otherwise. In this study, the schwa will be considered an allophone of [ɪ, ɛ, a, ʊ], as noted above.

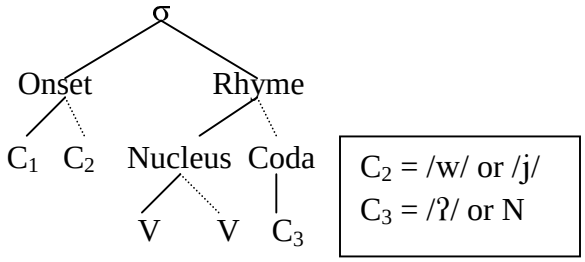
level, and long, accompanied often by a gentle rise at the end," the high tone as "high, long, and falling toward the end," and the creaky tone as "high, short, and falling, with a slow glottal closure." The tone that falls on schwa is neutral.

Some (Cornyn 1944, Khin 1976, Wheatley 1987, Green 1995) consider there also to be a fourth tone with the general features of creaky tone followed by glottal stop. Cornyn (1944) describes this glottal tone as "high, extremely short, with a sharp glottal closure." According to Khin (1976), the glottal tone has a higher pitch than the creaky tone, and the effort of the larynx in producing the glottal tone is greater. In this study, a system of three phonemic tones will be adopted; the glottal tone will be considered a phonetic tone, the product of creaky tone followed by glottal stop.

2.3. Syllables and Phonotactics

The basic Burmese syllable structure is $C_1(C_2)V(V)(C_3)$. An onset is obligatory and consists of a consonant C_1 optionally followed by an approximant C_2.[5] The rhyme minimally contains a monophthongal nucleus, but may also contain a diphthong, although some diphthongs are not permitted in open syllables. There may also be a coda C_3, which may only be a glottal stop or a nasal.[6] The syllable structure may thus be represented by the following schematic.

(3) Burmese syllable structure[7]



[5] Wheatley (1987) states that a Burmese syllable minimally has CV structure, where a vowel is preceded by glottal stop if not by another consonant.

[6] Green (1995) describes these possible codas as "placeless consonants." Final nasals are represented in orthography and pronounced incidentally as nasals homorganic with the following consonant in rapid speech. However, in normal speech, these nasals are realized only as nasalization on the preceding vowel. Note additionally that final glottal stop is often assimilated to a following onset.

[7] The dotted lines in the schematic indicate that an element is optional.

Note, however, that /j/ only occurs after labials; clusters */kj, tj/ are ill-formed (Green 1995). As mentioned above, /ei, ai, au, ou/ are the only diphthongs. In addition, /ɔ/ does not occur with a glottal coda: */ɔʔ/ (Cornyn 1944); this gap has consequences for rendering English syllables which contain /ɔ/ and a coda obstruent. Note further that the presence of only one slot in the coda naturally prevents a nasal from co-occurring with a glottal stop in coda position; the configuration of a nasalized vowel followed by a tautosyllabic coda glottal is therefore disallowed: *V̰ʔ (Cornyn 1944).

With regard to vowels, the lax vowels [ɪ, ɛ, ʊ, ʌ] appear only in closed syllables (i.e., when followed by a glottal stop or with nasalization from an underlying nasal coda). Like the lax vowels, the diphthongs /ai, au/ also do not occur in open syllables (Cornyn 1944).

Two different syllable types occur in Burmese, distinguished by Green (1995) as major and minor: major syllables are heavy, containing any vowel except schwa and bearing tone, while minor syllables are light, contain schwa and no other vowel, do not bear tone, and are not word-final. While most Burmese vowels can be found in monosyllabic words, a syllable with a schwa cannot stand on its own (Cornyn 1944); it is always bound to a following major syllable. Most Burmese words are either monosyllabic or consist of a minor syllable followed by a major syllable; words longer than two syllables are mostly compounds or loanwords (Green 1995). Since Burmese is for the most part monosyllabic and tends to place stress on every syllable, it is a syllable-timed rather than stress-timed language (Win 1998).

Some additional phonological generalizations are made by Green (2002) that are contradicted by data from native Burmese or loanwords. The diphthongs /ei, ou/ are said to pattern with the other two diphthongs /ai, au/ by not occurring in open syllables (also stated in Cornyn 1944, Win 1998), but several native Burmese forms contradict this

claim (e.g., /jɛ̀ì/ ‘water’, /pwéî/ ‘gathering’, /dọ̰ṵ/ {plural morpheme}).[8] Furthermore, note the following minimal quadruplet that leaves /ou/ in an open syllable in the first three forms: /pòù/ ‘to have extra’, /póú/ ‘insect’, /pọ̰ṵ/ ‘to send’, /pouʔ/ ‘to run, go running’. The idea that /ei, ou/ cannot occur in open syllables is clearly false. Finally, the lax vowel /ɛ/ is included in the Burmese vowel inventory alongside tense /e/ and is said to occur in open syllables as well as syllables closed by glottal stop, but /ɛ/ is never found to contrast with /e/ in open syllables in either the native Burmese data or the loanword data examined in this study; this vowel clearly appears to be an allophone of /e/ that occurs in closed syllables.

2.4. Phonological Alternations and Processes

There are several interesting phonological processes in Burmese, two of which are sandhi voicing and tone sandhi. First, sandhi voicing applies between syllables in “close juncture” (Cornyn 1944). When preceded by a vowel-final syllable in close juncture, a syllable-initial voiceless consonant becomes voiced.[9]

(4) Sandhi voicing between syllables in close juncture

a.	[ŋá] ‘five’	[tʃʌʔ] ‘money’	[ŋádʒʌʔ] ‘five monies’
b.	[sʰ̰i] ‘oil’	[póṵ̃] ‘tin can’	[sʰ̰ibóṵ̃] ‘oil can’
c.	[kʰwéi t̪θóṵ̃] ‘three dogs’	[kàṵ̃] {classifier for animals}	[kʰwéi t̪θóṵ̃ gàṵ̃] ‘three dogs’
d.	[ʃi̪] ‘to have’	[tè] {present/past marker}	[ʃi̪dè] ‘has’

Voicing also occurs in the process of compounding words, which results in further alternation between voiceless and voiced consonants. An initial voiceless consonant in the second word of a compound becomes voiced when the first word in the compound

[8] It seems Green (2002) may even acknowledge this himself, as he recognizes that /ai, au/ in English open syllables are adapted into Burmese with an epenthetic coda consonant, either a glottal stop or nasal (which turns into nasalization), but conspicuously leaves out similar data for /ei, ou/.

[9] The voiceless sonorants, /ʃ/, /h/, and /ʔ/, however, are not affected by this voicing process.

ends in a vowel, and this voicing spreads to an initial voiceless consonant in the first member of the compound.

(5) Voicing alternation between monosyllables in compounds

a.	[ŋá] ‘fish’	[séĩ̃] ‘uncooked’	[ŋəzéĩ̃] ‘fresh fish’
b.	[wá] ‘bamboo’	[kaʔ] ‘woven sheeting’	[wəgʌʔ] ‘bamboo sheeting’
c.	[sá] ‘eat’	[pwéi̯] ‘gathering’	[zəbwéi̯] ‘table’
d.	[tʃáũ̃] ‘floor’	[póú] ‘insect’	[dʒəbóú] ‘biting floor bug’
e.	[s^{h}àũ̃] ‘hair’	[pìĩ̃] ‘string’	[zəbìĩ̃] ‘hair’
f.	[k^{h}á] ‘waist’	[pʌʔ] ‘go around’	[gəbʌʔ] ‘belt’
g.	[pà] ‘cheek’	[sʌʔ] ‘at the edge’	[bəzʌʔ] ‘mouth’

These voicing processes may become relevant for English loanwords, if multimorphemic loans are analyzed as compounds, for instance.

Tone sandhi also occurs between syllables in open juncture and close juncture. When preceding an open juncture, low tone becomes “shorter than before comma or period” and “does not rise at the end”; high tone “does not fall”; and creaky tone has a glottal closure that is “not so slow.” The tone on a vowel followed by a glottal catch remains the same, “except that in very rapid speech the final glottal stop sometimes assimilates” to the following consonant (Cornyn 1944). When preceding a close juncture, low tone becomes even shorter; high tone becomes shorter and rising; and creaky tone loses its glottal closure. Vowels with a glottal catch become extremely shortened, and the glottal assimilates to the following consonant (Cornyn 1944). These tone sandhi processes may become relevant in describing the process of tone assignment in English loanwords.

2.5. Summary

This brief overview of Burmese phonology sets forth numerous points regarding phonological gaps and particular differences with respect to English (e.g., inventory

disparities, syllable structure conditions, and phonotactic constraints) that come into play in the analysis of the English loanword data in subsequent chapters.

3. Tones in Loanwords

Vowels in English loanword adaptations may carry any Burmese tone (low, high, creaky, or glottal[10]) as well as no tone.

3.1. Low Tone

Low tone occurs freely before and after atonic syllables, as well as before and after all four phonetic tones. Low tone is also found to occur on all of the vowels.

(1) Adaptations with only low tone
[L, LL, LLL, LLLL, LLLLL][11]

a. [bà̰] 'bank'
b. [zʊ̰̀] 'June'
c. [pʰàɪ̰̀] 'file'
d. [mèi] 'May'
e. [pʰàʊ̰̀] 'form'
f. [jà̰] 'rum'
g. [dʒʊ̰̀] 'John'
h. [wàɪ̰̀] 'wine'
i. [ʔèmì] 'Amy'
j. [nàɪ̰̀ lʊ̰̀] 'nylon'
k. [ʔèɪpjì] 'April'
l. [pɪ̀zà] 'pizza'
m. [ʔà̰ ɾì] 'auntie'
n. [pòùlà̰] 'Poland'
o. [bɪ̀.ʔèɪ] 'B.A.'
p. [jùnɪ̀bàsɪ̀ɾì] 'university'
q. [bɪ̀jà] 'beer'
r. [pàʊ̰̀ dà] 'powder'
s. [bɪ̀ɾɔ̀] 'bureau'
t. [ɾàɪ̰̀ pʰè] 'rifle'
u. [sɪ̀ɗì] 'CD'
v. [ɾàbà] 'rubber'
w. [tʃʰèbɪ̀] 'Chevy'
x. [sʰwètà] 'sweater'
y. [kɔ̀pʰ̪i] 'coffee'
z. [ɾì bɪ̀] ~ [ɾì bwɪ̀] < *T.V.* 'television'
aa. [dɔ̀là] 'dollar'
bb. [tàjà] 'tire'
cc. [pʰ̪ɪ̀lɪ̰̀] < *feeling* 'inspiration'
dd. [ʔà̰ kè] 'uncle'
ee. [hʊ̰̀ dà] 'Honda'
ff. [wɪ̰̀ sʰà] 'Windsor'
gg. [dʒɔ̀nɪ̀] 'Johnny'
hh. [pʰ̪ɪ̰̀ là̰] 'Finland'
ii. [zùlàɪ̰̀] 'July'
jj. [gɪ̀tà] 'guitar'

[10] Remember from §2.2 that the glottal tone is considered here as an allophone of creaky tone that occurs with a glottal stop. However, whether glottal tone is considered to be an allophone of creaky tone or to have phonemic status separate from the glottal stop that co-occurs with it is not important in examining the data at this point. While one analysis is that an independently distinctive glottal tone is being used to adapt the syllables in which it surfaces, a simple alternative analysis posits that it is creaky tone being used for these syllables and that the glottal stop segment inserted for other reasons (see §4.4 and §6.1) naturally results in the glottal tone present in these syllables.

[11] L = low, H = high, C = creaky, G = glottal, N = neutral (atonic).

kk. [kòṵ̀̃ pjṵ̀tà] 'computer'
ll. [hà̰̃ bàɡà] 'hamburger'
mm. [ɗìzḭ̀̃ bà] 'December'
nn. [ɺ̰ìbàɾ̰ì] ~ [lèbàɾ̰ì] 'liberty'
oo. [dàḭ̀̃ jànà] 'Diana'
pp. [nèìʃḭ̀̃ nè] 'national'
qq. [dàḭ̀̃ jàʝ̰ì] 'diary'
rr. [nèðàlà̰̃] 'Netherlands'
ss. [sḭ̀̃ ɡàpù] 'Singapore'
tt. [nòùwḭ̀̃ bà] 'November'
uu. [sʰwìzàlà̰̃] 'Switzerland'
vv. [jèìɗìjòù] 'radio'
ww. [tòùjòùtà] 'Toyota'
xx. [bìɗìjɔ̀] ~ [bwìɗìjɔ̀] < *video* 'VCR', 'videotape'
yy. [kòùkàkòùlà] 'Coca-Cola'
zz. [wḭ̀̃ dàmìjà] 'Windermere'

(2) Adaptations with only low tone and neutral syllables
[LNL, LNLL, LNNLL, NL, NLL, NLLL, NLNL]

a. [bàbəjà] 'Barbara'
b. [dʒàmənì] 'Germany'
c. [bàḭ̀̃ səkè] 'bicycle'
d. [màzədà] 'Mazda'
e. [bɔ̀sətʊ̰̃] 'Boston'
f. [wìsəkì] 'whiskey'
g. [ʔḭ̀̃ ɡəlà̰̃] 'England'
h. [zà̰̃ nəwàɾì] 'January'
i. [pʰèìpʰəwàɾì] 'February'
j. [bìləkəlḭ̀̃ tḭ̀̃] 'Bill Clinton'
k. [dəɾà̰̃] 'drum'
l. [səpèḭ̀̃] 'Spain'
m. [pʰəlḭ̀̃] 'film'
n. [sətàḭ̀̃] 'style'
o. [dʒəpà̰̃] 'Japan'
p. [səpʰɪ̰̃] 'Sphinx'
q. [dəɾàḭ̀̃ βà] 'driver'
r. [sətìjàɾàḭ̀̃] 'steering wheel'
s. [kʰəʝḭ̀̃ sʰòùdà] 'cream soda'
t. [səpàkəlḭ̀̃] 'sparkling'
u. [ʔəkèɾəmì] 'academy'

(3) Adaptations with low tone co-occurring with high, creaky, and/or glottal
[CLCC, GHL, GHLL, GL, GLGL, GLL, GNG, GLG, GNL, GNLL, HL, HNG, LC, LCCL, LCLL, LG, LGL, LGNG, LH, LLG, LLH, LLHH, LLHHH, LNCC, LNG, LNH, LNHCC, LNHHH, LNLG, NLHH, NLHC, NLHHH, NLGHH]

a. [wḭtòùɾ̰ḭja̰] 'Victoria'
b. [ʃʌʔ ʔéḭ̀̃ dʒì] 'shirt'[12]
c. [lɪʔbɪ̰́̃ kàlà] 'Living Color'
d. [dʒɛʔsʰɪ̰̃] 'Jetson'
e. [maiʔkèdʒɛʔsʰɪ̰̃] 'Michael Jackson'
f. [ʔauʔtòùbà] 'October'

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[12] From 'shirt' + 'top'. See the appendix for glosses of classifiers and compounds and more detailed explanations of the meanings of certain words.

g. [dʒɛʔsǐkà] ‘Jessica’
h. [sɛʔtĭ̃bà] ‘September’
i. [mɛʔsʰĭkòù] ‘Mexico’
j. [sɪʔtĭmaʔ] ~ [sɪʔtĭmaʔ] ‘City Mart’
k. [kɛʔpətèĭ̃] ‘captain’
l. [pɛʔpəsǐ] ~ [pɛʔsǐ] ‘Pepsi’
m. [bɛʔt̪θəlĭhà̃] ‘Bethlehem’
n. [bɔ́pĭ̃] < *ball(point) pen* ‘pen’
o. [ʔĭ̃gəleiʔ] ‘English’
p. [jèʃu̱] < *Yeshua* ‘Jesus’
q. [jèǐju̱wa̱lĭ̃] ‘Jerusalem’
r. [t̪θiɾ̪i̱lĭ̃gà] ‘Sri Lanka’
s. [ʔɔ̀gouʔ] ‘August’
t. [nà̃bʌʔ] ‘number’
u. [ʔidʒɪʔ] ‘Egypt’
v. [dàɾaiʔtà] ‘director’
w. [bǐ.ʔɛʔsǐ] ‘B.Sc.’
x. [pʰĭlɪʔpàĭ̃] ‘Philippines’
y. [ʔĭlɪʔzəbɛʔ] ‘Elizabeth’
z. [nĭ̀kóú] ‘Nicole’
aa. [bɔ̀ lóú̃] ‘ball’
bb. [nĭ̀sʰá̃] ‘Nissan’
cc. [ʃà̃péĭ̃] ‘champagne’
dd. [mɔ̀tɔ̀bouʔ] ‘motorboat’
ee. [dʒà̃ʃĭ̃.ʔeiʔ] ‘Junction Eight’
ff. [kwèǐkà.ʔouʔ] ‘Quaker Oats’
gg. [màsǐtí] ‘Mercedes’
hh. [ʔĭ̃dòùníʃá] ‘Indonesia’
ii. [ʔàdʒĭ̃tína] ‘Argentina’
jj. [ʔit̪θijópíjá] ‘Ethiopia’
kk. [ʔèĭ̃dəɾi̱ja̱] ‘India’
ll. [màgəjɛʔ] ‘Margaret’
mm. [ʔĭ̃dəjú] ‘Andrew’
nn. [ʔɔ̀sətéílĭja̱] ~ [ʔɔ̀sətéílĭjá] ‘Australia’
oo. [bèĭ̃gəlàdɛʔ] ~ [bà̃gəlàdɛʔ] ‘Bangladesh’
pp. [ʔəmèǐjíká] ~ [ʔəmèǐjíka̱] ‘America’
qq. [səlòùbákĭjá] ~ [səlòùbɛ/kĭjá] ‘Slovakia’

3.2. High Tone

High tone occurs after neutral syllables and before and after all four tones, as well as on all vowels.

(4) Adaptations with only high tone
[H, HH, HHH]

a. [bóú̃] ‘bomb’
b. [kĭ̃] ‘king’
c. [ká] ‘car’
d. [lɔ́] ‘Laos’
e. [tʃʰá] ‘Charles’
f. [pʰóú̃] ‘phone’
g. [pʰóú] < *four* ‘heroin’
h. [kwĭ̃] ‘queen’
i. [dʒĭ̃] ‘jeans’
j. [tʰáĭ̃] ~ [jóúd̠ijá] ‘Thailand’
k. [ʔiméĭ] ‘e-mail’
l. [taiʔ.pʰő̃] ‘typhoon’

(5) Adaptations with only high and neutral syllables
[NH, NHH]

a. [kəpʰé] ~ [kəpʰ̋i] ‘café’
b. [sətóú] ‘store’
c. [kəjáũ̋] ‘crown’
d. [məléíʃá] ‘Malaysia’

(6) Adaptations with high tone co-occurring with low, creaky, and/or glottal
[CH, GH, GHL, GHG, GHLL, GNH, GNNH, HG, HL, HNG, LH, LLH, LLHH, LLHHH, LNH, LNHCC, LNHHH, NGH, NHG, NLHH, NLHC, NLHHH, NLGHH]

a. [jʊ̬ʃá]‘Russia’
b. [sʰaiʔká] ‘sidecar’
c. [kaʔ pjá] ‘card’
d. [ʃʌʔ ʔéĩ̋ dʒ̃i] ‘shirt’
e. [sɪʔtĭ́maʔ] ~ [sɪʔtĭ̋maʔ] ‘City Mart’
f. [lɪʔbĩ̋ kàlà] ‘Living Color’
g. [ʔɪʔzəjéí] ‘Israel’
h. [kɛʔt̬θəjĩ̋] ‘Katherine’
i. [bʌʔsəká] < *bus* + *car* ‘bus’
j. [hábʌʔ] ‘Harvard’
k. [ʔaiʔsəkəjĩ̋] ‘ice cream’
l. [dʒóúsʰɛʔ] ‘Joseph’
m. [kɔ́leiʔ] ‘college’
n. [bɔ́pĩ̋] < *ball(point) pen* ‘pen’
o. [déíbɪʔ] ‘David’
p. [ʔĩ̋ gəleiʔ] ‘English’
q. [tʃʰɔ́kəlɛʔ] ‘chocolate’
r. [nĭ̀kóú] ‘Nicole’
s. [sík̂əɾɛʔ] ‘cigarette’
t. [nĭ̀sʰã̋] ‘Nissan’
u. [bɔ̀ lóũ̋] ‘ball’
v. [màsĭ̀tí] ‘Mercedes’
w. [ʃã̋ péĩ̋] ‘champagne’
x. [ʔĩ̋ dòùníʃá] ‘Indonesia’
y. [ʔàdʒĩ̋ tína] ‘Argentina’
z. [ʔĩ̋ dəjú] ‘Andrew’
aa. [ʔɪ̬t̬θijɔ́píjá] ‘Ethiopia’
bb. [səteiʔʃóú] ‘stage show’
cc. [ʔɔ̀sətéíl̰íj̰ą̰] ~ [ʔɔ̀sətéíl̰íjá] ‘Australia’
dd. [nəjújauʔ] ‘New York’
ee. [tʰəɾʌʔká] < *truck* + *car* ‘truck’
ff. [səlòùbákî́já] ~ [səlòùbɛʔkî́já] ‘Slovakia’
gg. [ʔəmɛ̀ĭ̀jíká] ~ [ʔəmɛ̀ĭ̀jíką̰] ‘America’

3.3. Creaky Tone

Creaky tone occurs after neutral syllables, before glottal tone, and before and after low and high tone. Creaky tone occurs on a smaller subset of vowels—the oral vowels [a, i, o, u] and the nasalized vowels [ĩ, ãĩ, ãũ].[13]

(7) Adaptations with only creaky tone
[C, CC]

a. [dʒ̰ɔ̰] 'George'
b. [kã̰ṵ̃] 'count'
c. [pã̰ḭ̃] 'pint'
d. [hɔ̰dɔ̰] 'hot dog'

(8) Adaptations with only creaky and neutral tone
[NC]

a. [səkɔ̰] 'Scott'
b. [səpʰ̃ḭ̃] 'Sphinx'

(9) Adaptations with creaky tone co-occurring with low, high, and/or glottal
[CG, CH, CLCC, LC, LCCL, LCLL, LNCC, LNHCC, LNHHH, NLHH, NLHC]

a. [tḭbɛʔ] 'Tibet'
b. [jṵʃá] 'Russia'
c. [wḭtòùɾḭjạ] 'Victoria'
d. [jèʃṵ] < *Yeshua* 'Jesus'
e. [jèĭjṵwạlḭ̃] 'Jerusalem'
f. [t̪θĭɾḭlḭ̃gà] 'Sri Lanka'
g. [ʔèḭ̆dəɾḭjạ] 'India'
h. [ʔɔsətéílḭjạ] ~ [ʔɔsətéílĺjá] 'Australia'
i. [ʔəmèĭjíká] ~ [ʔəmèĭjíkạ] 'America'

3.4. Glottal Tone

Glottal tone occurs before and after atonic syllables, low tone, and high tone, as well as after creaky tone. It occurs with the lax monophthongs [a, ɛ, ɪ, ʌ, ʊ] as well as the diphthongs [ei, ou, ai, au].[14]

[13] The gaps are [e, ã, ʊ̃, ei, ou, ẽĩ, õũ].
[14] The only gap is [ɔ]. Remember that glottal stop cannot close syllables with nasalized vowels in Burmese, so it is expected that this tone does not occur with the nasalized vowels, [ĩ, ã, ʊ̃, ẽĩ, õũ, ãĩ, ãũ].

(10) Adaptations with only glottal tone
[G, GG]

a. [keiʔ] ‘cake’
b. [dʒɛʔ] ‘Jack’
c. [pʰʊʔ] ‘Ford’
d. [maʔ] ‘March’
e. [gɛʔ] ‘gas’
f. [sʰaiʔ] ‘size’
g. [gauv] ‘golf’
h. [bɛʔ] ‘bad’
i. [kɛʔsʰɛʔ] ‘cassette’
j. [meiʔkʌʔ] ‘make-up’
k. [dʒɛʔkɛʔ] ‘jacket’

(11) Adaptations with only glottal and neutral tone
[GNG, NG, NGNG, NNG]

a. [bɪʔsəkɪʔ] ‘biscuit’
b. [mɛʔt̪θədɪʔ] ‘Methodist’
c. [bəɾeɪʔ] ‘brake’
d. [pəleiʔ] ‘police’
e. [kʰəɾɪʔ] ‘Christ’
f. [səkʌʔ] ‘skirt’
g. [kəlɪʔ] ‘clip’
h. [pəlaʔsətɪʔ] ‘plastic’
i. [səpəjaiʔ] ‘Sprite’

(12) Adaptations with glottal tone co-occurring with low, high, and/or creaky
[CG, GH, GHL, GHLL, GL, GLGL, GLL, GHG, GLG, GNH, GNL, GNLL, GNNH, HG, HNG, LG, LGL, LGNG, LLG, LNG, LNLG, NGH, NHG, NLHHH, NLGHH]

a. [t̪ibɛʔ] ‘Tibet’
b. [sʰaiʔká] ‘sidecar’
c. [kaʔ pjá] ‘card’
d. [ʃʌʔ ʔéĩ̯ dʒi̯] ‘shirt’
e. [lɪʔbĩ̯ kàlà] ‘Living Color’
f. [dʒɛʔsʱĩ̯] ‘Jetson’
g. [maiʔkèdʒɛʔsʱĩ̯] ‘Michael Jackson’
h. [ʔauʔtòùbà] ‘October’
i. [dʒɛʔsi̯kà] ‘Jessica’
j. [sɛʔt̪ĩ̯ bà] ‘September’
k. [mɛʔsʱi̯kòù] ‘Mexico’
l. [sɪʔtímaʔ] ~ [sɪʔt̪imaʔ] ‘City Mart’
m. [bʌʔsəká] < *bus* + *car* ‘bus’
n. [kɛʔt̪θəjĩ̯] ‘Katherine’
o. [ʔɪʔzəjéi] ‘Israel’
p. [kɛʔpətèĩ̯] ‘captain’
q. [pɛʔpəsi̯] ~ [pɛʔsi̯] ‘Pepsi’
r. [bɛʔt̪θəlihã̯] ‘Bethlehem’
s. [ʔaiʔsəkəjĩ̯] ‘ice cream’
t. [hábʌʔ] ‘Harvard’
u. [kɔ́leiʔ] ‘college’
v. [dʒóúsʰɛʔ] ‘Joseph’
w. [déibɪʔ] ‘David’
x. [sík̚əɾɛʔ] ‘cigarette’

y. [tʃʰɔ́kəlɛʔ] ‘chocolate’
z. [ʔĩ̃gəleiʔ] ‘English’
aa. [ʔidʒɪʔ] ‘Egypt’
bb. [ʔɔ̀gouʔ] ‘August’
cc. [nà̃bʌʔ] ‘number’
dd. [dàɾaiʔtà] ‘director’
ee. [bì.ʔɛʔsì] ‘B.Sc.’
ff. [pʰ̃ilɪʔpàĩ̃] ‘Philippines’
gg. [ʔilɪʔzəbɛʔ] ‘Elizabeth’
hh. [mɔ̀tɔ̀bouʔ] ‘motorboat’
ii. [dʒà̃ʃĩ̃.ʔeiʔ] ‘Junction Eight’
jj. [kwɛ̀ĩkà.ʔouʔ] ‘Quaker Oats’
kk. [màgəjɛʔ] ‘Margaret’
ll. [bɛ̀ĩ̃gəlàdɛʔ] ~ [bà̃gəlàdɛʔ] ‘Bangladesh’
mm. [sətei?ʃóú] ‘stage show’
nn. [tʰəɾʌʔká] < *truck* + *car* ‘truck’
oo. [nəjújauʔ] ‘New York’
pp. [səlòùbákíjá] ~ [səlòùbɛʔkíjá] ‘Slovakia’

The presence of glottal tone is closely related to the glottal stop segment that co-occurs with it, a multi-purpose segment that serves among other things to instantiate an output correspondent of an input coda consonant (see §6.1) and to lax an output vowel in approximation to a lax input vowel (see §4.4). In other words, this tone appears to be conditioned by segmental and syllabic context, as is creaky tone to a lesser extent; the function of the glottal stop that occurs with the tone dictates its distribution, such that it comes to occur on vowels that are lax, short, in closed syllables, or either of the diphthongs [ai, au], which cannot occur in open syllables in Burmese (see §4.4).

3.5. Atonic Syllables

The reduced vowel [ə] is tonically neutral, and it is the only vowel that cannot bear low, high, creaky, or glottal tone. A syllable containing atonic [ə] is a minor syllable and must occur bound to a following major syllable containing a full vowel in native Burmese words (see §2.3). But note that this restriction on minor syllables seems to be suspended for epenthetic schwas inserted in loanword adaptations.

(13) Adaptations with consecutive neutral tones
[LNNLL, GNNH, NNG]

a. [bì**lə**kəlĩ̃tĩ̃] ‘Bill Clinton’
b. [ʔai?**sə**k**ə**jĩ̃] ‘ice cream’

c. [**sə****p**əjaiʔ]‘Sprite’

In (13a-c), two syllables containing toneless [ə] are allowed to occur consecutively, in contrast to the situation in non-compound native Burmese words.[15]

Tonically neutral syllables follow and precede a variety of tones in the loanword corpus.

(14) Adaptations with neutral syllables followed and preceded by low tone [GNL, GL, GNLL, LNL, LNLG, LNLL, LNNLL, NL, NLHH, NLHC, NLHHH, NLGHH, NLL, NLLL, NLNL]

a. [kɛʔpətèĩ̃] ‘captain’
b. [pɛʔpəsì] ~ [pɛʔsì] ‘Pepsi’
c. [bɛʔn̥θəlɪ̀hà̃] ‘Bethlehem’
d. [ʔĩ̃gəlà̃] ‘England’
e. [bàbəjà] ‘Barbara’
f. [dʒàmənì] ‘Germany’
g. [bàĩ̃səkè] ‘bicycle’
h. [màzədà] ‘Mazda’
i. [bɔ̀sətʊ̀̃] ‘Boston’
j. [wɪ̀səkɪ̀] ‘whiskey’
k. [bèĩ̃gəlàdɛʔ] ~ [bà̃gəlàdɛʔ] ‘Bangladesh’
l. [zà̃nəwàɾì] ‘January’
m. [pʰèɪpʰəwàɾì] ‘February’
n. [bɪ̀ləkəlɪ̃̀tɪ̃̀] ‘Bill Clinton’
o. [dəɾà̃] ‘drum’
p. [səpèĩ̃] ‘Spain’
q. [pʰəlɪ̃̀] ‘film’
r. [sətàĩ̃] ‘style’
s. [dʒəpà̃] ‘Japan’
t. [ʔəmèɪjíká] ~ [ʔəmèɪjíkə̰] ‘America’
u. [səlòùbákɪ́já] ~ [səlòùbɛʔkɪ́já] ‘Slovakia’
v. [dəɾàĩ̃βà] ‘driver’
w. [kʰəjɪ̃̀sʰòùdà] ‘cream soda’
x. [səɪ̃̀jàɾàĩ̃] ‘steering wheel’
y. [ʔəkèɾəmɪ̃̀] ‘academy’
z. [səpàkəlɪ̃̀] ‘sparkling’

(15) Adaptations with neutral syllables followed by high tone [GNH, GNNH, LNH, LNHCC, LNHHH, NH, NHG, NHH]

[15] In compound words, two minor syllables may occur consecutively if the first member of the compound is of the shape $\sigma_{minor}\sigma_{major}$. Compounding reduces the last syllable of the first member of the compound, thus resulting in compounds like [tʰə.mə.jè] ‘rice-water’ < [tʰə.mɪ̃́] ‘rice’ + [jè] ‘water’, and [kə.lə.bjè] ‘India’ < [kə.lá] ‘Indian’ + [pjè] ‘country’ (examples from Green 2002). These examples of compounds do not necessarily contradict the pattern of minor syllables binding to major syllables, if this requirement on the distribution of minor syllables applies only to pre-compounded forms of the individual members of a compound.

a. [bʌʔsəká] < *bus* + *car* ‘bus’
b. [ʔɪʔzəjéí] ‘Israel’
c. [kɛʔt̪θəjĩ˜] ‘Katherine’
d. [ʔaiʔsəkəjĩ˜] ‘ice cream’
e. [ʔĩ˜dəjú] ‘Andrew’
f. [ʔɔ̀sətéíl̪ijə̰] ~ [ʔɔ̀sətéíl̪ĩjá] ‘Australia’
g. [kəpʰé] ~ [kəpʱĩ] ‘café’
h. [sətóú] ‘store’
i. [nəjújauʔ] ‘New York’
j. [məléíʃá] ‘Malaysia’

(16) Adaptations with neutral syllables followed by creaky tone [LNCC, NC]

a. [ʔɛ̏ĩ˜dəɾ̰ijə̰] ‘India’
b. [səpʱ̰ɪ̰] ‘Sphinx’
c. [səkɔ̰] ‘Scott’

(17) Adaptations with neutral syllables followed and preceded by glottal tone [GNG, HNG, LGNG, LNG, NG, NGH, NGNG, NNG]

d. [bɪʔsəkɪʔ] ‘biscuit’
e. [mɛʔt̪θədɪʔ] ‘Methodist’
f. [tʃʰɔ́kəlɛʔ] ‘chocolate’
g. [ʔĩ˜gəleiʔ] ‘English’
h. [sík̀əɾɛʔ] ‘cigarette’
i. [ʔilɪʔzəbɛʔ] ‘Elizabeth’
j. [màgəjɛʔ] ‘Margaret’
k. [kəlɪʔ] ‘clip’
l. [bəɾeiʔ] ‘brake’
m. [pəleiʔ] ‘police’
n. [kʰəɾɪʔ] ‘Christ’
o. [səkʌʔ] ‘skirt’
p. [səteiʔʃóú] ‘stage show’
q. [tʰəɾʌʔká] < *truck* + *car* ‘truck’
r. [pəlaʔsətɪʔ] ‘plastic’
s. [səpəjaiʔ]‘Sprite’

Note that while there are examples of high tone and creaky tone following atonic syllables in the data, no examples contain these tones preceding atonic syllables. This distributional gap may indicate that these tones are liable to spread to adjacent following syllables; this idea is brought up again in the next section.

3.6. Low Tone vs. High Tone

The presence of low tone and high tone does not fall into a transparent pattern in the corpus of established loanwords, but the behavior of pseudoword adaptations shows some interesting patterns.

(18) Low tone vs. high tone in pseudowords[16]

a. [bóũ̃] ‘vome’ [vowm]
b. [bóũ̃] ‘vone’ [vown]
c. [pʰóú] ‘fole’ [fowl]
d. [pʰáũ̃] ‘fow’ [faʊ]
e. [bɔ́] ‘vore’ [vɔɹ]
f. [dʒáĩ̃] ‘jigh’ [dʒɑɪ]
g. [pʰáũ̃] ‘fown’ [faʊn]
h. [dʒáĩ̃] ‘jine’ [dʒɑɪn]
i. [líbȉ] ‘leevee’ [ˈlij.vij]
j. [l̃ibí] ‘leevee’ [lij.ˈvij]
k. [bílȉ] ‘veelee’ [ˈvij.lij]
l. [bílȉ] ‘veelee’ [vij.ˈlij]
m. [líbà] ‘leeba’ [ˈlij.bɑ]
n. [l̃ibá] ‘leeba’ [lij.ˈbɑ]
o. [l̃ɪ.s] ‘lixed’ [lɪkst]
p. [lĩ̃.sʰ] ‘lants’ [lænts]
q. [swáĩ̃] ‘swile’ [swɑɪl]
r. [lí.s] ~ [lɪʔkəsə̰θaʔ] ‘lixth’ [lɪksθ]
s. [kwî] ‘queel’ [kʰwijl]

Note the pairs in (18i-j, k-l, m-n), which differ only in the placement of stress. In each of these cases, the stressed syllable is assigned high tone in the adaptation, while the unstressed syllable is assigned low tone. Therefore, it seems that stress is indeed recognized in loanword adaptation and that it plays a role in tone assignment, at least in online adaptations of pseudowords.

Green (2002) observes that the tone most commonly found in English loanwords is low, and this generalization is supported by the data in this study. It appears then that low tone is the least marked tone in Burmese and thus the default that surfaces on input vowels when other factors such as stress are not brought to bear upon the adaptations. The occurrence of high tone, however, does not seem to follow a regular pattern. In more integrated loans, it does not correlate with stress.

(19) Adaptations with high tone appearing on unstressed input vowels

a. [ʔim**éĩ**] ‘e-mail’
b. [juʃ**á**]‘Russia’
c. [məléiʃ**á**] ‘Malaysia’
d. [sʰaiʔk**á**] ‘sidecar’
e. [sɪʔt**ĩ̃**maʔ] ~ [sɪʔt̃̃imaʔ] ‘City Mart’
f. [lɪʔb**ĩ̃** kàlà] ‘Living Color’

[16] The intended pronunciation of these pseudo-words is given to the right of the glosses.

g. [ʔɪʔzəj**éɪ̂**] ‘Israel’
h. [kɛʔt̪θəj**ɪ́˜**] ‘Katherine’
i. [ʔəmɛ̀ɪj**ɪ̂ká**] ~ [ʔəmɛ̀ɪj**ɪ̂**kə̰] ‘America’
j. [nɪ̀s^{h}**á˜**] ‘Nissan’
k. [ʔaiʔsəkəj**ɪ́˜**] ‘ice cream’
l. [màsɪ̀t**ɪ̂**] ‘Mercedes’
m. [ʔàdʒɪ̀˜ t́ɪn**á**] ‘Argentina’
n. [ʔɪ̀˜ dòùnɪ̂ʃ**á**] ‘Indonesia’
o. [ʔɪ̰t̪θɪjɔ́p**ɪ̂já**] ‘Ethiopia’
p. [ʔɪ̀˜ dəj**ú**] ‘Andrew’
q. [ʔɔ̀sətéɪl̰ɪj̰ə̰] ~ [ʔɔ̀sətéɪl**ɪ̰́já**] ‘Australia’
r. [sətɛiʔʃ**óú**] ‘stage show’
s. [səlòùbák**ɪ̂já**] ~ [səlòùbɛʔk**ɪ̂já**] ‘Slovakia’
t. [nəj**ú**jauʔ] ‘New York’

In (19b,c,i,m,n,o,q,s), word-final unstressed input vowels in open syllables are unexpectedly assigned high tone, while in (19a,d,e,f,g,h,j,k,l,p,r,t) word-medial unstressed vowels in open and closed syllables and word-final unstressed vowels in closed syllables are also assigned high tone. Furthermore, stressed vowels are not always assigned high tone, as seen in all of the multi-syllabic forms in (1) and (2) above, which do not contain a high tone anywhere in the word. In addition, Win (1998) raises the point that Burmese learners of English give equal stress to every syllable in polysyllabic words and keep stressed and unstressed syllables the same length in their pronunciations; thus, it is possible that Burmese speakers are just not very accurate in perceiving English stress, a prosodic feature that is absent from Burmese.

Clearly, then, other factors must be at work in the assignment of high tone besides stress[17]; however, what these factors are is not immediately apparent. In the case of words that are compounds in English, it may be that a high tone (or phonetically high tone, including creaky and glottal) assigned to the member of the compound that receives primary stress spreads onto an adjacent member of the compound, as in (19d,k,r,t).[18] On the other hand, in the non-compounds (19a,b,c,e,f,h,i,m,n,o,q,s), a phonetically high tone

[17] Note that low tone and high tone may also alternate with each other, as in the second syllable of (6e) [sɪʔt́imaʔ] ~ [sɪʔt̆imaʔ] ‘City Mart’, suggesting that stress cannot be the only factor in the assignment of high vs. low tone.
[18] But there are exceptions to this idea, e.g., (3n) [bɔ́pɪ̀˜] < *ball(point) pen* ‘pen’.

again appears to spread to an adjacent syllable to the right. Forms (19g,j,l,p) are still left to account for. One should observe that the final syllable of (19g) resembles that of (19a), V[l], and thus, a similar tonal treatment of the two forms becomes less anomalous. Perhaps deletion of coda [l] before the diphthong [ei] triggers the assignment of high tone to the vowel because of length considerations; high tone has the longest length and therefore helps to compensate for the reduction in sonorous length from the loss of [l].

Another point that should be recognized is the influence of word structure. According to Win (1998), who worked with Burmese speakers learning English as a second language, Burmese learners of English stress the last two syllables in words ending in *-ation* (e.g., *corporation*, *nation*) even though only the penultimate syllable of such words receives stress in English. This process mirrors what happens with loanwords with similar morphology; in these cases, the last two syllables constituting the derivational suffix are assigned high tone (or in many cases, creaky tone). Thus, it seems certain morphological endings in English loanwords tend to attract high tone.

3.7. Creaky Tone vs. Glottal Tone

As is further discussed in §6, the assignment of creaky tone and glottal tone is related to closed syllables in the input. Coda obstruents in English words are generally neutralized to glottal stop in Burmese adaptations, but when the vowel in a closed input syllable does not occur with glottal stop in Burmese, or when vowel quality preservation is relevant,[19] creaky tone serves as the reflex of the coda obstruent. The result is a close correspondence between closed syllables in English and glottal or creaky tone in Burmese. Note the following pseudo-words, in addition to the actual loanwords in §3.3 and §3.4 above.

[19] The glottal stop has the effect of laxing a tautosyllabic tense vowel (see §4.4).

(20) Creaky tone and glottal tone used in pseudo-word adaptations[20]

a.	[b**ei?**] ‘vate’ [vejt]	b.	[b**ei?**] ‘vade’ [vejd]
c.	[b**ai?**] ‘vite’ [vɑɪt]	d.	[b**ai?**] ‘vide’ [vɑɪd]
e.	[p^{h}**ou?**] ‘fote’ [fowt]	f.	[p^{h}**ou?**] ‘fode’ [fowd]
g.	[b**u̯**] ‘vute’ [vuwt]	h.	[b**u̯**] ‘vude’ [vuwd]
i.	[b**i̯**] ‘veet’ [vijt]	j.	[b**i̯**] ‘veed’ [vijd]
k.	[b**au?**] ‘vout’ [vaʊt]	l.	[b**au?**] ‘voud’ [vaʊd]
m.	[p^{h}**ɛ?**] ‘fet’ [fɛt]	n.	[b**ɪ?**] ‘vit’ [vɪt]
o.	[b**ɪ?**] ‘vid’ [vɪd]	p.	[b**ʊ?**] ‘vood’ [vʊd]
q.	[b**ʊ?**] ‘voot’ [vʊt]	r.	[g**ɛ?**] ‘gat’ [gæt]
s.	[g**ɛ?**] ‘gad’ [gæt]	t.	[l**ɑ̯**.s] ‘larts’ [lɑɹts]
u.	[l**ɑ̯**.s] ‘larst’ [lɑɹst]	v.	[l**a?**] ‘lasked’ [læskt]
w.	[h**ĩ̯**.s] ‘hanst’ [hænst]	x.	[h**ʌ?**.s] ‘hults’ [hʌlts]
y.	[h**ʌ?**.s] ‘hulst’ [hʌlst]		

Creaky tone, a feature used secondarily to manifest the heaviness of many English syllables, reflects the glottalized quality of the last part of a vowel before a coda obstruent and what is often an actual (non-distinctive) glottal closure in English closed syllables. Creaky tone and glottal tone are acoustically very similar (Win 1998), both phonetically high and differing only slightly in length and temporal distance between glottal striations, so creaky tone serves as a close alternative to glottal tone in those cases where glottal stop—and, thus, glottal tone—cannot occur.

[20] Note that forms (20t-y) do not obey the otherwise strict constraint keeping coda consonants “placeless” in Burmese (Green 2002). This may be due to the special nature of adapting nonsense words, but it may also be the case that the coronal [s] in these forms is extrasyllabic and stands as a sort of appendix to the main syllable structure of the word. In this sense, these forms may more accurately represent an intermediate stage in the development of an L2 phonology of English in a native Burmese speaker. The form [lís] ~ [lɪʔkəsəṭθaʔ] ‘lixth’ [lɪksθ] is also surprising. The second variant preserves multiple coda consonants, while the first variant lacks glottal stop but contains the lax vowel [ɪ], anyway; in the first variant it appears that a previously present glottal stop has been deleted, leaving behind a phonetically high tone. This form also seems to better exemplify an intermediate L2 phonology than the adaptation process applied to loanwords.

Glottal tone may be assigned to a syllable for reasons other the presence of an input coda obstruent (see §4.4). Similarly, creaky tone may surface on syllables with no corresponding input coda obstruent.

(21) Creaky tone appearing with no coda obstruent source

a. [wḭtòùɾḭja̰] ‘Victoria’
b. [ʔɔ̀sətéilḭja̰] ~ [ʔɔ̀sətéilḭjá] ‘Australia’[21]
c. [ʔɛ̀ɪ̃ dəɾḭja̰] ‘India’
d. [ʔəmɛ̀ijíká] ~ [ʔəmɛ̀ijíka̰] ‘America’
e. [t̪θ̈iɾḭlɪ̃ gà] ‘Sri Lanka’
f. [tḭbɛʔ] ‘Tibet’
g. [jṵʃá] ‘Russia’
h. [jèʃṵ] < *Yeshua* ‘Jesus’
i. [jɛ̀ɪ̃jṵwa̰lɪ̃] ‘Jerusalem’

For many of these forms, it is not completely clear that they are borrowed directly from English, e.g., (21c,e,h,i). The anomalous segments in (21c,e,i), [ɾ], [t̪θ], and [w], respectively, point to the possibility that they are not borrowed directly from English; otherwise, these may simply be older loanwords that have been subject to native sound changes since they were borrowed into Burmese (although there is little evidence for the sound changes that would have been necessary to produce the current forms). In addition, form (21h) could clearly be borrowed from another language like Hebrew.

On the other hand, form (21c) has penultimate and final syllables that are nearly identical to those in (21a) and the first variant of (21b): Cḭ.Ca̰. The recurrence of these tonal anomalies suggests that these words may have been borrowed at around the same time in an earlier wave of loans; to this group we might add (21d), which has final syllable Ca̰.

Finally, forms (21f-g) resemble each other in that creaky tone falls on what is a lax vowel in the English word. As is discussed in §4.4, glottal stop epenthesis tends to occur in an open syllable with a lax vowel, but perhaps it is the case that creaky tone was

[21] Note the alternation between high tone and creaky tone in the variants of (21b,d).

the device previously used to mark lax input vowels and these forms retain traces of the older treatment. Note the assignment of creaky tone to the first vowel in (21a) *Victoria*, which occurs despite the availability of a glottal adaptation. The glottal adaptation is even preferable to the creaky adaptation, since it includes a segmental reflex of the coda [k] in the first syllable, but it is nevertheless creaky tone that surfaces on the first syllable. These forms all point to the possibility that in the past creaky tone served the functions that glottal tone does now.

3.8. Summary

In this section some of the patterns of tone assignment in English loanwords have been examined. The assignment of high tone appears to be influenced by word stress, but other factors appear to dictate its ultimate distribution, including tonal spread phenomena. In addition, high tone and creaky tone are prone to falling on certain morphological endings. Glottal tone and creaky tone are both related to closed syllables, although both can occur even when the input syllable lacks a coda obstruent; glottal tone is also responsible for vowel laxing and phonotactic conformity, while exceptional occurrences of creaky tone may be relics of previous status as the tone used to accomplish what glottal tone currently accomplishes in the majority of recent loans. Low tone has the widest distribution, supporting the claim of Green (2002) that it serves as the default tone in loanwords. These observations are summarized below.

(22) Features of loanwords correlating with tone assignment

Tone	Correlations
Glottal	presence of coda obstruent, lax/short vowel
Creaky	presence of coda obstruent, lax/short vowel, morphological suffixes
High	word stress, sonorous length, morphological suffixes
Low	default tone

Despite general tendencies in where tones fall, a truly definitive and predictive account of tone assignment does not emerge from the data. Instead, there are many instances in which tone assignment appears to be idiosyncratic, which presents a problem for the basic premise of modern linguistics that linguistic phenomena is regular and rule-governed.

4. Vowels in Loanwords

From §2.1, the Burmese inventory of vowel phones contains:

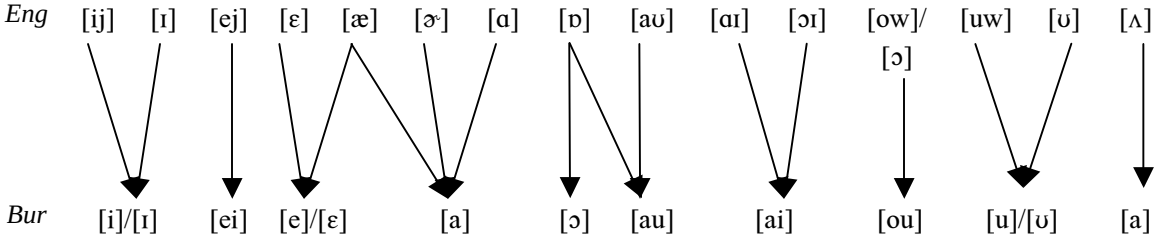
	Front	Central	Back
High	i ĩ		u ũ
Mid	e (ɛ)[22]	(ə ʌ)	(o) ɔ
Low		a ã	
Diphthongs	ei ẽi ai ãi au ãũ ou õũ		

The vowels in Burmese adaptations are generally conservative of the vowel quality in English borrowings.

4.1. Correspondences

The following chart summarizes the vowel correspondences between Burmese and English, taking the basic vowel inventory of Standard American English.

(1) Vowel correspondences between English and Burmese



The smaller set of Burmese vowels results in some English vowel categories collapsing to one Burmese vowel.

4.1.1. Tense Vowels

English tense vowels are generally rendered by tense monophthongs or diphthongs in Burmese.

[22] As stated in §2.1, the vowels in parentheses are allophonic in Burmese, as are the oral lax vowels [ɪ] and [ʊ]; [ɪ] is an allophone of [i], [ɛ] of [e], [ʌ] of [a], and [ə] of [ɪ, ɛ, ʌ, a].

(2) Adaptation of [ij]: English [ij] → Burmese [i][23]

a. [ʔəkèrəm**ì**] ‘academy’
b. [dʒàmən**ì**] ‘Germany’
c. [wɪ̃̀dàm**ì**jà] ‘Windermere’
d. [səlòùbák**í**já] ~ [səlòùbɛʔk**í**já] ‘Slovakia’
e. [ʔàdʒɪ̃̀**tí**ná] ‘Argentina’
f. [ʔèɪ̃̀dər**i**ja̰] ‘India’
g. [ʔã̀**tì**] ‘auntie’
h. [ʔɪ̃̀dòùn**í**ʃá] ‘Indonesia’
i. [b**ì**.ʔèì] ‘B.A.’
j. [ʔèm**ì**] ‘Amy’
k. [b**ì**.ʔɛʔsì] ‘B.Sc.’
l. [dʒɔ̀n**ì**] ‘Johnny’
m. [b**ì**jà] ‘beer’
n. [l**ì**bàt**ì**] ~ [lèbàt**ì**] ‘liberty’
o. [s**ì**d**ì**] ‘CD’
p. [màsìt**í**] ‘Mercedes’
q. [tʃʰèb**ì**] ‘Chevy’
r. [n**ì**sʰã̀] ‘Nissan’
s. [zã̀nəwàr**ì**] ‘January’
t. [ʔɔ̀sətéíl**i**ja̰] ~ [ʔɔ̀sətéíl**í**já] ‘Australia’
u. [kɔ̀pʰ**ì**] ‘coffee’
v. [t**ì**b**ì**] ~ [t**ì**bw**ì**] < *T.V.* ‘television’
w. [d**ì**zɪ̃̀bà] ‘December’
x. [jùnìbàsìt**ì**] ‘university’
y. [dàɪ̃̀jàj**ì**] ‘diary’
z. [p**ì**zà] ‘pizza’
aa. [ʔ**ì**dʒɪʔ] ‘Egypt’
bb. [jèìd**ì**jòù] ‘radio’
cc. [ʔ**ì**lɪʔzəbɛʔ] ‘Elizabeth’
dd. [pɛʔpəs**ì**] ~ [pɛʔs**ì**] ‘Pepsi’
ee. [ʔ**í**méí] ‘e-mail’
ff. [t̪θìr**i**lɪ̃̀gà] ‘Sri Lanka’
gg. [ʔ**ì**t̪θ**ì**jɔ́p**í**já] ‘Ethiopia’
hh. [wìsək**ì**]‘whiskey’
ii. [pʰèìpʰəwàr**ì**] ‘February’
jj. [pʰ**ì**lɪ̃̀] < *feeling* ‘inspiration’
kk. [kʰəj**ɪ̃̀**sʰòùdà] ‘cream soda’
ll. [sɪʔ**tí**maʔ] ~ [sɪʔ**tì**maʔ] ‘City Mart’
mm. [dʒ**ɪ̃̀**] ‘jeans’
nn. [ʔaiʔsəkəj**ɪ̃́**] ‘ice cream’
oo. [kw**ɪ̃́**] ‘queen’

(3) Adaptation of [uw]: English [uw] → Burmese [u][24]

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[23] But note [pʰìlɪʔpàɪ̃̀] ‘Philippines’, which appears to be a spelling pronunciation of -iCe; another possibility is that these words for countries in the vicinity of Burma are not actually borrowed from English, but from a neighboring language. The second vowel in [pəleiʔ] ‘police’ is also eccentric, but this form is the only one in which [ij] occurs in a syllable closed by an obstruent. The vowel is influenced by the glottal stop result of laryngeal neutralization applying to the coda obstruent (see §6.1), and the preference appears to be for maintaining the tenseness of the vowel with a tense diphthong as opposed to one of the other lax vowels that co-occur with glottal stop.

[24] Note the form [bìrɔ̀] ‘bureau’, which lacks the complex onset and second vowel off-glide present in English /bjuɹow/. As mentioned in §2.3, the glide [j] may follow labials in a complex onset, so if the input for the Burmese adaptation of *bureau* were the English pronunciation, then a complex onset [bj] would be

a. [ʔĩ˜dəj**ú**] ‘Andrew’
b. [z**ù**làȉ˜] ‘July’
c. [kòȕ˜pj**ù**tà] ‘computer’
d. [j**ù**nȉbàsȉtȉ] ‘university’
e. [jȅȉj**ṵ̰**wa̰lĩ˜] ‘Jerusalem’
f. [z**ʊ̏˜**] ‘June’

In forms (2mm-oo) and (3f), the tense vowels [i] and [u] are laxed as a result of the vowel nasalization realizing the following coda nasal (see §6.4). The off-glides in English [ij] and [uw] do not surface in the Burmese forms, but the off-glides in [ej] and [ow] do, in the form of diphthongs.

(4) Adaptation of [ej]: English [ej] → Burmese [ei][25]

a. [d**éî**bɪʔ] ‘David’
b. [ʔɔ̀sət**éîl**ḭja̰] ~ [ʔɔ̀sət**éîl**îjá] ‘Australia’
c. [ʔ**ȅȉ**pjȉ] ‘April’
d. [ʔîm**éî**] ‘e-mail’
e. [bȉ.ʔ**ȅȉ**] ‘B.A.’
f. [məl**éî**ʃá] ‘Malaysia’
g. [j**ȅȉ**dȉjòù] ‘radio’
h. [m**ȅȉ**] ‘May’
i. [kw**ȅȉ**kà.ʔouʔ] ‘Quaker Oats’
j. [dʒà˜ʃĩ˜.ʔ**ei**ʔ] ‘Junction Eight’[26]
k. [k**ei**ʔ] ‘cake’
l. [sət**ei**ʔʃóú] ‘stage show’
m. [bəɾ**ei**ʔ] ‘brake’
n. [m**ei**ʔkʌʔ] ‘make-up’
o. [ʃà˜p**éĩ˜**] ‘champagne’
p. [səp**ȅĩ˜**] ‘Spain’

(5) Adaptation of [ow]: English [ow] → Burmese [ou][27]

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expected in the output, as well as a diphthongal second vowel, as in (5). The actual form, however, is [bȉɾò], a result more consistent with the French pronunciation, which has not a glide but a high front rounded vowel following the word-initial [b] and no off-glide on the second vowel.

[25] The forms [kəpʰé] ~ [kəpʰî] ‘café’, [màsȉtî] ‘Mercedes’, and [ʔèmȉ] ‘Amy’ do not show the diphthong. The word *café* may be borrowed from French like *bureau*, in which case the input vowel would have been a monophthong, while the adaptation of *Mercedes* (as well as the second variant of *café*) may be influenced by orthographic <e>. The lack of a diphthong for *Amy* appears to be related to the following nasal. As stated in §2.3, Win (1998) claims that all four Burmese diphthongs occur only with nasalization or glottal stop; this appears to be true only for /ai, au/, but /ei/ (as well as /ou/) do not seem to occur before nasal segments. If this is a distributional regularity, then it would help to explain the avoidance of a diphthong in the adaptation of *Amy*.

[26] The [ʔ] in forms (4j-m) is the reflex of a coda consonant (see §6.1), but in the case of (4n) *make-up*, the glottal serves to shorten the vowel (see §4.4 below), which is shorter than it would be in an open syllable (e.g., *may cup*).

[27] But there is no diphthong in [ʔiṯθȉjɔ́pîjá] ‘Ethiopia’. It is possible that diphthongs are avoided in particularly long words of five or more syllables, just as an extra syllable to preserve [ɹ] is avoided in the

a. [tòùj**òù**tà] ‘Toyota’
b. [n**òù**wĩ̃ bà] ‘November’
c. [k**òù**kàk**òù**là] ‘Coca-Cola’
d. [ʔaʊʔt**òù**bà] ‘October’
e. [mɛʔsʰĩ̃k**òù**] ‘Mexico’
f. [səl**òù**bákî́já] ~ [səl**òù**bɛʔkî́já] ‘Slovakia’
g. [nĩ̃k**óú**] ‘Nicole’
h. [p**òù**là̰] ‘Poland’
i. [ʔĩ̃ d**òù**nî́ʃá] ‘Indonesia’
j. [səteiʔʃ**óú**] ‘stage show’
k. [dʒ**óú**sʰɛʔ] ‘Joseph’
l. [jɛ̀ĩ̃dijò**ù**] ‘radio’
m. [kwɛ̀ĩ̃kà.ʔ**ou**ʔ] ‘Quaker Oats’
n. [pʰ**óṹ**] ‘phone’

The other English tense vowels are adapted with similar Burmese counterparts.

(6) Adaptation of [ɑ]: English [ɑ] → Burmese [a][28]

a. [bɛ̀ĩ̃ gəl**à**dɛʔ] ~ [b**à̰**gəl**à**dɛʔ] ‘Bangladesh’
b. [sʰaiʔk**á**] ‘sidecar’
c. [ʔ**à**dʒĩ̃ tín**á**] ‘Argentina’
d. [gĩ̃t**à**] ‘guitar’
e. [b**à**bəjà] ‘Barbara’
f. [h**á**bʌʔ] ‘Harvard’
g. [k**á**] ‘car’
h. [m**à**zədà] ‘Mazda’
i. [tʃʰ**á**] ‘Charles’
j. [kòùk**à**kòùl**à**] ‘Coca-Cola’
k. [səp**à**kəlĩ̃] ‘sparkling’
l. [m**à**gəjɛʔ] ‘Margaret’
m. [səlòùb**á**kî́já] ~ [səlòùbɛʔkî́já] ‘Slovakia’
n. [k**a**ʔ pjá] ‘card’
o. [m**a**ʔ] ‘March’
p. [sɪʔtĩ́m**a**ʔ] ~ [sɪʔt̃im**a**ʔ] ‘City Mart’
q. [ʔ**à̰**t̃i] ‘auntie’
r. [nĩ̃sʰ**á̰**] ‘Nissan’

(7) Adaptation of [ɒ]/[ɔ]: English [ɔ] → Burmese [ou] / __[ɹ][29]
English [ɒ] → Burmese [u] or [au] / __T]$_{\sigma}$, __N]$_{\sigma}$
otherwise, English [ɒ] → Burmese [ɔ][30]

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adaptation of *Australia* (see §7.1). A diphthong is also lacking for the initial vowel in [mɔ̀tɔ̀bouʔ] ‘motorboat’, perhaps the result of an assimilation to the monophthongal second vowel.

[28] The form [t̪θĩɾ̪ĩ̃ gà] ‘Sri Lanka’ is consistent with a penultimate source vowel of [æ] instead of [ɑ], so this may be a spelling pronunciation. The forms [bóṹ] ‘bomb’, [dɔ̀là] ‘dollar’, [ʔauʔtòùbà] ‘October’, [səkɻ̪] ‘Scott’, [hʊ̃ dà] ‘Honda’, [hɻ̪dɻ̪] ‘hot dog’, [nàĩ̃ lʊ̃] ‘nylon’, and [kɔ́leiʔ] ‘college’ are consistent with a source vowel of [ɒ] or [ɔ] instead of [ɑ]; these adaptations appear to come from British source forms or orthographic influence.

[29] The anomalous final vowel in [sĩ̃ gàpù] ‘Singapore’, another name for a country near Burma, may indicate that this word was not borrowed from English. The word occurs with [u] in at least one other language—Russian.

a. [ʔɔ̀gouʔ] ‘August’
b. [ʔɔ̀sətéiljja̰] ~ [ʔɔ̀sətéilɨ́já] ‘Australia’
c. [kɔ̀pʰ̃i] ‘coffee’
d. [bɔ̀sətʊ̃˨] ‘Boston’
e. [tʃʰɔ́kəlɛʔ] ‘chocolate’
f. [dʒɔ̀nɨ̃] ‘Johnny’
g. [bɔ̀ lóʊ̃˥] ‘ball’
h. [hɔ̰dɔ̰] ‘hot dog’
i. [dʒɔ̰̀] ‘George’
j. [pʰ**óú**] < *four* ‘heroin’
k. [sət**óú**] ‘store’
l. [wɨ̰t**òù**ɾɨ̰jja̰] ‘Victoria’
m. [pʰ**ʊ**ʔ] ‘Ford’
n. [nəjúj**au**ʔ] ‘New York’
o. [g**au**ʔ] ‘golf’
p. [dʒ**ʊ̀**˨] ‘John’
q. [pʰ**àʊ̀**˨] ‘form’

In forms (7m-o) and (7p-q), the vowel occurs with glottal stop or nasalization and is raised or diphthongized[31] to avoid the phonotactically ill-formed *ɔʔ and *ɔ̃ (see §2.3).

4.1.2. Lax Vowels

English lax vowels tend to correspond to Burmese tense vowels, as the Burmese vowel inventory does not contain phonemic lax vowels.

(8) Adaptation of [ɪ]: English [ɪ] → Burmese [i][32]

a. [ʔəmɛ̀ɪ**j́i**ká] ~ [ʔəmɛ̀ɪ**j́i**ka̰]
‘America’
b. [sʰw**ɪ̌**zàlà˨] ‘Switzerland’
c. [ʔɛ̀ɪp**j̰i**] ‘April’
d. [t**j̰i**bɛʔ] ‘Tibet’
e. [g**ɪ̌**tà] ‘guitar’
f. [jùn**ɪ̌**bàs**ɪ̌**tɨ̃] ‘university’
g. [s**ɪ́**kəɾɛʔ] ‘cigarette’
h. [l**ɪ̃**bàtɨ̃] ~ [l**ɛ̀**bàtɨ̃] ‘liberty’
i. [b**ɪ̌**ləkəl**ɪ̃˨** t**ɪ̃˨**] ‘Bill Clinton’
j. [dʒɛʔs**ɪ̌**kà] ‘Jessica’

[30] The vowel [ɔ] occurs in free variation with a slightly higher [o].
[31] With glottal stop, raising seems to occur when there is a voiced obstruent in the coda, while diphthongization occurs with a voiceless obstruent in the coda. With nasalization, the presence of coda /ɹ/ corresponds to diphthongization, which may be a reflection of the sonorous length of /ɹ/ in the input (the segment being either articulated in Standard American English or deleted with compensatory lengthening of the vowel in British English).
[32] Unexpected vowel qualities surface in [ʔɛ̀ɪ˨dəɾɨ̰jja̰] ‘India’, (8bb) *English*, the second variant of (8h) *liberty*, and [səʧ̃ɨ̰jàɾàɪ̃˨] ‘steering wheel’ (cf. (8u) *Living Color* and (8dd) *feeling*). The word *India* may not be borrowed from English (note the [ɾ] that has no correspondent in the English source), while the final vowel in (8bb) *English* recalls the adaptation of the final vowel in [pəlei?] ‘police’, possibly indicating a different treatment of the high vowels before sibilant codas that applied in older loanwords. The anomalous vowels in the second variant of *liberty* and in *steering wheel* may also be related to earlier borrowing, and in the case of *steering wheel*, an effect of assimilation to the preceding vowel [a] may be at work.

k. [w**i̯**tòùɾi̯jə̯] ‘Victoria’
l. [mɛʔs^{ʰ}**ɨ̆**kòù] ‘Mexico’
m. [b**ɨ̆**ɗijɔ] ~ [bw**ɨ̆**ɗijɔ] < *video* ‘VCR’, ‘videotape’
n. [n**ɨ̆**kóú] ‘Nicole’
o. [w**ɨ̆**səkɨ̀] ‘whiskey’
p. [ʔidʒɪʔ] ‘Egypt’
q. [mɛʔt̪θədɪʔ] ‘Methodist’
r. [kəlɪʔ] ‘clip’
s. [déíbɪʔ] ‘David’
t. [pəlaʔsətɪʔ] ‘plastic’
u. [lɪʔbɪ̃kàlà] ‘Living Color’ (store name)
v. [ʔɪ̃dòùníʃá] ‘Indonesia’
w. [maiʔkèdʒɛʔs^{ʰ}**ɪ̃**] ‘Michael Jackson’
x. [kɪ̃] ‘king’
y. [nèɨʃɪ̃nè] ‘national’
z. [ʔɪ̃gəlà] ‘England’
aa. [p^{ʰ}**ɨ̆**ilɪʔpàɪ̃] ‘Philippines’
bb. [ʔɪ́gəl**ei**ʔ] ‘English’
cc. [kɛʔt̪θəjɪ̃] ‘Katherine’
dd. [p^{ʰ}ɨlɪ̃] < *feeling* ‘inspiration’
ee. [səpàkəlɪ̃] ‘sparkling’
ff. [p^{h}əlɪ̃] ‘film’
gg. [sɪ̀̃gàpù] ‘Singapore’
hh. [p^{ʰ}**ɨ̆**là] ‘Finland’
ii. [wɪ̀̃dàmɨ̆jà] ‘Windermere’
jj. [səp^{ʰ}**ɲ̟**] ‘Sphinx’
kk. [dʒɛʔs^{ʰ}**ɨ̆**] ‘Jetson’
ll. [wɪ̀̃s^{h}à] ‘Windsor’

(9) Adaptation of [ɛ]: English [ɛ] → Burmese [e][33]

a. [tʃ^{h}**è**bì] ‘Chevy’
b. [s^{h}w**è**tà] ‘sweater’
c. [j**è**ʃu̟] < *Yeshua* ‘Jesus’
d. [n**è**ðàlà] ‘Netherlands’
e. [ʔəm**è̟**jíká] ~ [ʔəm**è̟**jíkə̟] ‘America’
f. [j**è̟**ju̟wə̟lɪ̃] ‘Jerusalem’
g. [ʔɪʔzəj**éí**] ‘Israel’
h. [p^{h}**è̟**p^{h}əw**à**ɾì] ‘February’
i. [zà̃nəw**à**ɾì] ‘January’
j. [ʔàdʒɪ̃tíná] ‘Argentina’
k. [nòùwɪ̃bà] ‘November’
l. [bɔ́pɪ̀̃] < *ball(point) pen* ‘pen’
m. [ɗizɪ̀̃bà] ‘December’
n. [dʒóús^{h}**ɛ**ʔ] ‘Joseph’
o. [b**ɛ**ʔt̪θəlɪ̀h**à̃**] ‘Bethlehem’
p. [màgəj**ɛ**ʔ] ‘Margaret’
q. [kɛʔs^{h}**ɛ**ʔ] ‘cassette’
r. [m**ɛ**ʔs^{ʰ}ikòù] ‘Mexico’
s. [tʃ^{h}ɔ́kəl**ɛ**ʔ] ‘chocolate’
t. [bèɪ̃gəlàd**ɛ**ʔ] ~ [bà̃gəlàd**ɛ**ʔ] ‘Bangladesh’
u. [sɪ́kəɾ**ɛ**ʔ] ‘cigarette’
v. [dʒɛʔk**ɛ**ʔ] ‘jacket’

[33] The penultimate vowel in (9h-i) is probably due to orthographic influence. In (9o), the final vowel is more consistent with an input [ə] than [ɛ] (see (17) in §4.4). Note also the anomalous second vowel in [dàɾaiʔtà] ‘director’, which may be assimilating to the quality of the preceding or following vowel (cp. [səɵ̃jàɾàɪ̃] ‘steering wheel’).

w. [bǐ.ʔɛʔsǐ] ‘B.Sc.’
x. [tḭbɛʔ] ‘Tibet’
y. [ʔilɪʔzəbɛʔ] ‘Elizabeth’
z. [dʒɛʔsʰɪ̃] ‘Jetson’
aa. [pɛʔpəsǐ] ~ [pɛʔsǐ] ‘Pepsi’
bb. [sɛʔtɪ̃bà] ‘September’

Diphthongization of [e] occurs before liquids,[34] e.g., (9e-g), and nasalization or a following glottal stop (see §6.1 and §6.4 for further discussion) results in laxing of the tense vowel, e.g., (8p-ll), (9j-bb). In (9j-m), the vowel of interest is furthermore raised to avoid the ill-formed *ɛ̃ (see §2.3).

The low front vowel [æ] receives a treatment that resembles the adaptation of [ɛ] in (9) above.

(10) Adaptation of [æ]: English [æ] → Burmese [e] / __$C_{[-nas]}]_{\sigma}$[35]
English [æ] → Burmese [a] / __$N]_{\sigma}$

a. [bɛʔ] ‘bad’
b. [kɛʔṭ̬θəjɪ̃] ‘Katherine’
c. [dʒɛʔ] ‘Jack’
d. [dʒɛʔkɛʔ] ‘jacket’
e. [kɛʔpətèɪ̃] ‘captain’
f. [maiʔkèdʒɛʔsʰɪ̃] ‘Michael Jackson’
g. [gɛʔ] ‘gas’
h. [zà̃nəwàɾǐ] ‘January’
i. [ʃà̃péɪ̃] ‘champagne’
j. [dʒəpà̃] ‘Japan’
k. [bà̃] ‘bank’
l. [hà̃bàgà] ‘hamburger’
m. [ʔɪ̃dəjú] ‘Andrew’
n. [bèɪ̃gəlàdɛʔ] ~ [bà̃gəlàdɛʔ] ‘Bangladesh’

Laryngeal neutralization of a coda consonant (see §6.1) or glottal stop epenthesis (see §4.4) result in the presence of a glottal stop after the vowel of interest in (9a-g), which

[34] Diphthongization also occurs before the labial in (9h) *February* (although the next segment is a liquid). This word belongs to the eccentric class of month names, which show many other unusual features, so this vowel may be the result of a different treatment applying to earlier borrowings.
[35] However, the forms [dàɪ̃jànà] ‘Diana’ and [pəlaʔsətɪʔ] ‘plastic’ contain [a], which is likely due to the coexistence of British and American pronunciations, with British forms containing [a] rather than [æ] as the source vowel. In [kəpʰé] ~ [kəpʰí] ‘café’, a source vowel of [a] could correspond to the initial reduced vowel, and [a] would be the vowel if the word is actually borrowed from French (cp. *bureau*). In the case of [nèɪʃɪ̃nè] ‘national’, the form appears to have been analogized to the derivationally related word *nation*.

laxes [e] to [ɛ].[36] Nasalization also has an effect on the quality of the vowel, an effect which here is usually one of centralization, e.g., (10h-l), as formulated in the second rule in (10), but which can be one of raising, e.g., (10m), or diphthongization, e.g., (10n, first variant).

On the other hand, the mid central vowel /ʌ/ is lowered to Burmese [a].

(11) Adaptation of [ʌ]: English [ʌ] → Burmese [a][37]

a. [ɾà**b**à] 'rubber'
b. [t^{h}əɾʌʔká] < *truck* + *car* 'truck'
c. [bʌʔsəká] < *bus* + *car* 'bus'
d. [meiʔkʌʔ] 'make-up'
e. [dəɾà˜] 'drum'
f. [nà˜bʌʔ] 'number'
g. [jà˜] 'rum'
h. [ʔà˜kè] 'uncle'
i. [dʒà˜ʃɪ˜.ʔeiʔ] 'Junction Eight' (store name)

The vowel [a] is prone to raising when followed by a glottal stop.[38] When this raising occurs, it has the effect of more closely approximating the English source vowel. The vowel adaptation in (11b-d) might then be thought of as English [ʌ]T → Burmese [aʔ] → Burmese [ʌʔ].

Finally, the high lax vowel /ʊ/ is adapted into Burmese as [ʊ], which is followed by the glottal stop [ʔ].

(12) Adaptation of [ʊ]: English [ʊ] → Burmese [ʊ]

a. [b**ʊ**ʔ] 'voot' [vʊt]
b. [b**ʊ**ʔ] 'voot' [vʊd]

[36] However, a glottal stop is not epenthesized after the second vowel in [ʔəkèɾəmǐ] 'academy' (and consequently the vowel is tense, as [ɛ] cannot occur without a glottal stop in Burmese). Here there is a tension between flapping the /d/ (an intervocalic process which does not occur after consonants, e.g., [ʔ]) and adapting lax [æ] with [ɛ] + [ʔ]; the choice is made in favor of the flap [ɾ].
[37] There is also the form [jʊʃá] 'Russia', which appears to have been influenced by orthography.
[38] The pre-glottal stop raising of [a] is like the flapping of [d] in being a common but not obligatory process.

But very little data exists for [ʊ], and the examples of its adaptation are only in pseudo-words; therefore, this correspondence should be considered tentative.

4.1.3. Diphthongs

English diphthongs correspond to very similar Burmese diphthongs.

(13) Adaptation of [ɑɪ]: English [ɑɪ] → Burmese [ai][39]

a. [s^{h}**ai**ʔ] 'size'
b. [s^{h}**ai**ʔká] 'sidecar'
c. [səpəj**ai**ʔ] 'Sprite'
d. [w**àĩ̃**] 'wine'

(14) Adaptation of [aʊ]: English [aʊ] → Burmese [au]

a. [p**àũ̃**dà] 'powder'
b. [k**a̰ṵ̃**] 'count'

(15) Adaptation of [ɔɪ]: English [ɔɪ] → Burmese [wai]

a. [bw**áĩ̃**] 'boy'
b. [kw**àĩ̃** tɛʔtè] < *coil* 'to get in hot water'
c. [dʒw**áĩ̃**] 'Joy'

4.2. Schwa

The reduced vowel [ə] is toneless in Burmese and serves as an allophone of the lax vowels [a, ɪ, ɛ, ʊ] (see §2.2). The Burmese [ə] is used to render reduced vowels in English words[40] as long as syllable combination restrictions are respected: a minor syllable with reduced vowel [ə] must occur bound to a following major syllable containing a full vowel (Win 1998). Otherwise, full vowels are used in adaptations.

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[39] The form [k^{h}əɾɪʔ] 'Christ' is likely a borrowing from another language (e.g., any of the Romance languages, which have [i] as the vowel) or a spelling pronunciation of the English form.

[40] And [ə] can surface in an adaptation even when the source form contains a full vowel, e.g., [kəp^{h}é] ~ [kəp^{h}i] 'café'. This may be indicative of an earlier borrowing that has been prone to native Burmese vowel reduction processes for a longer time.

(16) Adaptation of [ə]/[ə̰]: English [ə] → Burmese [ə] / __σ_{major}[41]

a. [ʔəkèɾəmɪ̏] ‘academy’	b. [sík̚əɾɛʔ] ‘cigarette’
c. [ʔəmèɪ̯jíká] ~ [ʔəmèɪ̯jík̚a̰] ‘America’	d. [pəleiʔ] ‘police’
e. [mɛʔt̪θədɪʔ] ‘Methodist’	f. [dʒəpà˜] ‘Japan’
g. [ʔɪ̏lɪʔzəbɛʔ] ‘Elizabeth’[42]	h. [zà˜nəwàɾɪ̏] ‘January’
i. [pʰèɪ̯pʰəwàɾɪ̏] ‘February’	j. [dʒàmənɪ̀] ‘Germany’
k. [bɛʔt̪θəlɪ̏hà˜] ‘Bethlehem’	l. [bèɪ̯˜gəlàdɛʔ] ~ [bà˜gəlàdɛʔ] ‘Bangladesh’

In examples (16k-l), the third vowel is a full vowel, not [ə]. This is likely due to the preceding schwa, which instantiates a minor syllable that must be followed by a full vowel in the next syllable. In other words, no two consecutive syllables may both contain [ə].

However, a quick look at (17k) [bɪ̀ləkəlɪ̏˜tɪ̏˜] ‘Bill Clinton’, as well as [səpəjaiʔ] ‘Sprite’ and [ʔaiʔsəkəjɪ̏˜] ‘ice cream’, will show that the restrictions on the distribution of minor syllables must be amended. These restrictions are suspended in a way for borrowings in that a series of epenthetic schwas appears to be exempt. Consecutive minor syllables are allowed in the above cases, as both of these schwas do not have input correspondents. However, in (16k-l), the vowel in the third syllable—preceded by a minor syllable in each case—does have an input correspondent, and neither of these vowels is thus adapted as [ə].

[41] Orthographic influence may play a role in the presence of full vowels in [zùlàɪ̏˜] ‘July’, [kòùkàkòùlà] ‘Coca-Cola’, [sɪ̏˜gàpù] ‘Singapore’, [jɛ̀ɪ̯jʊwa̰lɪ̏˜] ‘Jerusalem’, [kɛʔsʰɛʔ] ‘cassette’ (first vowel consistent with a source vowel of [æ]), [gɪ̏tà] ‘guitar’, and [jùnɪ̀bàsɪ̏tɪ̀] ‘university’. In the case of [dàɾaiʔtà] ‘director’, assimilation to vowels in neighboring syllables, a sort of “spreading” of vowel quality, may be at work (this possibility is applicable to *university* and *cassette* as well). Front vowel quality seems to spread regressively, while back vowel quality seems to spread progressively.

[42] The initial vowel in the input for *Elizabeth* was presumably [ij] instead of [ə].

The restrictions on the occurrence of minor syllables result in consistent avoidance of [ə] word-finally, as there is no major syllable available to bind to the minor syllable in this case.

(17) Avoidance of [ə] in word-final syllables

a. [nèìʃì̃ **nè**] ‘national’

b. [bàì̃ sək**è**] ‘bicycle’

c. [ʔà̃ k**è**] ‘uncle’

d. [ɾàì̃ pʰ**è**] ‘rifle’

e. [maiʔk**è**dʒɛʔsʰì̃] ‘Michael Jackson’

f. [ʔɪʔzəj**éî**] ‘Israel’

g. [màgəj**ɛ**ʔ] ‘Margaret’

h. [dʒɛʔk**ɛ**ʔ] ‘jacket’

i. [tʃʰɔ́kəl**ɛ**ʔ] ‘chocolate’

j. [kɔ́l**ei**ʔ] ‘college’

k. [ʔɔ̀g**ou**ʔ] ‘August’

l. [ʔi̇̀t̪θìjɔ́pîj**á**] ‘Ethiopia’

m. [wḭtòùɾḭj**a̰**] ‘Victoria’

n. [kòùkàkòùl**à**] ‘Coca-Cola’

o. [dʒɛʔsìk**à**] ‘Jessica’

p. [ʔèì̃ dəɾḭj**a̰**] ‘India’

q. [məléîʃ**á**] ‘Malaysia’

r. [ʔì̃ dòùníʃ**á**] ‘Indonesia’

s. [dàì̃ jàn**à**] ‘Diana’

t. [màzəd**à**] ‘Mazda’

u. [hʊ̀̃ d**à**] ‘Honda’

v. [jṵʃ**á**] ‘Russia’

w. [bàbəj**à**] ‘Barbara’

x. [t̪θìɾḭlì̃ g**à**] ‘Sri Lanka’

y. [ʔàdʒì̃ tîn**á**] ‘Argentina’

z. [tòùjòùt**à**] ‘Toyota’

aa. [kʰəĵì̃ sʰòùd**à**] ‘cream soda’

bb. [pìz**à**] ‘pizza’

cc. [ʔəmèìjîk**á**] ~ [ʔəmèìjîk**a̰**] ‘America’

dd. [səlòùbákîj**á**] ~ [səlòùbɛʔkîj**á**] ‘Slovakia’

There are two general substitutions made for word-final schwa. The first substitution is [e], which is realized as [e] in replacement of [ə] followed by coda /l/[43] and as [ɛ] in replacement of [ə] followed by a coda obstruent.[44] The second substitution is [a], which replaces [ə] in open syllables (as well as [ə] with rhoticity, see §4.3).

Schwa is also avoided in syllables closed by a nasal.

[43] Win (1998) observes that “when followed by /l/, the schwa sometimes alternates with [ɛ]” in the pronunciation of Burmese learners of English as a second language.
[44] But different final vowels are used in the adaptation of (17j-k), which both hint at influence from the orthographic representation.

(18) Avoidance of [ə] in nasal-final syllables

a. [pòùl**à̃**] ‘Poland’
b. [s^{h}wɨ̀zàl**à̃**] ‘Switzerland’
c. [nèðàl**à̃**] ‘Netherlands’
d. [p^{h}ɪ̃ l**à̃**] ‘Finland’
e. [ʔɪ̃ gəl**à̃**] ‘England’
f. [k**òù̃** pjùtà] ‘computer’
g. [bɔ̀sət**ù̃**] ‘Boston’
h. [kɛʔpət**èɪ̃**] ‘captain’
i. [kɛʔt̪θəj**ɪ̃**] ‘Katherine’
j. [ʔàdʒ**ɪ̃** tínà] ‘Argentina’
k. [bɨ̃ləkəlɪ̃ **tɪ̃**] ‘Bill Clinton’
l. [dʒɛʔs^{h}**ɪ̃**] ‘Jetson’
m. [maiʔkèdʒɛʔs^{h}**ɪ̃**] ‘Michael Jackson’
n. [dʒà̃ **ʃɪ̃**.ʔeiʔ] ‘Junction Eight’

A large overlap exists between the set of words with [ə] in word-final syllables and the set of words with [ə] in nasal-final syllables, but [ə] is avoided in nasal-final syllables that are not word-final as well, e.g., (18f,j).

4.3. Vocalization of Rhoticity

As mentioned above, rhotacized vowels are adapted as the vowel [a].

(19) Adaptation of [ɚ]: English [ɚ] → Burmese [a][45]

a. [ʔauʔtòùb**à**] ‘October’
b. [kòù̃ pjùt**à**] ‘computer’
c. [dàɾaiʔt**à**] ‘director’[46]
d. [đizɪ̃ b**à**] ‘December’
e. [dɔ̀l**à**] ‘dollar’
f. [ɾàb**à**] ‘rubber’
g. [dəɾàɪ̃ β**à**] ‘driver’
h. [sɛʔtɪ̃ b**à**] ‘September’
i. [nòùwɪ̃ b**à**] ‘November’
j. [lɪʔbɪ̃ kàl**à**] ‘Living Color’ (store name)
k. [wɪ̃ s^{h}**à**] ‘Windsor’
l. [pàù̃ d**à**] ‘powder’
m. [s^{h}wèt**à**] ‘sweater’
n. [hà̃ b**àg à**] ‘hamburger’
o. [nèð**à**là̃] ‘Netherlands’
p. [dʒ**à**mənɨ̀] ‘Germany’
q. [s^{h}wɨ̀z**à**là̃] ‘Switzerland’
r. [m**à**sɨ̀tí] ‘Mercedes’
s. [l̪ib**à**t̪i] ~ [lèb**à**t̪i] ‘liberty’
t. [wɪ̃ d**à**mɨ̀j**à**] ‘Windermere’ (street name)

[45] The second vowel in [mɔ̀tɔ̀bouʔ] ‘motorboat’ is likely due to orthographic influence.
[46] The first vowel in *director* may also be rhotacized in the source, in which case [a] is the natural result in the output.

u. [jùnɨ̃b**à**sɨ̃tɨ̃] ‘university’
v. [kwɛ̀ɨ̃k**à**.ʔouʔ] ‘Quaker Oats’
w. [dàɪ̃ j**à**ʝi] ‘diary’
x. [tàj**à**] ‘tire’ (of a car)
y. [ʃʌʔ ʔéɪ̃ dʒɨ̃] ‘shirt’
z. [hábʌʔ] ‘Harvard’
aa. [səkʌʔ] ‘skirt’
bb. [nà˜bʌʔ] ‘number’

Again, there is a large overlap between the set of words with [ə] in word-final syllables and the set of words with rhotacized [ə], but substitution by [a] occurs in medial syllables as well, e.g., (18n-u).[47]

4.4. Other Phenomena

There are other features of the data that are of interest, as they do not appear to be motivated by correspondence to particular source segments. One process that occurs with English words containing lax vowels is epenthesis of a glottal stop after a vowel that is lax in the source.

(20) Vowel laxing via glottal stop epenthesis

a. [bɨ̃.ʔ**ɛʔ**sɨ̃] ‘B.Sc.’
b. [k**ɛʔ**t̪θəjɪ́˜] ‘Katherine’
c. [b**ɛʔ**t̪θəl̃ihà˜] ‘Bethlehem’
d. [k**ɛʔ**s^{h}ɛʔ] ‘cassette’
e. [k**ɛʔ**pətɛ̀ɪ̃˜] ‘captain’
f. [dʒ**ɛʔ**sɨ̃kà] ‘Jessica’
g. [m**ɛʔ**t̪θədɪʔ] ‘Methodist’
h. [dʒ**ɛʔ**kɛʔ] ‘jacket’
i. [p**ɛʔ**pəsɨ̃] ~ [pɛʔsɨ̃] ‘Pepsi’
j. [səlòùbákíjá] ~ [səlòùb**ɛʔ**kíjá] ‘Slovakia’
k. [b**ɪʔ**səkɪʔ] ‘biscuit’
l. [ʔ**ɪʔ**zəjéí] ‘Israel’
m. [p^{h}ɨl**ɪʔ**pàɪ̃˜] ‘Philippines’[48]
n. [ʔɨl**ɪʔ**zəbɛʔ] ‘Elizabeth’
o. [s**ɪʔ**t̃ímaʔ] ~ [s**ɪʔ**t̃ímaʔ] ‘City Mart’
p. [l**ɪʔ**bɪ́˜kàlà] ‘Living Color’
q. [m**eiʔ**kʌʔ] ‘make-up’
r. [pəl**aʔ**sətɪʔ] ‘plastic’
s. [bʌ**ʔ**səká] < *bus* + *car* ‘bus’

[47] Note the differential treatment of the structurally similar (19w) and (19x). In (19w), the first vowel is adapted as a diphthong, while in (19x), it is adapted as a monophthong. However, the rhotic vowel (the second vowel in both forms) surfaces regularly as [a].

[48] The first vowel in (20m-n), lax in the source for at least (20m), is not laxed via glottal epenthesis in the output, which may reflect a dispreference for epenthetic glottals in consecutive syllables.

This epenthesis may serve three functions. First, it results in a closer approximation to the quality of the source vowel, as the glottal stop has a laxing effect on the preceding tautosyllabic vowel. Second, it acts as a device used to shorten vowels, reflecting the relative length of source vowels, e.g., (20q-r), since a syllable closed by glottal stop is relatively short in Burmese. Finally, the presence of a glottal stop as coda can avoid phonotactic violations. The diphthongs /ai/ and /au/ must occur in heavy syllables, and glottal stop epenthesis serves to make a syllable with these particular diphthongs heavy.

(21) Phonotactic conformity of diphthongs via glottal stop epenthesis

a. [ʔ**ai**ʔsəkəjĩ̃] ‘ice cream’ b. [m**ai**ʔkèdʒɛʔs^{h}ĩ̃] ‘Michael Jackson’

A second way in which the diphthongs /ai/ and /au/ can be kept from violating Burmese phonotactics is to nasalize them. This nasalization may be likened to glottal epenthesis as a process that creates a heavy syllable; in this case, it is the underlying coda nasal that makes the syllable heavy.

(22) Phonotactic conformity of diphthongs via vowel nasalization[49]

a. [zùl**àĩ̃**] ‘July’
b. [n**àĩ̃**lʊ̃] ‘nylon’
c. [dəɾ**àĩ̃**βà] ‘driver’
d. [p^{h}**àĩ̃**] ‘file’
e. [d**àĩ̃**jànà] ‘Diana’
f. [t^{h}**áĩ̃**] ~ [jóúd̪íjá] ‘Thailand’
g. [d**àĩ̃**jàjĩ] ‘diary’
h. [sət**àĩ̃**] ‘style’
i. [b**àĩ̃**səkè] ‘bicycle’
j. [ɾ**àĩ̃**p^{h}è] ‘rifle’
k. [p**àũ̃**dà] ‘powder’

There is no coda nasal segment in the relevant input syllables that could be the input correspondent of this nasalization. In fact, in most of the examples in (22), no nasal

[49] Note the eccentric forms [zã̃nəwàɾ̃i] ‘January’ and [nèiʃ̃nè] ‘national’, in which there appears to be a spread of nasality from the medial [n].

segment occurs anywhere in the word; thus, spreading of nasality from another syllable in the word cannot account for the nasalization in (22). This nasalization is instead motivated by the phonotactic restriction on /ai/ and /au/ that limits these diphthongs to heavy syllables.

What determines whether nasalization or glottal epenthesis is chosen over the other as the method of respecting Burmese phonotactic restrictions on /ai/ and /au/? The critical factor appears to be the voicing of the following consonant. Glottal epenthesis occurs before voiceless consonants, when a relatively short vowel would closely approximate the length of the source vowel, while nasalization usually occurs before a voiced consonant (a sonorant or a voiced obstruent).[50] It should be noted that in native Burmese, voiced consonants do not occur after glottal stop,[51] so this fact may account for the distribution of glottal epenthesis versus nasalization; a strong preference against voiced consonants following glottal stop results in glottal epenthesis applying before voiceless consonants.

4.5. Summary

This section has looked at the correspondences between English and Burmese vowels. English vowels are generally rendered with similar Burmese vowels. Both tense and lax English vowels are rendered by tense vowels in Burmese, although the presence of glottal stop or nasalization has a laxing effect. English [ə] is rendered by a similar Burmese [ə] unless Burmese restrictions on the occurrence of major and minor syllables dictate otherwise, in which case [ə] is rendered by a full vowel. The epenthesis of glottal stop serves to bring a Burmese vowel closer to the English source vowel in tenseness and length, and, in addition to vowel nasalization, is used as a strategy of aligning the diphthongs [ai] and [au] with Burmese phonotactic requirements.

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[50] Forms (22i-j) are exceptions to this generalization.

[51] And this generally holds true for the loanword corpus, too, with the exception of the voiced fricative [z], which occurs after [ʔ] in a few forms. This extremely limited occurrence of voicing after [ʔ] is not an unnatural phonological tendency, as voicing is relatively difficult to implement immediately after the sharp glottal stricture of [ʔ].

The recognition of laxness in adaptations suggests that a borrower is able to recognize a feature that is distinctive in the source language despite the fact that the feature is not distinctive in the native language. Furthermore, the fact that vowel quality is to some extent sacrificed (e.g., tensing, diphthongization) in order to realize consonants faithfully implies that consonants are the anchors in loanword adaptation and that their adaptation takes priority over the adaptation of vowels—an interesting implication, given that vowels are the most sonorous and, thus, generally the most salient parts of a word.

5. Onset Consonants in Loanwords[52]

5.1. Segmental Correspondences

From §2.1, the Burmese consonant inventory contains:

	Labial	Dental	Coronal	Palatal	Velar	Glottal
Plosive	p p^h b		t t^h d		k k^h g	ʔ
Affricate				tʃ $tʃ^h$ dʒ		
Fricative		t̪θ d̪ð	s s^h z	ʃ		h
Nasal	m̥ m		n̥ n	ɲ̥ ɲ	ŋ̥ ŋ	
Lateral			l̥ l			
Flap			(ɾ)			
Approximant	w̥ w			j		

These segments are all phonemic with the exception of [ɾ], which occurs as an allophone of /d/. Again, the important gaps in the consonant inventory vis-à-vis English are labial fricatives, the rhotic /ɹ/, and the voiced palatal fricative /ʒ/. As is detailed below, Burmese replaces these foreign English segments with phonetically similar segments native to Burmese.

5.1.1. Filling Inventory Gaps

First, the labiodentals /f/ and /v/ become [p^h] and [b], respectively.

(1) Adaptation of /f/: English /f/ → Burmese [p^h][53]

a. [kə**p^h**é] ~ [kə**p^h**ḭ] ‘café’
b. [**p^h**ʊʔ] ‘Ford’
c. [kɔ̀p^hḭ] ‘coffee’
d. [**p^h**àṵ̃] ‘form’
e. [**p^h**ḭlɪ̃] < *feeling* ‘inspiration’
f. [**p^h**ḭlɪʔpàɪ̃] ‘Philippines’
g. [**p^h**àɪ̃] ‘file’
h. [**p^h**óṵ̃] ‘phone’
i. [**p^h**əlɪ̃] ‘film’
j. [ɾàɪ̃ **p^h**è] ‘rifle’

[52] All of the correspondences described in this section apply primarily to onset consonants, while coda consonants are given different treatments that are described in §6.
[53] The segment substituted for /f/ is aspirated [p^h] instead of unaspirated [p]. See §5.3 for a discussion of aspiration.

k. [**pʰ**ĩ̀là̰] ‘Finland’

(2) Adaptation of /v/: English /v/ → Burmese [b][54]

a. [tʃʰè**b**ì] ‘Chevy’
b. [há**b**ʌʔ] ‘Harvard’
c. [**b**ìdíjɔ̀] ~ [**b**wìdíjɔ̀][55] < *video* ‘VCR’, ‘videotape’
d. [tì**b**ì] ~ [tì**b**wì] < *T.V.* ‘television’
e. [lɪʔ**b**ĩ̀kàlà] ‘Living Color’
f. [səlòù**b**ákî́já] ~ [səlòù**b**ɛʔkî́já] ‘Slovakia’
g. [déi**b**ɪʔ] ‘David’
h. [jùnì**b**àsì̀tì] ‘university’

Second, onset /ɹ/[56] is replaced by the glide [j] or the flap [ɾ].

(3) Adaptation of /ɹ/: English /ɹ/ → Burmese [j], [ɾ][57]

a. [kɛʔt̪θə**j**ĩ̀] ‘Katherine’
b. [ʔəmèì**j**íká] ~ [ʔəmèì**j**íkə̰] ‘America’
c. [ʔĩ̀də**j**ú] ‘Andrew’
d. [zà̰nəwà**ɾ**ì] ‘January’
e. [ʔèìp**j**ì] ‘April’
f. [ʔaiʔsəkə**j**ĩ̀] ‘ice cream’
g. [ʔɪʔzə**j**éí] ‘Israel’
h. [màgə**j**ɛʔ] ‘Margaret’
i. [bàbə**j**à] ‘Barbara’
j. [**j**èìdíjòù] ‘radio’
k. [bə**ɾ**eiʔ] ‘brake’
l. [**ɾ**àĩ̀pʰè] ‘rifle’
m. [bì**ɾ**ò] ‘bureau’
n. [**ɾ**àbà] ‘rubber’
o. [kʰə**ɾ**ɪʔ] ‘Christ’
p. [**j**à̰] ‘rum’
q. [sî́kə**ɾ**ɛʔ] ‘cigarette’
r. [**j**u̯ʃá] ‘Russia’
s. [kʰə**j**ĩ̀sʰòùdà] ‘cream soda’
t. [səpə**j**aiʔ] ‘Sprite’
u. [dàĩ̀jà**j**ì] ‘diary’
v. [t̪θì**ɾ**i̯ì̃gà] ‘Sri Lanka’
w. [dà**ɾ**aiʔtà] ‘director’
x. [sətìjà**ɾ**àĩ̀] ‘steering wheel’

[54] Substitution by [w] is another option, although this appears to be a much less common substitution than that [b]. The only two examples of [w]-substitution are [wi̯tòùɾi̯jə̰]‘Victoria’ and [nòùwĩ̀bà] ‘November’, both of which are likely older loans. Also, note that intervocalic [b] appears prone to lenition (e.g., [dəɾàĩ̀βà] ‘driver’), although this lenition does not occur consistently.

[55] In the second variant of (2c) and (2d), a [w] is inserted after the labial segment. The conditioning environment for this epenthesis appears to be before the high front vowel [i]. There is no parallel rule or distribution in native Burmese. Instead, the complex onset renders the fricative [v] as a compromise between segments lying on either side of [v] on the sonority hierarchy; [b] is less sonorous and reflects the obstruency of the fricative, while [w] is more sonorous.

[56] This substitution occurs for onset /ɹ/, while coda /ɹ/ deletes.

[57] See §5.2 for a discussion of the alternation between the two possible substitutions for /ɹ/.

y. [də**ɾ**àĩ̃βà] ‘driver’
z. [t^{h}ə**ɾ**ʌʔká] < *truck* + *car* ‘truck’
aa. [də**ɾ**ã̀] ‘drum’
bb. [wi̯tò**ùɾ**i̯ją] ‘Victoria’
cc. [p^{h}èĭp^{h}əwà**ɾ**ĭ] ‘February’
dd. [ʔɔ̀sətéíli̯**j**ą] ~ [ʔɔ̀sətéílí**j**á] ‘Australia’

Finally, the palatal fricative /ʒ/ is devoiced to [ʃ].[58]

(4) Adaptation of /ʒ/: English /ʒ/ → Burmese [ʃ]

a. [ʔĩ̃dòùní**ʃ**á] ‘Indonesia’
b. [məléí**ʃ**á] ‘Malaysia’
c. [ʔà**ʃ**ą] ‘Asia’

5.1.2. Stops

The rest of the consonant substitutions are fairly straightforward. Voiceless stops in English generally correspond to unaspirated voiceless stops in Burmese. Stops that are aspirated in English tend to be rendered as unaspirated in Burmese.[59]

(5) Adaptation of [p^{h}]: English [p^{h}] → Burmese [p]

a. [ʃà̃**p**éĩ̃] ‘champagne’
b. [**p**ĭzà] ‘pizza’
c. [kòù̃**p**jùtà] ‘computer’
d. [**p**əlaʔsətɪʔ] ‘plastic’
e. [dʒə**p**à̃] ‘Japan’
f. [**p**òùlà̃] ‘Poland’
g. [sĩ̃gà**p**ù] ‘Singapore’
h. [**p**əleiʔ] ‘police’
i. [**p**ɛʔpəsĭ] ~ [pɛʔsĭ] ‘Pepsi’
j. [**p**àù̃dà] ‘powder’
k. [p^{h}ɬilɪʔ**p**àĩ̃] ‘Philippines’
l. [bɔ́**p**ĩ̃] < *ball(point) pen* ‘pen’

(6) Adaptation of [t^{h}]: English [t^{h}] → Burmese [t^{h}] / __[ɹ]

[58] There is little data for [ʒ], and in forms (4a-b), [ʒ] may already be devoiced if the input comes from British English (Bert Vaux, p.c.), so this should be considered a tentative correspondence.
[59] Substitution by aspirated stops is also possible (e.g., [t^{h}áĩ̃] ~ [jóúɗíjá] ‘Thailand’, [t^{h}əɾʌʔká] < *truck* + *car* ‘truck’, [k^{h}əɾɪʔ] ‘Christ’, [k^{h}əjĩ̯s^{h}òùdà] ‘cream soda’), but substitution by unaspirated stops is much more prevalent. The aspiration in the above three examples is probably related to the initial voiceless portion of [ɹ] that precedes the voiced portion when the segment immediately follows a voiceless aspirated stop in an onset cluster, and it is limited to this environment. Win (1998) states that “only [t^{h}] and [k^{h}] occur before /r/.../p/ still occurs as [p]” (although her loanword data does not agree). Data from Green (2002) appears to confirm this generalization (e.g., [ʔə.pə.ɾî.ʃə.jeiʔ] ‘appreciate’).

English [t^{h}] → Burmese [t], elsewhere

a. [ʔàdʒɪ̃ **t**íná] ‘Argentina’
b. [**t**àjà] ‘tire’
c. [gɪ̃**t**à] ‘guitar’
d. [**t**òùjòùtà] ‘Toyota’
e. [ʔauʔ**t**òùbà] ‘October’
f. [wi̯**t**òùɾi̯ją] ‘Victoria’
g. [sɛʔ**t**ɪ̃ bà] ‘September’
h. [**t**ibɪ̀] ~ [**t**ibwɪ̀] < *T.V.* ‘television’
i. [**t**i̯bɛʔ] ‘Tibet’
j. [**t^{h}**ə.ɾʌʔ.ká] < *truck* + *car* ‘truck’

(7) Adaptation of [k^{h}]: English [k^{h}] → Burmese [k^{h}] / __[ɹ]
English [k^{h}] → Burmese [k], elsewhere

a. [ʔə**k**èɾəmɪ̀] ‘academy’
b. [**k**ɪ̃] ‘king’
c. [bɪ̀lə**k**əlɪ̃ tɪ̃] ‘Bill Clinton’
d. [**k**wɪ́ ̃] ‘queen’
e. [**k**əp^{h}é] ~ [**k**əp^{h}í] ‘café’
f. [**k**òù**k**à**k**òùlà] ‘Coca-Cola’
g. [**k**eiʔ] ‘cake’
h. [**k**ɔp^{h}i] ‘coffee’
i. [**k**ɛʔpətèɪ̃] ‘captain’
j. [**k**ɔ́leiʔ] ‘college’
k. [**k**á] ‘car’
l. [**k**aʔ pjá] ‘card’
m. [lɪʔbɪ́ ̃ **k**àlà] ‘Living Color’
n. [s^{h}ai?**k**á] ‘sidecar’
o. [**k**ɛʔs^{h}ɛʔ] ‘cassette’
p. [**k**òù̃ pjùtà] ‘computer’
q. [**k**əlɪʔ] ‘clip’
r. [**k**ɛʔt̪θəjɪ́ ̃] ‘Katherine’
s. [**k^{h}**ə.ɾɪʔ] ‘Christ’

Stops that are unaspirated in English remain unaspirated in Burmese without exception.

(8) Adaptation of [p]: English [p] → Burmese [p]

a. [ʔèɪ**p**jɪ̀] ‘April’
b. [sə**p**àkəlɪ̃] ‘sparkling’
c. [ʔɪ̀t̪θɪjɔ́**p**íjá] ‘Ethiopia’
d. [sə**p**əjaiʔ] ‘Sprite’
e. [sə**p**èɪ̃] ‘Spain’

(9) Adaptation of [t]: English [t] → Burmese [t][60]

[60] Even the instances of English /t/ which can be flapped (as in American English) are rendered as [t], e.g., [sɪʔtímaʔ] ~ [sɪʔtɪ̃maʔ] ‘City Mart’, [kòù̃ pjùtà] ‘computer’, [mətòbouʔ] ‘motorboat’, [tòùjòùtà] ‘Toyota’,

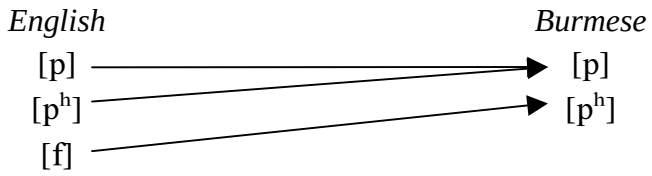
a. [sə**t**ijàɾàĩ̃] ‘steering wheel’
b. [sə**t**eiʔʃóú] ‘stage show’
c. [bɔ̀sə**t**ʊ̃] ‘Boston’
d. [ʔɔ̀sə**t**éilija] ~ [ʔɔ̀sətéilíjá] ‘Australia’
e. [kɛʔpə**t**èĩ̃] ‘captain’
f. [sə**t**àĩ̃] ‘style’
g. [dàɾaiʔ**t**à] ‘director’
h. [sə**t**óú] ‘store’
i. [pəlaʔsə**t**ɪʔ] ‘plastic’

(10) Adaptation of [k]: English [k] → Burmese [k]

a. [bàĩ̃sə**k**è] ‘bicycle’
b. [maiʔ**k**èdʒɛʔsʰĩ̃] ‘Michael Jackson’
c. [bɪʔsə**k**ɪʔ] ‘biscuit’
d. [səlòùbá**k**íjá] ~ [səlòùbɛʔ**k**íjá] ‘Slovakia’
e. [tʃʰɔ́**k**əlɛʔ] ‘chocolate’
f. [sə**k**ɔ̰] ‘Scott’
g. [kòù**k**àkòùlà] ‘Coca-Cola’
h. [sə**k**ʌʔ] ‘skirt’
i. [dʒɛʔ**k**ɛʔ] ‘jacket’
j. [səpà**k**əlĩ̃] ‘sparkling’
k. [meiʔ**k**ʌʔ] ‘make-up’
l. [ʔà̰**k**è] ‘uncle’
m. [kwɛ̀ĭ**k**à.ʔouʔ] ‘Quaker Oats’
n. [wĭsə**k**ĭ] ‘whiskey’

With regard to the voiceless labials, combining (8) with (1) and (5) yields the following system of correspondence between English and Burmese.

(11) Correspondences between English and Burmese voiceless labials



Note that the phones that are non-distinctive in English are collapsed together into one phone in Burmese, while phones that are distinctive in English are rendered by separate segments in Burmese.

[jùnĭbàsĭti] ‘university’, [sʰwètà] ‘sweater’. The lack of flapping here may be the result of British English source forms.

Voiced stops in English correspond to voiced stops in Burmese, as might be expected.[61]

(12) Adaptation of /b/: English /b/ → Burmese [b][62]

a. [**b**ì.ʔèì] ‘B.A.’
b. [**b**əɾeiʔ] ‘brake’
c. [**b**ì.ʔɛʔsì] ‘B.Sc.’
d. [**b**ìɾɔ̀] ‘bureau’
e. [**b**ɔ̀ lóʊ̃] ‘ball’
f. [**b**ʌʔsəká] < *bus* + *car* ‘bus’
g. [**b**à̰] ‘bank’
h. [hà̰ **b**àgà] ‘hamburger’
i. [**b**à**b**əjà] ‘Barbara’
j. [lì**b**àtì] ~ [lè**b**àtì] ‘liberty’
k. [**b**ìjà] ‘beer’
l. [mɔ̀tɔ̀**b**ouʔ] ‘motorboat’
m. [**b**ɛʔt̪θəlìhà̰] ‘Bethlehem’
n. [nà̰ **b**ʌʔ] ‘number’
o. [**b**àɪ̯̰ səkè] ‘bicycle’
p. [ʔauʔtòù**b**à] ‘October’
q. [**b**ìləkəlɪ̯̰ tɪ̯̰] ‘Bill Clinton’
r. [ɾà**b**à] ‘rubber’
s. [**b**ɪʔsəkɪʔ] ‘biscuit’
t. [sɛʔtɪ̯̰ **b**à] ‘September’
u. [**b**óʊ̃] ‘bomb’
v. [t̪ʲ**b**ɛʔ] ‘Tibet’
w. [**b**ɔ̀sətʊ̯̰] ‘Boston’

(13) Adaptation of /d/: English /d/ → Burmese [d][63]

a. [ʔɪ̯̰ **d**əjú] ‘Andrew’
b. [**d**əɾàɪ̯̰ βà] ‘driver’
c. [bèɪ̯̰ gəlà**d**ɛʔ] ~ [bà̰ gəlà**d**ɛʔ] ‘Bangladesh’
d. [wɪ̯̰ **d**àmɪ̀jà] ‘Windermere’
e. [sɪ̀**ð**ì] ‘CD’
f. [hʊ̯̰ **d**à] ‘Honda’
g. [**d**éíbɪʔ] ‘David’
h. [hɔ̰**d**ɔ̰] ‘hot dog’
i. [**d**ìzɪ̯̰ bà] ‘December’
j. [ʔèɪ̯̰ **d**əɾ̰jə̰] ‘India’
k. [**d**àɪ̯̰ jànà] ‘Diana’
l. [ʔɪ̯̰ **d**òùníʃá] ‘Indonesia’
m. [**d**àɪ̯̰ jàjì] ‘diary’
n. [màzə**d**à] ‘Mazda’

[61] But note that the English series is phonetically voiceless and unaspirated in initial and final position (Bert Vaux, p.c.).
[62] Note the anomalous [pʰèìpʰəwàɾì] ‘February’.
[63] English /d/’s which can be flapped tend to be rendered as [d] (e.g., [kʰəjɪ̯̰ sʰòùdà] ‘cream soda’, [jèìðijòù] ‘radio’, [bì**ð**ijɔ̀] ~ [bwì**ð**ijɔ̀] < *video* ‘VCR, videotape’, [mɛʔt̪θədɪʔ] ‘Methodist’), although substitution by [ɾ] (e.g., [ʔəkèɾəmì] ‘academy’) and by [t] (e.g., [màsɪ̀tí] ‘Mercedes’) also occurs in isolated instances. Just as in (11) above with the voiceless labials, this choice of rendering flapped /d/’s with [d] instead of [ɾ] has the result of preventing English /d/ from falling together with the segment /ɹ/, which often corresponds to [ɾ] in Burmese adaptations.

o. [**d**àɾaiʔtà] ‘director’
p. [pàṵ̃**d**à] ‘powder’
q. [**d**ɔ̀là] ‘dollar’
r. [**d**əɾà˜] ‘drum’

(14) Adaptation of /g/: English /g/ → Burmese [g][64]

a. [ʔɔ̀**g**ouʔ] ‘August’
b. [mà**g**əjɛʔ] ‘Margaret’
c. [sĩ˜**g**àpù] ‘Singapore’
d. [bèĩ˜**g**əlàdɛʔ] ~ [bà˜**g**əlàdɛʔ] ‘Bangladesh’
e. [**g**ɛʔ] ‘gas’
f. [**g**ĭtà] ‘guitar’
g. [ʔĩ˜**g**əlà˜] ‘England’
h. [hà˜bà**g**à] ‘hamburger’
i. [ʔĩ˜**g**əleiʔ] ‘English’
j. [**g**auʔ] ‘golf’

5.1.3. Affricates

The correspondence between English affricates and their Burmese renditions is also very close. The allophonically aspirated voiceless affricate is rendered by an aspirated alveopalatal affricate (cf. English [f] → Burmese [p^{h}]).

(15) Adaptation of /ʧ/: English /ʧ/ → Burmese [ʧ^{h}]

a. [**ʧ^{h}**á] ‘Charles’
b. [**ʧ^{h}**ɔ́kəlɛʔ] ‘chocolate’

And the voiced affricate is rendered by a voiced alveopalatal affricate.

(16) Adaptation of /ʤ/: English /ʤ/ → Burmese [ʤ][65]

a. [ʔà**ʤ**ĩ˜tína] ‘Argentina’
b. [**ʤ**ɔ̀nĭ] ‘Johnny’
c. [ʔi**ʤ**ɪʔ] ‘Egypt’
d. [maiʔkè**ʤ**ɛʔs^{h}ĩ˜] ‘Michael Jackson’
e. [**ʤ**ɔ̰] ‘George’
f. [**ʤ**ɛʔsĭkà] ‘Jessica’
g. [**ʤ**àmənì] ‘Germany’
h. [**ʤ**əpà˜] ‘Japan’

[64] Note the anomalous [sík əɾɛʔ] ‘cigarette’, which devoices an intervocalic [g]. Incidental devoicing also occurs in forms (13e) and (13f).
[65] Substitution by [z] occurs in three forms all limited to the category of month names: [zà˜nəwàɾĭ] ‘January’, [zṵ̃] ‘June’, and [zùlàĩ˜] ‘July’. On the other hand, in the form [jɛ̀ĭjṵwa̰lĩ˜] ‘Jerusalem’, it appears the source form does not come from English directly.

i. [**dʒ**ɛʔ] ‘Jack’
j. [**dʒ**ĩ˜] ‘jeans’
k. [**dʒ**ɛʔkɛʔ] ‘jacket’
l. [**dʒ**ʊ̃˜] ‘John’
m. [**dʒ**óús^{h}ɛʔ] ‘Joseph’
n. [**dʒ**à˜ʃĩ˜.ʔeiʔ] ‘Junction Eight’

5.1.4. Fricatives

As mentioned in §5.1.1, Burmese lacks labiodental fricatives, and so English /f/ and /v/ are replaced by Burmese [p^{h}] and [b], respectively. The dental fricatives /θ/ and /ð/ are rendered by the corresponding Burmese fricatives, which acoustically resemble affricates or stops.

(17) Adaptation of /θ/: English /θ/ → Burmese [t̪θ]
Adaptation of /ð/: English /ð/ → Burmese [d̪ð]

a. [bɛʔ**t̪θ**əlɪhà˜] ‘Bethlehem’
b. [kɛʔ**t̪θ**əjĩ˜] ‘Katherine’
c. [ʔɪ**t̪θ**ɪjɔ́píjá] ‘Ethiopia’
d. [mɛʔ**t̪θ**ədɪʔ] ‘Methodist’
e. [nè**ð**àlà˜] ‘Netherlands’[66]

The adaptation of the voiceless coronal sibilant /s/ occurs with either the Burmese aspirated [s^{h}] or unaspirated [s].[67]

(18) Adaptation of /s/: English /s/ → Burmese [s^{h}], [s][68]

a. [bɪ̌.ʔɛʔ**s**ì] ‘B.Sc.’
b. [dʒɛʔ**s**ìkà] ‘Jessica’
c. [jùnɪ̀bà**s**ɪ̀tɪ̃] ‘university’
d. [pɛʔpə**s**ì] ~ [pɛʔ**s**ì] ‘Pepsi’
e. [**s**ìdɪ̃] ‘CD’
f. [mà**s**ɪ̀tí] ‘Mercedes’
g. [**s**íkərɛʔ] ‘cigarette’
h. [**s**ĩ˜gàpù] ‘Singapore’
i. [**s**ɛʔtĩ˜bà] ‘September’
j. [**s**ɪʔtɪ́maʔ] ~ [**s**ɪʔt̃imaʔ] ‘City Mart’
k. [mɛʔ**s^{h}**ɪ̀kòù] ‘Mexico’
l. [maiʔkèdʒɛʔ**s^{h}**ĩ˜] ‘Michael Jackson’

[66] Here the affricate [d̪ð] is lenited intervocalically.
[67] See §5.3 for a more extended discussion of aspiration.
[68] Substitution by voiced [z] also occurs, e.g., [dɪ̃zĩ˜bà] ‘December’, [pɪ̃zà] ‘pizza’. However, the first form may be the result of intervocalic voicing of an initial [s], or else the result of a sandhi voicing process (if it is analyzed as a compound of *De-* and *-cember*, see §2.4), and the second form is likely a spelling pronunciation.

m. [kʰəjĩ **sʰ**òùdà] ‘cream soda’
n. [**sʰ**aiʔká] ‘sidecar’
o. [**sʰ**wìzàlã̀] ‘Switzerland’
p. [nì**sʰ**ã́] ‘Nissan’
q. [kɛʔ**sʰ**ɛʔ] ‘cassette’
r. [dʒóú**sʰ**ɛʔ] ‘Joseph’
s. [**sʰ**aiʔ] ‘size’
t. [**sʰ**wètà] ‘sweater’
u. [**s**əpèĩ] ‘Spain’
v. [ʔɔ̀**s**ətéìl̰ḭja̰] ~ [ʔɔ̀**s**ətéìlìjá] ‘Australia’
w. [**s**əpàkəlĩ] ‘sparkling’
x. [bàĩ **s**əkè] ‘bicycle’
y. [**s**əpəjaiʔ] ‘Sprite’
z. [bɪʔ**s**əkɪʔ] ‘biscuit’
aa. [**s**əteiʔʃóú] ‘stage show’
bb. [**s**əlòùbákìjá] ~ [**s**əlòùbɛʔkìjá] ‘Slovakia’
cc. [**s**ətìjàɾàĩ] ‘steering wheel’
dd. [bʌʔ**s**əká] < *bus* + *car* ‘bus’
ee. [**s**ətóú] ‘store’
ff. [ʔaiʔ**s**əkəjĩ] ‘ice cream’
gg. [**s**ətàĩ] ‘style’
hh. [pəlaʔ**s**ətɪʔ] ‘plastic’
ii. [bɔ̀**s**ətʊ̃] ‘Boston’
jj. [**s**əkɔ̰] ‘Scott’
kk. [**s**əkʌʔ] ‘skirt’
ll. [wì**s**əkì] ‘whiskey’

There is somewhat of a trend for /s/ to be rendered as [s] before a high front vowel, and this occurs as a rule before reduced vowels (forms u-ll). Before other full vowels, /s/ tends to be rendered with aspiration as [sʰ].

The voiced coronal /z/, voiceless palatal /ʃ/, and voiceless glottal /h/ remain the same in Burmese adaptations.

(19) Adaptation of /z/: English /z/ → Burmese [z][69]

a. [ʔilɪʔ**z**əbɛʔ] ‘Elizabeth’
b. [mà**z**ədà] ‘Mazda’
c. [ʔɪʔ**z**əjéì] ‘Israel’

(20) Adaptation of /ʃ/: English /ʃ/ → Burmese [ʃ][70]

a. [**ʃ**ã̀ péĩ] ‘champagne’
b. [jṵ**ʃ**á] ‘Russia’
c. [jè**ʃ**ṵ] < *Yeshua* ‘Jesus’
d. [**ʃ**ʌʔ ʔéĩ dʒì] ‘shirt’
e. [nèì**ʃ**ĩ nè] ‘national’
f. [səteiʔ**ʃ**óú] ‘stage show’ (concert)

[69] A voiceless adaptation also occurs in one form, [wĩ sʰà] ‘Windsor’.
[70] Note the anomalous [t̪θìɾḭlĩ gà] ‘Sri Lanka’ (although it is debatable what initial input consonant is). In addition, the form [tʃʰèbì] ‘Chevy’ appears to be a spelling pronunciation.

g. [dʒà˜ʃĭ˜.ʔeiʔ] ‘Junction Eight’
(store name)

(21) Adaptation of /h/: English /h/ → Burmese [h]

a. [bɛʔt̪θəlĭ**h**à˜] ‘Bethlehem’
b. [**h**ù˜dà] ‘Honda’
c. [**h**à˜bàgà] ‘hamburger’
d. [**h**ɔ̰dɔ̰] ‘hot dog’
e. [**h**ábʌʔ] ‘Harvard’

As mentioned above in (4) of §5.1.1, the voiced palatal /ʒ/ is devoiced to [ʃ].

5.1.5. Sonorants

Onset[71] nasals, liquids, and approximants are realized faithfully in Burmese adaptations with voiced segments (as opposed to the corresponding voiceless counterparts, which exist in Burmese).

(22) Adaptation of /m/: English /m/ → Burmese [m]

a. [ʔəkèɾə**m**ĭ] ‘academy’
b. [**m**àgəjɛʔ] ‘Margaret’
c. [**m**aʔ] ‘March’
d. [**m**èĭ] ‘May’
e. [ʔè**m**ĭ] ‘Amy’
f. [**m**àzədà] ‘Mazda’
g. [**m**əléíʃá] ‘Malaysia’
h. [**m**àsĭtí] ‘Mercedes’
i. [ʔĭ**m**éí] ‘e-mail’
j. [**m**ɛʔt̪θədɪʔ] ‘Methodist’
k. [dʒàməníˇ] ‘Germany’
l. [**m**ɛʔsʰĭkòù] ‘Mexico’
m. [**m**eiʔkʌʔ] ‘make-up’
n. [**m**aiʔkèdʒɛʔsʰĭ˜] ‘Michael Jackson’
o. [sɪʔtí**m**aʔ] ~ [sɪʔt̪imaʔ] ‘City Mart’
p. [wĭ˜dà**m**ĭjà] ‘Windermere’
q. [ʔə**m**èĭjíká] ~ [ʔə**m**èĭjíkə̰] ‘America’
r. [**m**ɔtɔ̀bouʔ] ‘motorboat’

(23) Adaptation of /n/: English /n/ → Burmese [n]

a. [ʔàdʒĭ˜tí**n**á] ‘Argentina’
b. [**n**əjújauʔ] ‘New York’

[71] See §5.5 for a discussion of how coda sonorants are adapted.

c. [dàĩ̃ jà**n**à] ‘Diana’
d. [**n̏**ikóú] ‘Nicole’
e. [dʒàmə**n̏**i] ‘Germany’
f. [**n̏**is^{h}ã̂] ‘Nissan’
g. [zà̃ **n**əwàɾ̂i] ‘January’
h. [**n**òùwĩ̃ bà] ‘November’
i. [dʒɔ̀**n̏**i] ‘Johnny’
j. [**n**à̃ bʌʔ] ‘number’
k. [**n**èĭʃĩ̃ **n**è] ‘national’
l. [**n**àĩ̃ lŭ̃] ‘nylon’
m. [**n**èðàlà̃] ‘Netherlands’
n. [jù**n̏**ibàs̏ɪt̂i] ‘university’

(24) Adaptation of /l/: English /l/ → Burmese [l]

a. [ʔɔ̀sətéi**l̰**ija̰] ~ [ʔɔ̀sətéi**l̏**já] ‘Australia’
b. [bèĩ̃ gə**l**àdɛʔ] ~ [bà̃ gə**l**àdɛʔ] ‘Bangladesh’
c. [zù**l**àĩ̃] ‘July’
d. [**l**ó] ‘Laos’
e. [bɛʔt̰θə**l̏**ihà̃] ‘Bethlehem’
f. [**l̏**ibàt̂i] ~ [**l**èbàt̂i] ‘liberty’
g. [**l**ɪʔbĩ̃ kà**l**à] ‘Living Color’
h. [sə**l**òùbákíjá] ~ [sə**l**òùbɛʔkíjá] ‘Slovakia’
i. [tʃ^{h}ɔ́kə**l**ɛʔ] ‘chocolate’
j. [mə**l**éíʃá] ‘Malaysia’
k. [kə**l**ɪʔ] ‘clip’
l. [nèðà**l**à̃] ‘Netherlands’
m. [kòùkàkòù**l**à] ‘Coca-Cola’
n. [nàĩ̃ **l**ŭ̃] ‘nylon’
o. [kɔ́**l**eiʔ] ‘college’
p. [p^{ɦ}i**l**ɪʔpàĩ̃] ‘Philippines’
q. [dɔ̀**l**à] ‘dollar’
r. [pə**l**aʔsətɪʔ] ‘plastic’
s. [ʔi**l**ɪʔzəbɛʔ] ‘Elizabeth’
t. [pòù**l**à̃] ‘Poland’
u. [ʔĩ̃ gə**l**à̃] ‘England’
v. [pə**l**eiʔ] ‘police’
w. [ʔĩ̃ gə**l**eiʔ] ‘English’
x. [b̏iləkə**l̏**ĩ̃ t̏ĩ̃] ‘Bill Clinton’
y. [p^{ɦ}i**l̏**ĩ̃] < *feeling* ‘inspiration’
z. [səpàkə**l̏**ĩ̃] ‘sparkling’
aa. [p^{ɦ}ĩ̃ **l**à̃] ‘Finland’
bb. [s^{h}w̏izà**l**à̃] ‘Switzerland’

(25) Adaptation of /w/: English /w/ → Burmese [w]

a. [k**w**è̏ikà.ʔouʔ] ‘Quaker Oats’
b. [**w̏**isəkì] ‘whiskey’
c. [k**w**ĩ̃] ‘queen’
d. [s^{h}**w̏**izàlà̃] ‘Switzerland’
e. [s^{h}**w**ètà] ‘sweater’
f. [**w̏**ĩ̃ s^{h}à] ‘Windsor’
g. [**w̏**ĩ̃ dàm̏ijà] ‘Windermere’
h. [**w**àĩ̃] ‘wine’

(26) Adaptation of /j/: English /j/ → Burmese [j][72]

a. [kòṵ **j**ùtà] ‘computer’
b. [nə**j**ú**j**auʔ] ‘New York’[73]
c. [dàı̯̰ **j**ànà] ‘Diana’
d. [tà**j**à] ‘tire’
e. [dàı̯̰ **j**àjı̰] ‘diary’
f. [tòù**j**òùtà] ‘Toyota’

5.2. Adapting Rhotics

In (3) of §5.1.1, two Burmese segments were shown to act as replacements for English /ɹ/: the glide [j] and the flap [ɾ].[74] The former has phonemic status in Burmese, while the latter is an allophonic variant of /d/ and otherwise has a distribution limited to borrowings from languages such as Pali (Cornyn 1944).

Both segments are phonetically similar to [ɹ]. The segments [ɹ] and [j] only differ possibly in their specification for the feature [anterior]. The glide [j] is [-anterior], while the alveolar [ɾ] is [+anterior]; the retroflex [ɹ], though, is probably [-anterior] (Bert Vaux, p.c.) like [j]. At the same time, [ɹ] and [ɾ] differ from each other in only one feature; [ɹ] is [+continuant], while [ɾ] is [-continuant].[75] Thus, replacement of [ɹ] by [j] or by [ɾ] is a relatively close approximation in either case.[76] The forms in (3) are split exactly equally with respect to adaptation by [j] or by [ɾ].

The impression of the informant is that as a Burmese speaker becomes more familiar with English, the percentage of [ɾ]-substitutions for English [ɹ] increases relative

[72] As mentioned in §2.3, the glide [j] may follow labials in a complex onset, as in example (26a). Therefore, if the input for the Burmese adaptation of, e.g., *bureau* were the modern English pronunciation, then a complex onset [bj] would be expected in the output. The actual form, however, is [bı̯ɾò]‘bureau’; this is a result that is more consistent with the French pronunciation, in which not a glide but a high front rounded vowel follows the word-initial [b].

[73] In (26b), the *[nj] cluster is resolved through epenthesis, preserving both segments, but in [zà̰ nəwàɾı̰] ‘January’, the glide is simply dropped.

[74] Win (1998) states that Burmese /l/ substitutes for English /ɹ/, but this substitution is not found anywhere in the loanword data.

[75] The segments [ɹ] and [ɾ] may also differ in their specifications for [sonorant], with [ɹ] being [+sonorant] and [ɾ] being [-sonorant], but the point remains that these segments are very similar to each other phonologically.

[76] In some dialects of English such as Scottish English, [ɾ] serves as an allophone of the phoneme /ɹ/, as well as the phonemes /t/ and /d/.

to the percentage of [j]-substitutions. In other words, a Burmese speaker who is not familiar with English will tend to produce English [ɹ] as [j], while one who is proficient or fluent in English will tend to produce English [ɹ] as [ɾ]. Free variation between these two variants also occurs, as the informant displays with many words (e.g., *Barbara*, *Andrew*, *rubber*).

In sum, which substitution is made seems to depend on a number of factors that include the speaker's degree of familiarity with English, the source language; the conversational context; and the point in time at which the loanword was integrated into the native language. As more Burmese speakers have come to study or otherwise learn English, more recently integrated loanwords appear more likely to show a [ɾ] as opposed to a [j] reflex of [ɹ].

5.3. Aspiration

As mentioned in §5.1.2, aspirated allophones of voiceless stops in English are generally replaced by unaspirated counterparts in Burmese, while aspirated allophones of voiceless affricates are rendered by aspirated segments. In §5.1.4, it is demonstrated that English /s/ surfaces as both unaspirated [s] and aspirated [s^h] in Burmese. Since English does not have phonemically aspirated fricatives, the source of the aspiration in Burmese adaptations is something of a mystery. It becomes less mysterious, however, if we consider voiceless fricatives to be specified as [+spread glottis] by default (Vaux 1998), in which case a rule of de-aspiration might be posited to account for the instances of unaspirated [s],[77] rather than a rule of aspiration to account for the aspirated forms. A deaspiration rule is preferable because its result coincides with the underlying motive of the adaptation process to approximate the English input (which does not contain aspiration in the case of fricatives), while an aspiration rule would be unmotivated, as its

[77] It is also possible that written input would bias the borrower to adapt /s/ as unaspirated, but note that in Korean, which has a similar [s]-[s^h] contrast, English /s/ is virtually always adapted as [s^h], even when the input was obviously a written source.

result would take the Burmese adaptations further away from the English targets. A default specification of [+spread glottis] for voiceless fricatives also helps to explain why the voiceless labiodental fricative /f/ is rendered by an aspirated stop [pʰ] instead of an unaspirated stop [p].[78]

5.4. Glottal Stop

The glottal stop appears freely as an onset in the adaptation of vowel-initial source words.[79] It is also the reflex of certain coda consonants,[80] but it appears frequently with no apparent coda correspondent.

(27) Glottal stop with no coda correspondent

a. [bì.ʔɛ**ʔ**sì] 'B.Sc.'	b. [bɪ**ʔ**səkɪʔ] 'biscuit'
c. [bɛ**ʔ**t̪θəlìhà̃] 'Bethlehem'	d. [kɛ**ʔ**sʰɛʔ] 'cassette'
e. [kɛ**ʔ**pətèɪ̃] 'captain'	f. [ʔìlɪ**ʔ**zəbɛʔ] 'Elizabeth'
g. [dʒɛ**ʔ**sìkà] 'Jessica'	h. [ʔɪ**ʔ**zəjéí] 'Israel'
i. [kɛ**ʔ**t̪θəjɪ̃] 'Katherine'	j. [dʒɛ**ʔ**kɛʔ] 'jacket'
k. [bʌ**ʔ**səká] < *bus* + *car* 'bus'	l. [pɛ**ʔ**pəsì] ~ [pɛʔsì] 'Pepsi'
m. [mei**ʔ**kʌʔ] 'make-up'	n. [pʰìlɪ**ʔ**pàɪ̃] 'Philippines'
o. [mɛ**ʔ**t̪θədɪʔ] 'Methodist'	p. [pəla**ʔ**sətɪʔ] 'plastic'
q. [lɪ**ʔ**bɪ̃ kàlà] 'Living Color'	r. [səlòùbákíjá] ~ [səlòùbɛ**ʔ**kíjá] 'Slovakia'
s. [ʔai**ʔ**səkəjɪ̃] 'ice cream'	t. [mai**ʔ**kèdʒɛʔsʰɪ̃] 'Michael Jackson'
u. [sɪ**ʔ**tíma ʔ] ~ [sɪʔtìmaʔ] 'City Mart'	

[78] In Korean, the same substitution of [pʰ] for /f/ occurs (e.g., [kʰʌpʰi] 'coffee'), although unlike in Burmese, [pʰ] also regularly renders both [p] (e.g., [sʰɨpʰa] 'spa') and [pʰ] (e.g., [pʰitʰʌ] 'Peter').
[79] Note that English also typically inserts a [ʔ] at the beginning of a word in isolation or following a pause. Presumably, though, Burmese speakers do not always hear English words pronounced in isolation and, therefore, receive some input that is vowel-initial.
[80] See §6 for a fuller discussion.

Three things appear to be accomplished by this glottal epenthesis: compliance with Burmese phonotactic restrictions, preservation of syllable weight, and preservation of vowel quality.

As stated in §2.3, the Burmese diphthongs /ai/ and /au/ do not occur in open syllables, but with a glottal coda or nasalization from an underlying nasal coda. So, for example, in (26s-t), glottal epenthesis occurs after [ai], as opposed to the alternative solution of nasalization, which would produce *[ʔãĩsəkəjĩ˜] for *ice cream* and *[mãĩkè] for *Michael*.

With regard to syllable weight preservation, glottal epenthesis keeps a heavy syllable heavy. In (26c,e,h,k,l,m,s), the coda consonant following the epenthetic glottal is preserved, yet shifted to an onset of a new syllable containing an epenthetic vowel; since the preceding syllable now lacks a coda, the glottal stop inserted serves to keep the syllable closed.

Also mentioned in §2.3 is the fact that the lax vowel allophones [ɪ, ɛ, ʌ, ʊ] appear only in closed syllables (and for [ɛ], only with a glottal and not a nasal coda). Since a coda is necessary for there to be a lax vowel in a given syllable, the effect of the epenthetic glottal is to make additional vowels available to render English input vowels. Where an English vowel is lax, glottal epenthesis will result in a Burmese lax vowel that more closely approximates the source vowel than a tense allophone. In (26b,f,h,n,q,u), [ɪʔ] approximates the lax vowel [ɪ]; in (26a,c,g,l,o), [ɛʔ] approximates lax [ɛ] and [æ]; and in (26k), [ʌʔ] approximates lax [ʌ].[81]

Since English lax vowels have a non-word-final distribution (they are always followed by a consonant), they are often found in closed syllables. This distribution results in epenthetic glottals often serving not only to reflect the presence of a source coda consonant, but also to approximate the laxness of a source vowel, as with the second

[81] Note forms (26d) [kɛʔsʰɛʔ] ‘cassette’, where the first source vowel appears to have been a full vowel instead of [ə], and (26p) [pəlaʔsətɪʔ] ‘plastic’, in which the second vowel suggests that the input was not an American English form (which would have had /æ/ as the first source vowel).

glottal in (26b,d,f,m,o,p,t). In this way, the second and third results of glottal epenthesis, syllable weight preservation and vowel quality preservation, are not unrelated to each other.

5.5. Summary

This section has examined the ways in which Burmese adapts English onset consonants. It has been observed that labiodentals are replaced by labials (/f/ → [p^h]; /v/ → [b]), that voiced palatals are devoiced (/ʒ/ → [ʃ]), and that rhotics are replaced by glides or flaps (/ɹ/ → [j]/[ɾ]). Other English segments are rendered by virtually identical Burmese counterparts; however, allophonically aspirated voiceless stops are generally replaced by unaspirated stops, and unaspirated /s/ often corresponds to aspirated [s^h]. The glottal stop [ʔ] is a segment that serves multiple functions in the adaptation of English loans, one of which will be looked at in detail in the next section on the adaptation of coda consonants.

The facts discussed in this section reveal additional aspects of the nature of Burmese loanword adaptation. Burmese speakers appear to make choices regarding the adaptation of consonants that prevent distinctions from being neutralized; in other words, a distinction between two consonants that are phonemically distinct in the source is maintained in the output. English [p^h] and [p], which are allophones of the same phoneme, are collapsed to Burmese [p], while English /p/ and /f/, which are separate phonemes, are rendered distinctly as [p] and [p^h], respectively. This underlying motivation helps to explain why Burmese speakers do not adapt the English aspirate [p^h] as simply the Burmese aspirate [p^h]; since aspiration is distinctive in Burmese, the Burmese perceptual system is presumably attuned to perceive it. Likewise, rendering English /d/, which is more often than not flapped, with Burmese [d] prevents English /d/ from falling together with segments rendered by [ɾ] (namely, English /ɹ/). Note that a partial neutralization occurs with English /ɹ/ and /j/, as /ɹ/ is rendered by both [ɾ] and [j],

but as [ɾ] becomes more common in loanwords, the movement of adaptations appears to be towards keeping a distinction between English /ɹ/ and /j/.

6. Coda Consonants in Loanwords

Burmese allows syllable onsets and disallows syllable codas except for the glottal stop /ʔ/ and the "placeless" nasal realized as vowel nasalization. How does Burmese resolve coda consonants present in English borrowings? The four main strategies employed are laryngeal neutralization to glottal stop; deletion and subsequent creaky phonation of the preceding vowel; outright deletion; and vowel nasalization. Epenthesis is also utilized to a lesser extent word-internally.[82]

6.1. Laryngeal Neutralization

Voiced and voiceless obstruents—stops, affricates, and fricatives—are all leveled to the glottal stop.

(1) Adaptation of coda /p/: /p/ → [ʔ] / __(C)]$_\sigma$

a. [kəlɪ**ʔ**] 'clip'
b. [meiʔkʌ**ʔ**] 'make-up'
c. [ʔ̃idʒɪ**ʔ**] 'Egypt'
d. [sɛ**ʔ**tɪ̃ bà] 'September'
e. [pɛʔpəsɨ̃] ~ [pɛ**ʔ**sɨ̃] 'Pepsi'[83]

(2) Adaptation of coda /t/: /t/ → [ʔ] / __]$_\sigma$

a. [səpəjai**ʔ**] 'Sprite'
b. [tɰ̃bɛ**ʔ**] 'Tibet'
c. [bɪʔsəkɪ**ʔ**] 'biscuit'
d. [dʒɛʔkɛ**ʔ**] 'jacket'

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[82] This analysis depends crucially on the assumption that the Burmese speakers who are the agents of this adaptation recognize or otherwise have knowledge of the syllabification of the English input forms; otherwise, the notion of "coda" consonants is meaningless. Arguments for and against making this assumption are presented in §7 and §8.

[83] In the first variant of (1e), as well as [kɛʔpətɛ̀ɪ̃] 'captain', one may notice that there is a glottal stop, but that coda /p/ is preserved via vowel epenthesis after it. This may be the result of the word-medial /p.s/ and /p.t/ sequences in these forms being analyzed as complex onsets instead of as sequences of coda and onset; this idea is developed further in §7. Note that in (1d) *September*, laryngeal neutralization applies normally; it may be that /p.t^h/ is treated differently than /p.t/. In (1c) *Egypt*, laryngeal neutralization applies as usual, as the word-final /pt/ sequence here is unambiguously a complex coda. Laryngeal neutralization also applies as usual with /t.s/, as in (1f) *Jetson*. Here, the identity of place between /t/ and /s/ may cause these segments to be analyzed as one segment (cp. treatment of /t.s/ in (2t) *Switzerland*, (2u) *pizza*), which is rendered by the more salient fricative; if this is the case, the glottal stop may be present as a reflex of pre-glottalization of /t/ or for vowel quality considerations. Note also the pseudoword adaptation [lɪ̃.s^h] 'lants' [lænts], in which again [ts] corresponds to the fricative only.

e. [kɛʔsʰɛ**ʔ**] ‘cassette’
f. [dʒɛ**ʔ**sʰĩ̃] ‘Jetson’
g. [tʃʰɔ́kəlɛ**ʔ**] ‘chocolate’
h. [màgəjɛ**ʔ**] ‘Margaret’
i. [kʰəɹɪ**ʔ**] ‘Christ’
j. [mɛʔẗ̪θədɪ**ʔ**] ‘Methodist’
k. [ʔɔ̀gou**ʔ**] ‘August’
l. [mɔ̀tɔ̀bou**ʔ**] ‘motorboat’
m. [sɪʔtĭma**ʔ**] ~ [sɪʔt̆ima**ʔ**] ‘City Mart’
n. [dʒà˜ʃĩ˜.ʔei**ʔ**] ‘Junction Eight’
o. [sík**ə**ɹɛ**ʔ**] ‘cigarette’
p. [kwɛ̏ikà.ʔou**ʔ**] ‘Quaker Oats’
q. [ʃʌ**ʔ** ʔéĩ˜dʒi̋] ‘shirt’
r. [səkʌ**ʔ**] ‘skirt’
s. [ʔ̆idʒɪ**ʔ**] ‘Egypt’
t. [pi̋**Ø**zà] ‘pizza’[84]
u. [sʰwi̋**Ø**zàlà˜] ‘Switzerland’[85]

(3) Adaptation of coda /k/: /k/ → [ʔ] / __]$_{\sigma}$
/k/ → Ø / N__]$_{\sigma}$[86]

a. [mɛ**ʔ**sʱikòù] ‘Mexico’
b. [maiʔkèdʒɛ**ʔ**sʱĩ˜] ‘Michael Jackson’
c. [bəɹei**ʔ**] ‘brake’
d. [nəjújau**ʔ**] ‘New York’
e. [kei**ʔ**] ‘cake’
f. [ʔau**ʔ**tòùbà] ‘October’
g. [dàɹai**ʔ**tà] ‘director’
h. [pəlaʔsətɪ**ʔ**] ‘plastic’
i. [dʒɛ**ʔ**] ‘Jack’
j. [tʰəɹʌ**ʔ**ká] < *truck* + *car* ‘truck’
k. [bà˜**Ø**] ‘bank’
l. [dʒà˜**Ø**ʃĩ˜.ʔeiʔ] ‘Junction Eight’

A coda /d/ is also neutralized, but a post-nasal /d/ has no reflex in the adapted output.

(4) Adaptation of coda /d/: /d/ → [ʔ] / __]$_{\sigma}$[87]

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[84] In forms (2t-u), a [ts] sequence becomes [z], in contrast to (2f), which displays the expected laryngeal neutralization of coda [t]. The former forms appear to be spelling pronunciations influenced by the presence of orthographic <z>, which is absent from the latter. If this is the case, however, it is still not immediately clear why there is no [ʔ] in *Switzerland* to reflect the coda [t]. It may be that [ts] is simply perceived by a Burmese speaker as the fricative, where [t], homorganic with [s] is overshadowed by the perceptually salient stridency of the following sibilant. One might expect [ʔ] to be epenthesized anyway to make the first vowel lax in approximation of the English source vowel, but this does not occur.

[85] Ø = indicates that a consonant has been deleted from that position, a sort of phonological trace (see §8 for further discussion).

[86] In (3k-l), there is no articulatory reflex of coda [k]. It appears that post-nasal /k/ in the input is deleted, or is not salient enough to be consistently perceived for adaptation in the first place. However, in the cluster [nt], [t] does surface, as creaky tone (e.g., [pa̰ĩ] ‘pint’).

[87] Unfortunately, the corpus lacks loanwords with coda /b/ or /g/, but the adaptations of the pseudowords *slag* and *glab* ([səlɛʔ] ‘slag’ < English [slæg], [gəlɛʔ] ‘glab’ < English [glæb]) indicate that the same process of laryngeal neutralization applies in these cases as well.

/d/ → Ø / N__]$_{\sigma}$

a. [bɛ**ʔ**] ‘bad’
b. [p^{h}ʊ**ʔ**] ‘Ford’
c. [déíbɪ**ʔ**] ‘David’
d. [hábʌ**ʔ**] ‘Harvard’
e. [ka**ʔ** pjá] ‘card’
f. [s^{h}ai**ʔ**ká] ‘sidecar’
g. [p^{h}ɪ̃ lɑ̃**Ø**] ‘Finland’
h. [s^{h}wɨ̀zàlɑ̃**Ø**] ‘Switzerland’
i. [nèðàlɑ̃**Ø**] ‘Netherlands’
j. [wɪ̃**Ø**s^{h}à] ‘Windsor’
k. [pòùlɑ̃**Ø**] ‘Poland’
l. [ʔɪ̃ gəlɑ̃**Ø**] ‘England’

(5) Adaptation of coda /tʃ/: /tʃ/ → [ʔ] / __]$_{\sigma}$

a. [ma**ʔ**] ‘March’
b. [kəlʌ**ʔ**] ‘clutch’

(6) Adaptation of coda /dʒ/: /dʒ/ → [ʔ] / __]$_{\sigma}$

a. [kɔ́lei**ʔ**] ‘college’
b. [sətei**ʔ**ʃóú] ‘stage show’

In the absence of evidence to the contrary, the adaptation rules for coda /s/ and the other fricatives in (7)-(11) have been formulated to apply in word-final environments, as opposed to the syllable-final environments for the adaptation of non-continuant obstruents in (1)-(6). This approach is more consistent with the data below. Note that the forms in which laryngeal neutralization spares a coda consonant, e.g., (7g-h), (8g-h), (11b), have the consonant in a word-internal position in every case.[88]

(7) Adaptation of coda /s/: /s/ → [ʔ] / __(C)]$_{PrWd}$[89]

a. [gɛ**ʔ**] ‘gas’
b. [pəlei**ʔ**] ‘police’

[88] There are admittedly few data items, however.

[89] In (7g-h), it looks again as if the -sC(C)- sequence is being treated as a tautosyllabic onset cluster instead of a heterosyllabic sequence of coda and onset (see §7). The form [lɔ́Ø] ‘Laos’, which displays outright deletion of the sibilant, may not come from English. In [bɨ̃iɛʔsɨ̃i] ‘B.Sc.’, the glottal serves to make the second vowel lax; it is unlikely that the form is analyzed with two consecutive, heterosyllabic /s/’s instead of just one, although if it were, then the rule in (7) could be changed to refer to the ends of syllables instead of words in order to account for the first coda /s/.

c. [ʔɔ̀gou**ʔ**] 'August' d. [mɛʔt̪θədɪ**ʔ**] 'Methodist'
e. [kʰəɾɪ**ʔ**] 'Christ' f. [kwɛ̀ìkà.ʔou**ʔ**] 'Quaker Oats'
g. [bʌʔsəká] < *bus* + *car* 'bus' h. [ʔaiʔsəkəjĩ̀] 'ice cream'

Laryngeal neutralization also applies to coda /z/, e.g., (8a), but more often than not, coda /z/ is simply deleted (usually in environments where it follows other coda consonants). Word-internally, a coda /z/ is preserved. Compare (8a) with (8g), for example.

(8) Adaptation of coda /z/: /z/ → [ʔ] / V__ $]_{PrWd}$
/z/ → Ø / C__ $]_{PrWd}$

a. [sʰai**ʔ**] 'size' b. [màsìtí**Ø**] 'Mercedes'
c. [tʃʰá**Ø**] 'Charles' d. [nɛ̀ðàlã̀**Ø**] 'Netherlands'
e. [dʒĩ̀**Ø**] 'jeans'[90] f. [pʰìlɪʔpàĩ̀**Ø**] 'Philippines'
g. [mà**z**ədà] 'Mazda'[91] h. [ʔɪʔ**z**əjéí] 'Israel'

Laryngeal neutralization applies as usual for the other fricatives.[92]

(9) Adaptation of coda /ʃ/: /ʃ/ → [ʔ] / __ $]_{PrWd}$

a. [bɛ̀ĩ̀gəlàdɛ**ʔ**] ~ [bã̀gəlàdɛ**ʔ**] 'Bangladesh' b. [ʔĩ̀gəlei**ʔ**] 'English'

(10) Adaptation of coda /f/: /f/ → [ʔ] / __ $]_{PrWd}$

a. [gau**ʔ**] 'golf' b. [dʒóúsʰɛ**ʔ**] 'Joseph'

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[90] The word *jeans* might be discounted as an example, since it could be argued that this form is being analyzed as a plural and that the singular form is the one that is input into the Burmese phonology, leaving /-z/ behind. A plural or possessive reanalysis of *Mercedes* may likewise account for the missing /z/ in (1b).
[91] Forms (8g-h) again mimic the treatment of onset clusters discussed in §7. But one should note that if *Mazda* is borrowed from Japanese [matsɯ̥da], a vowel would already be present between the two medial consonants, albeit devoiced (Michael Schuler, p.c.).
[92] The corpus lacks examples of coda /ʒ/, /v/, or /ð/, while the glottal fricative /h/ does not occur as a coda in English.

(11) Adaptation of coda /θ/: /θ/ → [ʔ] / __]$_{PrWd}$

a. [ʔilɪʔzəbɛ**ʔ**] ‘Elizabeth’ b. [bɛʔ**t̪θ**əl̪ihə̃] ‘Bethlehem’

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6.2. Creaky Phonation

Deletion of the offending coda consonant with subsequent creaky phonation of the preceding vowel is a repair strategy chosen when laryngeal neutralization would create a configuration that is ill-formed according to Burmese phonotactic requirements.

(12) Creaky phonation

a. [səkɔ̰] ‘Scott’ b. [hɔ̰dɔ̰] ‘hot dog’
c. [dʒɔ̰] ‘George’ d. [kã̰ṵ̃] ‘count’
e. [səpʰḭ̃] ‘Sphinx’ f. [wḭtòùɾḭjə̰] ‘Victoria’

In forms (12a-c), the disallowed *ɔʔ configuration[93] is avoided by realizing the coda consonant—/t/ in (12a), /t/ and /g/ in (12b), and /dʒ/ in (12c)—as creaky tone on the preceding vowel with no segmental reflex.

In forms (12d-e), the disallowed *V̰ʔ configuration is again avoided by placing creaky tone over the vowel preceding the coda consonant—/t/ in (12d), /k/ and /s/ in (12e). Note, however, that creaky tone can appear even when a glottal stop could provide an alternative, and even more sensible, repair strategy. In (12f), coda /k/ is realized by creaky tone even though a glottal adaptation would both provide an output correspondent and approximate the laxness of the preceding vowel; this particular repair choice may be accounted for if creaky tone used to fill the role that glottal tone does now (see §3.7), in which case (12f) might simply be an older borrowing.

6.3. Deletion

[93] Remember that this phonotactic is hypothesized from the gap of [ɔʔ] in native Burmese; there is no active evidence for this ban.

The liquids /ɹ/ and /l/ undergo outright deletion when they occur as codas.[94]

(13) Adaptation of coda /l/: /l/ → Ø / __(C)]$_{\sigma}$[95]

a. [bɔ́**Ø**pɪ̃˥] < *ball(point) pen* 'pen'
b. [gau**Ø**ʔ] 'golf'
c. [ʔɛ̀ɪpjɪ̃i**Ø**] 'April'
d. [ʔɪʔzəjéí**Ø**] 'Israel'
e. [bàɪ̃˥səkè**Ø**] 'bicycle'
f. [mai/kè**Ø**dʒɛʔsʰɪ̃˥] 'Michael Jackson'
g. [ʔà˜kè**Ø**] 'uncle'
h. [nɛ̀ɪʃɪ̃˥nè**Ø**] 'national'
i. [tʃʰá**Ø**] 'Charles'
j. [nɪ̀kóú**Ø**] 'Nicole'
k. [ʔímé**Ø**] 'e-mail'
l. [ɾàɪ̃˥pʰè**Ø**] 'rifle'
m. [pʰàɪ̃˥**Ø**] 'file'
n. [sətàɪ̃˥**Ø**] 'style'
o. [pʰə**ɫ**ɪ̃˥] 'film'[96]

(14) Adaptation of coda /ɹ/: /ɹ/ → Ø / __(C)]$_{\sigma}$[97]
/ɻ/ → [a][98]

a. [ʔà**Ø**dʒɪ̃˥tína] 'Argentina'
b. [lɪ̀bà**Ø**tɨ] ~ [lèbà**Ø**tɨ] 'liberty'
c. [dʒà**Ø**mənɨ̀] 'Germany'
d. [jùnɨ̀bà**Ø**sɨ̀tɨ] 'university'
e. [bà**Ø**bəjà] 'Barbara'
f. [ma**Ø**ʔ] 'March'
g. [sʰwɨ̀zà**Ø**là˜] 'Switzerland'
h. [mà**Ø**gəjɛʔ] 'Margaret'
i. [ká**Ø**] 'car'
j. [mà**Ø**sɨ́tɨ́] 'Mercedes'
k. [ka**Ø**ʔ pjá] 'card'
l. [mɔ̀tɔ̀**Ø**bouʔ] 'motorboat'
m. [tʃʰá**Ø**] 'Charles'
n. [nèðà**Ø**là˜] 'Netherlands'
o. [wɪ̃˥sʰà**Ø**] 'Windsor'
p. [nəjújau**Ø**ʔ] 'New York'
q. [kòù˜pjùtà**Ø**] 'computer'
r. [nòùwɪ̃˥bà**Ø**] 'November'

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[94] Deletion of coda /ɹ/ is a common process that occurs in British English, the Boston dialect of American English, and many other New England and Southern dialects. The deletion of coda /l/ also occurs in African American Vernacular English (e.g., [hoʊØd] 'hold').

[95] The first coda /l/ in [bɨ̃ləkəɫɪ̃˥tɪ̃˥] 'Bill Clinton' is preserved, not deleted, however. The most likely cause for the preservation here is the influence of orthographic <l>. Burmese speakers talking about politics, international relations, and the American president are probably educated and even proficient in reading/speaking English.

[96] Coda /l/ is preserved here (as an onset) because of the need for another syllable to realize the coda /m/. Alternatively, this form may be based on an input displaying metathesis of two medial segments, as in [flɪm], similar to forms that appear in Malaysian English and Singaporean English (Bert Vaux, p.c.).

[97] The conversion to glottal stop in [nà˜bʌʔ] 'number' is anomalous and occurs in no other data item.

[98] Coda /ɹ/ is vocalized in syllables that are differentially judged as monosyllabic or disyllabic by English speakers (i.e., where there may or may not be a syllabic /ɻ/), as in forms (14rr-tt).

s. [đizĩ̆ bà**Ø**] ‘December’
t. [s^{h}wètà**Ø**] ‘sweater’
u. [dàɾaiʔtà**Ø**] ‘director’
v. [ʔauʔtòùbà**Ø**] ‘October’
w. [dɔ̀là**Ø**] ‘dollar’
x. [pàũ̆ dà**Ø**] ‘powder’
y. [dəɾàĩ̆ βà**Ø**] ‘driver’
z. [kwɛ̀ikà**Ø**.ʔouʔ] ‘Quaker Oats’
aa. [p^{h}ʊ**Ø**ʔ] ‘Ford’
bb. [ɾàbà**Ø**] ‘rubber’
cc. [p^{h}àù**Ø**̆] ‘form’
dd. [sɛʔtĩ̆ bà**Ø**] ‘September’
ee. [dʒ̬ɔ̬**Ø**] ‘George’
ff. [ʃʌ**Ø**ʔ ʔéĩ̆ dʒ̬i] ‘shirt’
gg. [sɪʔtĩmaØʔ] ~ [sɪʔtĩmaØʔ] ‘City Mart’
hh. [lɪʔbĩ̆ kàlà**Ø**] ‘Living Color’
ii. [g̬ìtà**Ø**] ‘guitar’
jj. [sĩ̆ gàpù**Ø**] ‘Singapore’
kk. [hã̆ bàgà**Ø**] ‘hamburger’
ll. [səkʌ**Ø**ʔ] ‘skirt’
mm. [hábʌ**Ø**ʔ] ‘Harvard’
nn. [səpà**Ø**kəlĩ̆] ‘sparkling’
oo. [p^{h}óú**Ø**] < *four* ‘heroin’
pp. [sətóú**Ø**] ‘store’
qq. [s^{h}aiʔká**Ø**] ‘sidecar’
rr. [wĩ̆ dà**Ø**mĭj**à**] ‘Windermere’
ss. [tàj**à**] ‘tire’
tt. [bĭj**à**] ‘beer’

6.4. Vowel Nasalization

Nasal codas are systematically deleted in Burmese-adapted forms with nasalization of the preceding vowel. While in English the nasal segments are usually articulated in these words with some incidental nasalization of the preceding vowel, the forms adapted into Burmese realize the nasal segments as full nasalization on the preceding vowels and only incidental articulation of the segments themselves (preceding a voiced stop, for example).

(15) Adaptation of coda nasals: $V \rightarrow V_{[+nas]} / \_\_N(C)]_{\sigma}$

(16) Adaptation of coda /m/

a. [bɛʔt̪θəlĩ̆ hã̆] ‘Bethlehem’
b. [sɛʔtĩ̆ bà] ‘September’
c. [bóú̆] ‘bomb’
d. [hã̆ bàgà] ‘hamburger’
e. [ʃã̆ péĩ̆] ‘champagne’
f. [ʔaiʔsəkəjĩ̆] ‘ice cream’
g. [kòù̆ pjùtà] ‘computer’
h. [nòùwĩ̆ bà] ‘November’
i. [k^{h}əjĩ̆ s^{h}òùdà] ‘cream soda’
j. [nã̆ bʌʔ] ‘number’

k. [đizɪ̀̃bà] ‘December’
l. [jà̃] ‘rum’
m. [dəɾà̃] ‘drum’
n. [pʰəlɪ̀̃] ‘film’[99]
o. [pʰà̰ṵ̀̃] ‘form’[100]

(17) Adaptation of coda /n/[101]

a. [ʔɪ̀̃dəjú] ‘Andrew’
b. [wɪ̀̃sʰà] ‘Windsor’
c. [ʔàdʒɪ̀̃tíná] ‘Argentina’
d. [wà̰ɪ̀̃] ‘wine’
e. [ʔà̃ti] ‘auntie’
f. [kã̰ṵ̃] ‘count’
g. [bɪ̀ləkəlɪ̀̃tɪ̀̃] ‘Bill Clinton’
h. [dʒɛʔsʰɪ̀̃] ‘Jetson’
i. [bɔ̀sətṵ̀̃] ‘Boston’
j. [maiʔkèdʒɛʔsʰɪ̀̃] ‘Michael Jackson’
k. [kɛʔpətḛ̀ɪ̀̃] ‘captain’
l. [nèðàlà̰̃] ‘Netherlands’
m. [ʃà̃pḛ́ɪ̀̃] ‘champagne’
n. [nɪ̀sʰá̰̃] ‘Nissan’
o. [pʰɪ̀̃là̰̃] ‘Finland’
p. [nàɪ̀̃lṵ̀̃] ‘nylon’
q. [hṵ̀̃dà] ‘Honda’
r. [bɔ́pɪ̀̃] < *ball(point) pen* ‘pen’
s. [ʔḛ̀ɪ̀̃dəɾḭjə̰] ‘India’
t. [pʰɪlɪʔpà̰ɪ̀̃] ‘Philippines’
u. [ʔɪ̀̃dòùníʃá] ‘Indonesia’
v. [pʰó̰ṵ́̃] ‘phone’
w. [dʒəpà̃] ‘Japan’
x. [pòùlà̰̃] ‘Poland’
y. [dʒɪ́̃] ‘jeans’
z. [kwɪ́̃] ‘queen’
aa. [dʒṵ̀̃] ‘John’
bb. [səpḛ̀ɪ̀̃] ‘Spain’
cc. [zṵ̀̃] ‘June’
dd. [sʰwɪ̀zàlà̰̃] ‘Switzerland’
ee. [dʒà̃ʃɪ̀̃.ʔeiʔ] ‘Junction Eight’
ff. [wɪ̀̃dàmɪ̀jà] ‘Windermere’
gg. [kɛʔt̪θəjɪ́̃] ‘Katherine’

(18) Adaptation of coda /ŋ/[102]

[99] Notice that in this form, a vowel occurs after /l/ to carry the nasalization realizing coda /m/. If the input for this loanword is the metathesized form [flɪm], which seems to be the case, then the vowel is already in the right position.

[100] It is ambiguous whether the nasalization here is a reflex of the coda nasal or a phonotactic effect (remember from §2.3 that the [ai] and [au] diphthongs occur only in heavy syllables).

[101] Note the nasalization in [nèɪʃ̃nè] ‘national’, which does not come from a coda /n/. There are a few possibilities for why there is nasalization here. First, it may be that the nasalization serves to approximate the laxness of the second vowel (nasalization being preferred over glottal epenthesis, since a nasal segment follows the vowel). The second possibility is that this is not a pronunciation of *nation*, but of *nation* + *-al*. If this were the case, it would account for the quality of the first vowel; it would also account for the nasalization on the second vowel as reflecting the incidental nasalization on the second vowel of *nation* in English. This situation would have several implications (e.g., a preference for uniformity within a derivational paradigm, recognition of non-distinctive phonetic features of the input) that are brought up again in §8.

a. [k**í̃**] ‘king’
b. [ʔ**à̃**kè] ‘uncle’
c. [b**à̃**] ‘bank’
d. [s**ì̃**gàpù] ‘Singapore’
e. [ʔ**ì̃**gəlà̃] ‘England’
f. [səpàkəl**ì̃**] ‘sparkling’
g. [ʔ**í̃**gəleiʔ] ‘English’
h. [t̪θìɾi̯l**ì̃**gà] ‘Sri Lanka’
i. [p^{h}il**ì̃**] < *feeling* ‘inspiration’
j. [sətìjàɾ**àì̃**] ‘steering wheel’
k. [dʒ**à̃**ʃĩ.ʔeiʔ] ‘Junction Eight’
l. [lɪʔb**í̃**kàlà] ‘Living Color’
m. [b**èì̃**gəlàdɛʔ] ~ [b**à̃**gəlàdɛʔ] ‘Bangladesh’

The presence of phonemic nasal vowels in Burmese is able to compensate for the constraint banning the articulation of non-laryngeal syllable codas, a set that includes nasal segments specified for place.

6.5. Summary

This section has provided an overview of how coda consonants in borrowings are resolved in Burmese. Laryngeal neutralization applies to stops and affricates syllable-finally and to fricatives word-finally, and deletion with creaky phonation of the preceding vowel is a secondary strategy used to avoid phonotactically ill-formed sequences, as creaky tone can occur on all vowels. Outright deletion applies to the non-nasal sonorants, while deletion with vowel nasalization is the method of resolving nasal codas. Consonant clusters also present a problem for the Burmese borrower, and these are discussed in the following section. The facts presented in this section are best taken in conjunction with those in §5. Namely, consonants in English loanwords are given different treatments that correlate with their syllabification: onsets are preserved, while codas are neutralized or deleted. The question that remains is what gives rise to this pattern. Do Burmese speakers have knowledge of English syllabification that they can access in loanword adaptation, or is it possible to account for this pattern without referring to a borrower’s knowledge of syllabification? This issue is taken up in §7 and §8.

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[102] English /ŋ/ generally occurs as a coda.

7. Consonant Clusters in Loanwords

Burmese does not allow consonant clusters in syllable onsets or codas. This restriction presents a significant problem for incorporating English borrowings since English is a relatively cluster-heavy language, with clusters in both syllable onsets and codas that can contain up to four consonants. The two main strategies used to resolve consonant clusters in loanword adaptations are vowel epenthesis and consonant deletion. Vowel epenthesis is primarily used to resolve onset clusters, while deletion occurs mostly in coda clusters (in addition to the laryngeal neutralization and creaky phonation processes used to resolve simple codas).

7.1. Onset Clusters

Onset clusters are generally resolved through vowel epenthesis. A reduced vowel [ə] is inserted between the members of the cluster in order to conform to the basic CV syllable template that allows only one onset consonant.[103]

(1) Onset clusters resolved through vowel epenthesis[104]: Ø → [ə] / [$_{\sigma}$ C__C$_{[+cons]}$

a. [ʔì̃**d**ə**j**ú] 'Andrew'
b. [wì**s**ə**k**ì] 'whiskey'
c. [ʔì̃**g**ə**l**à̃] 'England'
d. [**s**ə**t**àì̃] 'style'
e. [ʔɔ̀**s**ə**t**éìl̰ḭa̰] ~ [ʔɔ̀sətéìlíjá] 'Australia'[105]
f. [**p**ə**l**aʔ**s**ə**t**ɪʔ] 'plastic'
g. [bèì̃**g**ə**l**àdɛʔ] ~ [bà̃**g**ə**l**àdɛʔ] 'Bangladesh'
h. [**s**ə**l**òùbákíjá] ~ [**s**ə**l**òùbɛʔkíjá] 'Slovakia'
i. [**d**ə**ɾ**à̃] 'drum'
j. [**s**ə**p**ʰḭ̃] 'Sphinx'
k. [bìlə**k**ə**l**ì̃tì̃] 'Bill Clinton'
l. [**s**ə**k**ɔ̰] 'Scott'
m. [bɪʔ**s**ə**k**ɪʔ] 'biscuit'
n. [**s**ə**k**ʌʔ] 'skirt'
o. [bɔ̀**s**ə**t**ʊ̀̃] 'Boston'
p. [**d**ə**ɾ**àì̃βà] 'driver'

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[103] The epenthesis is always anaptyctic and never prothetic (see Fleischhacker 2000 on how anaptyxis and prothesis occur with different types of clusters in many languages).
[104] There is also the form [t̪θìr̥i̥lì̃gà] 'Sri Lanka', which shows epenthesis of [i] in between the first two consonants. As mentioned in §5.1.4, the initial consonant in this form is anomalous with respect to other adaptations; this fact, in addition to the difference choice of epenthetic vowel, suggests that this is an older borrowing, or that it came into Burmese from another language.
[105] Note that the /ɹ/ in this cluster does not have an output correspondent (cf. (3a) *Sprite*). The informant did produce [ʔɔ̀sətəjéìlíjá] once, however, before producing the forms in (1e).

q. [**bəɾ**eiʔ] ‘brake’
r. [**sə**p**è**ĩ̃] ‘Spain’
s. [bʌʔ**sə**k**á**] < *bus* + *car* ‘bus’
t. [**t**^{h}**əɾ**ʌʔká] < *truck* + *car* ‘truck’
u. [ʔĩ̃ **gəl**eiʔ] ‘English’
v. [**sə**t**ó**ú] ‘store’
w. [tʃ^{h}**ɔ́kəl**ɛʔ] ‘chocolate’
x. [**k**^{h}**əj**ĩ̃ s^{h}**ò**ù**dà**] ‘cream soda’
y. [**k**^{h}**əɾ**ɪʔ] ‘Christ’
z. [**sə**teiʔʃóú] ‘stage show’ (concert)
aa. [**kəl**ɪʔ] ‘clip’ (for hair)
bb. [**sə**t̪ijàɾàĩ̃] ‘steering wheel’
cc. [bà**bəj**à] ‘Barbara’[106]
dd. [kɛʔ**t̪θəj**ĩ̃] ‘Katherine’
ee. [**sə**p**à**k**əl**ĩ̃] ‘sparkling’[107]
ff. [s^{h}**à**ĩ̃ **kəl**ó**ú**̃] ‘cyclone’
gg. [s^{h}**à**k**əɾ**ɛʔdauʔ] ‘Sir Craddock’
hh. [**kəj**á**ú**̃] ‘crown’
ii. [**pəl**àsətà] ‘plaster’
jj. [kʊ̃ **gəɾ**ɛʔ] ‘Congress’
kk. [**gəl**aiʔdà] ‘glider’
ll. [ʔə**pəɾ**í**ʃ**əjeiʔ] ‘appreciate’
mm. [ʔà**p**^{h}**əɾ**j̰ikə̰] ‘Africa’
nn. [dɪʔ**sə**k**ò**ù] ‘disco’

Remember from §2.3 that stop-glide clusters are allowed to a limited extent in Burmese. These clusters do not trigger epenthesis in adaptations, and the epenthesis rule in (1) has been formulated to reflect this fact.

(2) Stop-glide clusters that do not trigger vowel epenthesis[108]

a. [**kw**ɛ̃̀kà.ʔouʔ] ‘Quaker Oats’
b. [**kw**ĩ̃] ‘queen’
c. [**s**^{h}**w**ètà] ‘sweater’
d. [**s**^{h}**w**ĩ̃zàlã̃] ‘Switzerland’
e. [kòʊ̃ **pj**ùtà] ‘computer’
f. [**mj**ùnĩ̃sĩ̃pè] ‘municipal’

[106] In (1cc-dd), it is assumed that the input forms are bisyllabic with a medial cluster, /bɹ/ for *Barbara* and /θɹ/ for *Katherine*; however, it is possible that the [ə] in these forms is not epenthetic, but instead the reflex of an actual vowel in the input.

[107] In (1ee), it is assumed that the input form is bisyllabic with a medial /kl/ cluster, but it is also possible that the [ə] in the Burmese adaptation reflects an input vowel. The basic verb form *sparkle* has a syllabic final liquid ([spɑɹk̩l]) or a schwa ([spɑɹkəl]) in English, and the *-ing* participial form may also be pronounced in this way by English speakers. Barring that, however, there may be an effect of paradigm uniformity, as mentioned in §6.4 with *national*. So even if a Burmese speaker took /spɑɹklɪŋ/ with no syllabic liquid or schwa as the input form, knowledge of the derivationally related form /spɑɹk̩/ might have an effect on the output of *sparkling*. At this point, it cannot be claimed that a Burmese speaker would necessarily have this knowledge, just that it is a possibility.

[108] Note the exceptional forms [zà̃nəwàɾ̃ì] ‘January’ and [p^{h}ɛ̀ip^{h}əwàɾ̃ì] ‘February’, in which the glide [j] in the medial cluster ([nj] in *January*, [bj] in *February*) is dropped with no reflex in the output form. In addition, the epenthesis described in (1) notably does not occur in [ʔɛ̀ipʃ̃ì] ‘April’, cf. (1q,cc,ll), in which epenthesis does occur into a labial-/ɹ/ cluster. As previously mentioned in §5.1, the forms for month names display other unusual features, so this class of words may have been borrowed at an earlier time than most of the other forms.

However, note the form [nəjújauʔ] ‘New York’, in which vowel epenthesis occurs into the initial /ɲj/ cluster.[109] From §2.3, the cluster /ɲj/ and all other clusters of a coronal or velar and the palatal glide are banned in Burmese. The epenthesis that occurs into the initial cluster of *New York* implies that a Burmese speaker indeed recognizes it as a consonant cluster, as opposed to a singular palatal nasal segment, for instance (which occurs in Burmese in both voiced and voiceless forms, see §2.1). Here, there is a choice between vowel epenthesis on the one hand and a particular consonant substitution of [ɲ] for /ɲj/ on the other hand[110]; the choice made is for vowel epenthesis.

There are a couple of examples of triconsonantal onset clusters $C_1C_2C_3$ in the corpus. In these cases, vowel epenthesis applies as in (1) between both pairs of consonants in the cluster.

(3) Triconsonantal clusters resolved through vowel epenthesis[111]

a. [**sə**p**ə**j**a**iʔ] ‘Sprite’ b. [ʔaiʔ**sə**k**ə**j**ĩ**˜] ‘ice cream’[112]

These forms require two epenthetic vowels to break up the triconsonantal cluster, even when only one is technically necessary, as in (3a). Although *[kj] in (3b) would be ill-formed, the cluster [pj] in (3a) is allowed in Burmese. Nonetheless, epenthesis breaks up this smaller cluster as well, just as it breaks up all the labial-[ɹ] clusters in (1). It appears,

[109] The input form presumably contained this cluster from a British English form, in contrast to the alternate (American) pronunciation [nuw.jɔɹk], in which there is no glide preceding the [u].
[110] Simple deleting the glide is a third option, but less likely, as Burmese loanword adaptation appears to be uniformly conservative of onset consonants, even in clusters.
[111] However, C_3 is simply dropped in [ʔðsətéiliji̯a̯] ~ [ʔðsətéilíjá] ‘Australia’. Remember the possibility raised above in §4.1.1 that words longer than five syllables are avoided, even in loanword adaptation.
[112] It may be assumed that *ice cream* is borrowed without a syllabic/morphemic boundary between *ice* and *cream*. The fact that many English speakers pronounce *ice cream* as if with a triconsonantal onset cluster without aspiration, as [ˈaɪ.skrijm] as opposed to [ˈaɪs.kʰrijm], implies that such input could be available to the Burmese speaker.

then, that the transformation of [ɹ] into [j] must occur after vowel epenthesis into the cluster (see §8.2).

If one assumes that Burmese speakers who are the agents of adaptation have knowledge of English syllabification or otherwise hypothesize and impose their own syllabification on English forms, it is clear that the application of vowel epenthesis in these cases itself implies that each of these clusters is being analyzed as a cluster, not as a sequence of coda and onset. For instance, the epenthesis in (1o) *Boston* indicates that the /st/ is being recognized as a joint onset[113]; the syllabification of the input is [bɔ.stən] as opposed to [bɔs.tən]. If the latter, heterosyllabic syllabification represented the Burmese speaker's syllabification of the word, then one might expect the /s/ in the coda of the first syllable to be neutralized to a glottal stop, as happens with *gas* and *police* word-finally; however, the segment is preserved in the adaptation via anaptyxis (see Fleischhacker 2000 for a detailed analysis of anaptyxis vs. prothesis), as is C_1 in (1a-c,e-g).

There are some problems with this analysis. For one, the laryngeal neutralization of /s/ as formulated in §6.1 is a word-final process,[114] so there is little reason to suppose laryngeal neutralization would apply to word-medial coda consonants. However, the formulation of the neutralization rule for /s/ is confounded by the fact that /s/ forms legal clusters in English with so many consonants; the clusters /sp/, /st/, /sk/, /sf/,[115] /sm/, /sn/, /sl/, and /sw/ are all well-formed, which creates a situation in the corpus where there are no items with a heterosyllabic sequence of -s.C-[116] in which one would be able to see whether Burmese speakers neutralize an /s/ serving as a word-medial coda in the English

[113] Another possibility is that the Burmese speaker starts with no syllable structure and just attached the [s] to an epenthetic syllable nucleus. The problem with this possibility is that it does not capture the behavior of word-final [s], which is not preserved via epenthesis, but neutralized instead.

[114] Presumably, word-final coda /s/ might be realized with less acoustic energy than word-medial coda /s/, resulting in the restricted word-final environment for the application of the neutralization rule.

[115] The /sf/ cluster shows up mostly in foreign words such as *sphere* and *Sphinx*, but has become prevalent in the lexicon of English to the point that it may be considered a well-formed cluster of English.

[116] And it is unclear whether Burmese speakers would draw a distinction between heterosyllabic [s.t^h] (e.g., *distaste*) and tautosyllabic [st] (e.g. *distend*), although a similar distinction seems to be drawn between [p.t^h] and [p.t] (see §6.1).

form. So the line of reasoning that states that a word-medial coda /s/ could not undergo laryngeal neutralization is a bit flawed in that it depends on a rule formulated word-finally on the basis of how word-final fricatives are treated; there is a lack of evidence about the treatment of heterosyllabic sequences of -s.C-. Beyond this flawed logic, though, is the fact that there are few instances of word-medial biconsonantal clusters in the corpus which might be able to show whether the preservation treatment of word-medial /s/-clusters can be generalized to all word-medial clusters (e.g., /dɹ/ and /bɹ/ occur only word-initially in the corpus of established loanwords).[117] Because the sibilant /s/ is such a perceptually salient segment, it may be that it is given special preservation treatment that does not necessarily refer to its syllabification at all (although it is invariably neutralized word-finally). The treatment of a medial /dɹ/ cluster, for instance, would be able to shed more light on whether the onset clusters in the corpus are given an anaptyctic treatment because of their status as onset clusters or because of their word-initial position (where a consonant sequence is most likely to be an onset cluster, instead of a sequence of unsyllabified appendix segment and solo onset).[118] However, examples of medial $N.C_1C_2$ sequences point to the usefulness of syllabification knowledge; these are discussed below in §7.3.

7.2. Coda Clusters

Complex codas are usually simplified by deletion. In clusters containing /ɹ/ as C_1, the simplification is uncomplicated, as coda /ɹ/ regularly deletes,[119] yielding essentially a simple coda C_2, which undergoes the normal process of laryngeal neutralization to glottal stop (see §6.1), e.g., (4g-n). Clusters containing /l/ are resolved in a similar way, e.g., (4e), as coda /l/ also deletes fairly consistently.

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[117] There are non-/s/ medial clusters in forms (1v,cc-ee)—/kl/, /bɹ/, and /θɹ/—but again, it cannot be claimed with certainty that these are true clusters and that the schwa in these forms is not the correspondent of an input vowel instead of the result of anaptyctic epenthesis.

[118] Data from Green (2002) and Win (1998), however, do contain more words with word-medial clusters that do not include a sibilant, and these clusters are treated as onset clusters in adaptation as expected.

[119] However, if the input comes from British English forms, then coda /ɹ/ will not be present in the input to begin with, as British English has its own /ɹ/-deletion rule.

(4) Coda clusters neutralized to glottal stop

a. [ʔɔ̀gou**ʔ**] ‘August’
b. [mɛʔẗ̪θədɪ**ʔ**] ‘Methodist’
c. [k^{h}ərɪ**ʔ**] ‘Christ’
d. [kwèĭkà.ʔou**ʔ**] ‘Quaker Oats’
e. [gau**ʔ**] ‘golf’
f. [ʔidʒɪ**ʔ**] ‘Egypt’
g. [ka**ʔ** pjá] ‘card’
h. [ma**ʔ**] ‘March’
i. [p^{h}ʊ**ʔ**] ‘Ford’
j. [hábʌ**ʔ**] ‘Harvard’
k. [nəjújau**ʔ**] ‘New York’
l. [səkʌ**ʔ**] ‘skirt’
m. [ʃʌ**ʔ** ʔéĭ̃ dʒĭ] ‘shirt’
n. [sɪʔt̪̆ima**ʔ**] ~ [sɪʔt̪̆ima**ʔ**] ‘City Mart’

In clusters containing /s/, as in (4a-d), it is not clear which member of the cluster corresponds to the glottal stop and which is deleted, but all things being equal, it is preferable to assume that the less salient, non-sibilant member of the cluster is deleted and that the sibilant /s/ yields glottal stop. In the terms of Steriade (2002), the P-Map projects a faithfulness constraint against the deletion of the stop in these cases that is ranked above the faithfulness constraint against the deletion of the sibilant; this ranking emerges from the different perceptual distances between these segments and nothing: Δ(s-Ø) > Δ(T-Ø).[120]

In other clusters containing two stops, e.g., (4f), it is even less clear which member of the cluster corresponds to the glottal stop and which is deleted. Since T_2 in a T_1T_2 cluster tends to be obligatorily released, it will be assumed that it is T_2 that is more perceptually salient; thus, T_1 is deleted, and T_2 is replaced by the glottal stop. This chain of events is in keeping with the idea that the more perceptually salient of the two consonants in a cluster escapes deletion and is thus neutralized to a glottal stop. The

[120] There is also the possibility that glottal stop is the output correspondent of both members of the cluster, but there is no timing evidence that would indicate so.

more perceptually salient consonant is the sibilant in a ST/TS cluster and presumably T_2 in a T_1T_2 cluster.[121]

However, when a syllable contains a vowel that does not occur with a glottal coda, creaky phonation is maintained as an alternative strategy to laryngeal neutralization in order to avoid violations of Burmese phonotactics.

(5) Coda clusters corresponding to creaky tone

a.	[səpʰ**ḭ̃**] ‘Sphinx’	b.	[k**ã̰ṵ̃**] ‘count’
c.	[dʒɔ̰] ‘George’	d.	[p**ã̰ḭ̃**] ‘pint’

In NC clusters, the second consonant (which is usually voiced and homorganic with the nasal) is deleted without adding a glottal or creaky tone.[122]

(6) $NC_{[+vcd]}$ coda clusters simplified with no glottal or creaky reflex[123]

a.	[dʒ**ɪ́̃ Ø**] ‘jeans’	b.	[pʰilɪʔp**àɪ̃ Ø**] ‘Philippines’
c.	[nèðàl**à̃ ØØ**] ‘Netherlands’[124]	d.	[pʰɪ̃ l**à̃ Ø**] ‘Finland’
e.	[sʰwɪ̀zàl**à̃ Ø**] ‘Switzerland’	f.	[pòùl**à̃ Ø**] ‘Poland’
g.	[w**ɪ̀̃ Ø**sʰà] ‘Windsor’	h.	[ʔɪ̃ gəl**à̃ Ø**] ‘England’

In (6d-h), for instance, a post-nasal /d/ does not yield creaky tone as in (5a-b).[125] As mentioned previously, this absence of creaky tone might be a case of /d/, homorganic

[121] However, a counterargument could be made that T_1, being the member of the cluster adjacent to a vowel, is actually the more salient member of the cluster. Thus, it is really just speculation whether T_1 or T_2 is the consonant that deletes.

[122] But note [dʒà̃ ʃɪ̃ .ʔeiʔ] ‘Junction Eight’ and [bà̃] ‘bank’, in which the coda consonant following the nasal is voiceless and is still lost with no creaky tone trace, cf. (5a-b). These words may be older borrowings; (5a) *Sphinx* and (5b) *count* are newer at least, since they were adapted online instead of spontaneously produced. The disappearing post-nasal voiceless stop in (5a-b) is almost the reverse of the “intrusive” stop in words like *Chomsky*, in which a mistiming of the raising of the velum results in the insertion of a voiceless stop between the nasal and the fricative, e.g., *Chom*[p]*sky*.

[123] Ø = indicates that a consonant has been deleted from that position, a sort of phonological trace (see §8 for further discussion).

[124] There may be a triconsonantal coda in *Netherlands*, [ndz].

with preceding /n/ and often unreleased, simply not being salient enough to be perceived by the Burmese speaker, in which case it would not be present in the input to begin with. But there may simply be two different treatments of post-nasal coda consonants that correlate with voicing—voiced consonants deleting and voiceless consonants yielding creaky tone on the preceding (nasalized) vowel. This differential treatment of $NC_{[+vcd]}$ and $NC_{[-vcd]}$ is not unnatural (see Pater 1996 on particular effects of $NC_{[-vcd]}$).

The reverse case of CN codas is also represented in the corpus.

(7) CN coda clusters

a. [pʰ**àù̃**] 'form' b. [pʰə**lî̃**] 'film'

In (7a) the sonorant /ɹ/ is dropped, while the /m/ surfaces as nasalization. In (7b), the sonorant /l/ does not get dropped, oddly enough. One might expect the adaptation of *film* to be [pʰì̃], with the /l/ deleting as in (4e) *golf*, but the actual form looks suspiciously like the output of a source form with a syllabic nasal or a schwa, something along the lines of /fɪlm̩/ or /fɪləm/.[126] If this source, perhaps a spelling pronunciation, constituted the input, then metathesis of the vowels would resolve the problem of having schwa (a minor syllable vowel, see §2.3) in the final syllable, and vowel nasalization applying as usual would take care of the rest. Alternatively, it is possible that the input is actually [fliːm], as it is in other language varieties such as Malaysian English and Singaporean English (Bert Vaux, p.c.).

The form [tʃʰá] 'Charles' is also of interest. The coda contains three consonants, /ɹlz/, none of which surface in the output. The deletion of /ɹ/ and /l/ is expected, but /z/ is deleted as well; no [ʔ] correspondent occurs in the output. This unexpected deletion

[125] Remember that laryngeal neutralization to glottal stop is not an option here due to the absence of *Ṽʔ, a static pattern in Burmese.
[126] Compare (7b) to Korean [pʰilɨm] 'film'. The rendition of *film* in Hindi also seems to be based on an input like [filəm].

might be explained by length considerations. The word *Charles* is a relatively long monosyllable, with a particularly extended sonorous portion of three segments, /ɑɹl/. Syllables with a glottal catch, however, are relatively short (see §2.2). Therefore, the deletion of /z/ in *Charles* should perhaps be seen more as the avoidance of the short glottal syllable than as deletion; deletion of /z/ maintains a longer vowel length that is closer to the sonorous length of the input than the very short glottal syllable.

It should be noted that it seems to be the sonorous length, rather than just the vowel length, that seems to be important; the pure vowel portion of *Charles* is, after all, only one segment long. The prediction made here is that another coda-heavy word in which the sonorous portion of the word is relatively short will not trigger a similar avoidance of laryngeal neutralization. The word *sixths* /sɪksθs/, for example, which has four [-sonorant] coda consonants that do not contribute to the sonorous length of the word, would be predicted to be adapted with glottal tone as [sɪʔ]. This is, in fact, the form that the informant gives as the adaptation.

7.3. Heterosyllabic Sequences

One indication of whether Burmese speakers have knowledge of English syllabification is the way in which they deal with word-medial consonant sequences that syllabify across consecutive syllables in English. Are these heterosyllabic sequences treated heterosyllabically as a sequence of coda and onset, or do they get treated as a tautosyllabic onset cluster (or, for that matter, a tautosyllabic coda cluster)?

The data indicate that the Burmese speaker has a good sense of the syllabification of input forms. A sequence of the shape N.C containing a nasal followed by an onset to the following syllable is not treated as a complex onset NC or a prenasalized segment ^{N}C.[127]

[127] Nor is it treated as a complex coda NC, which is another possibility but very unlikely as it would deprive the following syllable of an onset.

(8) N.C sequences treated heterosyllabically

a. [ʔĩ̀ **d**òùníʃá] 'Indonesia'	b. [t̪θìɾḭlĩ̀ **g**à] 'Sri Lanka'
c. [ʔàdʒĩ̀ **t**ìná] 'Argentina'	d. [wĩ̀ **d**àmìjà] 'Windermere'
e. [ʔã̀ **t**ì] 'auntie'	f. [ʔèĩ̀ **d**əɾḭja̰] 'India'
g. [bèĩ̀ **g**əlàdɛʔ] ~ [bã̀ **g**əlàdɛʔ] 'Bangladesh'	h. [dìzĩ̀ **b**à] 'December'
i. [bìləkəlĩ̀ **t**ĩ̀] 'Bill Clinton'	j. [dʒã̀ **ʃ**ĩ̀.ʔeiʔ] 'Junction Eight'
k. [ʃã̀ **p**éĩ̀] 'champagne'	l. [ʔĩ̀ **g**əlã̀] 'England'
m. [kòù̃ **p**jùtà] 'computer'	n. [ʔĩ̀ **g**əleiʔ] 'English'
o. [nòùwĩ̀ **b**à] 'November'	p. [lɪʔbĩ̀ **k**àlà] 'Living Color'
q. [nã̀ **b**ʌʔ] 'number'	r. [pʰĩ̀ **l**ã̀] 'Finland'
s. [hã̀ **b**àgà] 'hamburger'	t. [hò̃ **d**à] 'Honda'
u. [sɛʔtĩ̀ **b**à] 'September'	v. [sĩ̀ **g**àpù] 'Singapore'

There is no anaptyctic epenthesis into the sequence; instead, the nasal is realized as vowel nasalization, just as a word-final (and, thus, syllable-final) nasal is realized (see §6.4). But knowledge of syllabification is not necessary to explain the adaptation of the nasals here if Burmese speakers pick up on the incidental vowel nasalization preceding coda nasals,[128] in which case they could simply be trying to approximate this phonetic detail with their adaptation instead of paying attention to the syllabic status of a given nasal.

However, as alluded to above in §7.1, examples exist of longer N.C_1C_2 sequences that are treated as one would expect from their syllabification in English.

(9) N.C_1C_2 sequences treated heterosyllabically[129]

a. [ʔĩ̀ **d**ə**j**ú] 'Andrew'	b. [ʔĩ̀ **g**ə**l**ã̀] 'England'
c. [bèĩ̀ **g**ə**l**àdɛʔ] ~ [bã̀ **g**ə**l**àdɛʔ] 'Bangladesh'	d. [ʔĩ̀ **g**ə**l**eiʔ] 'English'

[128] On the other hand, vowel nasalization in English is taken by some linguists as evidence in support of the lack of nasal segments in English (Bert Vaux, p.c.). In this view, nasalization is distinctive, while the articulation of nasal segments is not.

[129] Note also that the C.C_1C_2 clusters in the following forms are treated heterosyllabically: [naiʔkəlʌʔ] 'nightclub',

e. [kʊ̃ **gəɾ**ɛʔ] ‘Congress’

Here the nasal is treated as a coda as in (8). The hypothetical syllabification $NC_1.C_2$ should result in creaky tone over the nasalized vowel as in (5), or because C_1 is voiced, outright loss of C_1 as in (6), but neither of these things occur. In the former case, the word *Andrew*, for example, would be expected to be rendered as [ʔɪ̃.jú], while in the latter case, the expected form would be [ʔɪ̃.jú]; however, the attested form [ʔɪ̃ dəjú] preserves C_1 (= [d]) instead of deleting it.

Significantly, the resolution of C_1C_2 via vowel epenthesis resembles the general treatment of word-initial (and, thus, onset) clusters seen in (1). In (9a-d), C_1 is preserved via anaptyctic epenthesis; it corresponds to an output segment (cf. the loss of some post-nasal consonants in §6.1) instead of turning into creaky tone on the preceding vowel (see §6.2). To account for these facts without referring to syllabification, we would need to posit either a general dispreference for creaky nasal vowels or a left-to-right scansion algorithm that scans a phonological word starting from the first vowel two segments at a time and treats any C_1C_2 that falls into the scanning frame as a sequence of coda/onset or onset/onset (and not coda/coda) according to rules yet to be determined. The possibility of a dispreference for creaky nasal vowels is a generalization that is not supported by tone distribution in native Burmese, in which creaky tone appears to be the only tone capable of functioning as a morpheme and is the “default” tone in the orthographic system.

There are problems with the hypothetical scansion algorithm described above. First, the scanning frame of two segments should be expanded to at least four segments in order to be able to scan a triconsonantal cluster and a following vowel. Second, some set of rules or principles must be present in the system to tell the algorithm whether to label a particular consonant in a particular environment as a coda or an onset so that the consonant receives the correct treatment. Perhaps one should start by biasing the

algorithm to interpret liquid- or nasal-initial clusters as coda/onset and sibilant-initial clusters as onset/onset, so to keep things simple, the algorithm would scan all $C_{1[+cons,+son,-nas]}C_2V$ and $C_{1[+nasal]}C_2V$ as coda/onset, all $C_{1[+strid]}C_2V$ as onset/onset, and all other sequences as onset/onset; a sequence would be interpreted as coda/coda when the end of the word enters the frame. Scanning the set of "other" sequences as onset/onset, however, cannot account for the cases in which Burmese adaptations correctly treat a non-liquid/nasal/sibilant-initial sequence as coda/onset.

(10) Heterosyllabic $C_1.C_2$ sequences treated heterosyllabically ($C_1 \neq$ N, /ɹ/[130])

a. [dʒɛ**ʔsʰ**ĩ̀] 'Jetson'
b. [maiʔkèdʒɛ**ʔsʰ**ĩ̀] 'Michael Jackson'
c. [pɛʔpəsḭ̀] ~ [pɛ**ʔs**ḭ̀] 'Pepsi'
d. [sətei**ʔʃ**óú] 'stage show'
e. [sʰai**ʔk**á] 'sidecar'
f. [dàɾai**ʔt**à] 'director'
g. [mɛ**ʔsʰ**ìkòù] 'Mexico'
h. [sɛ**ʔt**ĩ̀bà] 'September'
i. [ʔau**ʔt**òùbà] 'October'
j. [hɔ̰**d**ɔ̰] 'hot dog'
k. [w**ḭt**òùɾḭja̰] 'Victoria'
l. [ʔ**àt**eiʔ t̪θəmouʔdəjà] 'Arctic Ocean'[131]

In these examples, sequences such as /ks/, /ts/, and /kt/ which fall into the "other" category are treated as coda/onset as seen in the glottal or creaky reflex of C_1. So, clearly, the scanning algorithm would require additional information in order to function correctly in producing the observed results. But this information is essentially equivalent to the knowledge of English syllabification that the scanning algorithm is supposed to make it unnecessary for Burmese speakers to possess. Thus, hypothesizing such a scanning algorithm to replace any syllabification knowledge Burmese speakers use in loanword adaptation is doomed to failure.

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[130] The case in which C_1 is a nasal is laid out in (8); the nasal is realized as vowel nasalization. The case in which C_1 = /ɹ/ is also of little interest, as coda /ɹ/ systematically deletes.

[131] Here the coda /k/ is deleted with no glottal or creaky reflex.

But this is not to say that Burmese adaptation agents have perfect knowledge of English syllabification. They do not, and this is most plainly seen in the treatment of certain heterosyllabic consonant sequences as complex onsets. In these cases there is no glottal or creaky reflex of C_1, as is expected for a coda/onset sequence; instead, vowel epenthesis applies to resolve the sequence, just as it does for complex onsets.

(11) Heterosyllabic $C_1.C_2$ sequences treated like tautosyllabic clusters $.C_1C_2$

a. [ʔɪʔ**zəj**éí] 'Israel'
b. [bɛʔ**t̪θəl̪**ihà˜] 'Bethlehem'
c. [mà**zəd**à] 'Mazda'
d. [kɛʔ**pət**èĩ˜] 'captain'
e. [pɛʔ**pəs**ì] ~ [pɛʔsì] 'Pepsi'[132]
f. [ʔaʔ**təl**à˜teiʔ t̪θəmouʔdəjà] 'Atlantic Ocean'

It is unclear why these sequences are recognized as onset/onset instead of coda/onset, but UG may be exerting its influence here in creating a preference for onset maximization. Also, it is possible that Burmese speakers overgeneralize some syllabification patterns (e.g., the status of /θɹ/ as a possible complex onset is extended to /θl/ in (1b) *Bethlehem*, /tɹ/ is extended to /tl/ in (1f) *Atlantic Ocean*). It is worth noting that these are not linguistically impossible onset clusters; the clusters /zd/, /zr/, /pt/, and /ps/ in (1a,c-e) are all attested in Russian, /tl/ occurs in Nahuatl, and /θl/ is present in Modern Greek. A second possibility is that Burmese speakers have an incomplete knowledge of English syllabification and are biased to interpret consonant sequences they are unsure of as tautosyllabic onset clusters according to principles that may lie in UG, such as the Obligatory Onset Principle, the Maximum Onset Principle, and increasing sonority on the sonority hierarchy (see Floccia et al. for a study comparing five different syllabification systems).

[132] The two alternate forms of *Pepsi* display, respectively, the unexpected onset-cluster treatment of /p.s/, and the expected coda/onset treatment of /p.s/.

7.4. Summary

In this section, different patterns have been discerned in Burmese adaptations of English consonant clusters. It has been observed that the main strategy for resolving onset clusters is vowel epenthesis, while the major method of resolving coda clusters is consonant deletion. This differential treatment of heterosyllabic consonant sequences generally reflects their syllabification in English correctly, which provides strong evidence that the input to Burmese loanword phonology has a pre-specified syllabification structure. On the other hand, Burmese speakers' apparently imperfect knowledge of English syllabification patterns results in some heterosyllabic consonant sequences being adapted as tautosyllabic onset clusters, according to a principle of onset maximization that must come from UG.

8. Analysis and Discussion

8.1. Optimality-Theoretic Account

8.1.1. Burmese Constraints

The preceding investigation of the modifications that Burmese phonology makes to English loanwords has made frequent reference to general "constraints" in Burmese, including reference to syllable structure. Optimality Theory (Prince and Smolensky 1993), or OT, provides a way to explicitly formalize and order these constraints in order to account for the surface forms of Burmese-adapted English borrowings. From the loanword corpus, we may conclude that the presence of an onset in Burmese is obligatory, conforming to the typology of many other languages. This requirement may be stated in the form of an obligatory onset constraint, following Kager (1999).

(1) **ONSET**[133]
*[$_{\sigma}$ V ('Syllables must have onsets.')

In addition, Burmese seems to be no different from many other languages in preferring open syllables, a preference that can be captured in a constraint against syllable codas. Glottal stop is the only segment allowed as a coda, while vowel nasalization arises from what may be considered an underlying "placeless" nasal coda; thus, it appears a constraint specifically targets coda consonants specified for place (Green 2002).

(2) ***CODA[place]**
*C]$_{\sigma}$ ('Coda consonants must be placeless.')
|
PLACE

The ban against tautosyllabic consonant clusters can be summarized with the following two constraints.

[133] Note that there are differing opinions about the need for an ONSET constraint (e.g., Blevins 2003, who suggests that consonant epenthesis of glottal stop and glide onsets has its roots in historical phonology).

(3) *COMPLEX-ONSET[134]
*[σ $CC_{[+cons]}$ (‘Onsets are simple.’)

(4) *COMPLEX-CODA
*$CC_{[+cons]}$]σ (‘Codas are simple.’)

Several other structures are ill-formed in Burmese, and these in turn project their own constraints.

(5) *FREE-LOW-DIPHTHONG
*aV]σ
(‘Low diphthongs, [ai] and [au],[135] occur in closed syllables.’)

(6) *[ɔ]-AND-GLOTTAL
*ɔʔ]σ (‘The vowel [ɔ] does not occur with coda [ʔ].’)

(7) *NASAL-MID-VOWEL
*[-consonantal, -high, -low, +nasal]
(‘Mid monophthongs[136] occur only as oral vowels.’)

(8) *FINAL-SCHWA
*ə(C)]PrWd (‘A minor syllable does not occur word-finally.’)

(9) FREE-TENSE-VOWEL
*$V_{[+ATR]}$C]σ (‘Tense monophthongs occur only in open syllables.’)

The constraints described above fall into the category of markedness constraints; they all make statements about what is generally preferred or dispreferred in the language. A set of constraints must also maintain faithfulness to the input to preserve

[134] The seemingly redundant [+consonantal] specification of the second C in (3) and (4) is necessary to allow the obstruent-glide clusters permitted in Burmese.
[135] Green (2002), along with Cornyn (1944) and Win (1998), claims that all of the diphthongs occur only in closed syllables, but as mentioned in §2.3, this generalization only holds true for the low diphthongs [ai] and [au].
[136] It is only the monophthongs and not the diphthongs that are targeted by *NASAL-MID-VOWEL and FREE-TENSE-VOWEL in (7) and (9).

some distinctions, as English loanwords do not all fall together into Burmese as the same hyper-unmarked form in accordance with the markedness constraints:

(10) **DEP-IO** (Kager 1999)
Output segments must have input correspondents.
('No epenthesis.')

(11) **MAX-IO** (Kager 1999)
Input segments must have output correspondents. ('No deletion.')

The first faithfulness constraint, DEP-IO, helps to account for why adjacent consonants in the input are not always resolved via vowel epenthesis, for instance, while the second faithfulness constraint, MAX-IO, provides an explanation for why offending segments from the input continue to have reflexes in the output. There are more fine-grained MAX constraints as well.

(12) **MAX-PLACE**
Input segments specified for [place] must be specified for [place] in the output. ('No laryngeal neutralization.')

(13) **MAX-NASAL**
An input [+nasal] specification must correspond to some output [+nasal] correspondent. ('No deletion of nasality.')

(14) **MAX-CODA-OBS**
Input coda obstruents must have a reflex in the output.
('Leave some trace of coda obstruents.')

(15) **MAX-ONSET**
Onset segments in the input must have fully specified output correspondents. ('No onset deletion, simplification, or neutralization.')

Another family of faithfulness constraints specifically mandates that segments keep the same featural specification in the output that they have in the input.

(16) **IDENT[ATR]**
Input vowels must keep the same value for [±ATR] in their output correspondents. (‘Tense vowels will be tense, lax vowels will be lax.’)

(17) **IDENT[back, high]**
Input vowels must keep the same values for [±back] and [±high] in their output correspondents. (‘No changes in vowel height or frontness.’)

8.1.2. Constraint Ranking

Now we turn to the larger question of how these constraints are ranked in order to choose the actual surface form from a variety of possible outputs. For now, it will be adequate to assume that the input in each case is the Standard (American) English pronunciation[137] of the loanword. The ranking is compiled bit by bit as we work through examples in the data set.[138]

(18) *FREE-LOW-DIPHTHONG >> DEP-IO

mai.kəl ‘Michael’	mai.ke	☞ maiʔ.ke
*FREE-LOW-DIPHTHONG	*!	
DEP-IO		*

[137] Except where this differs significantly from the British pronunciation (e.g., in words containing /ɹ/ in syllable codas), or where other important phonetic details need to be considered.
[138] The segmental substitutions discussed in §4 and §5 are mostly irrelevant here and so have been ignored for the most part. Therefore, the possible outputs considered in these tableaux take correspondences between Burmese segments and English segments for granted, unless there is more than one reasonable substitution. It should also be noted that in the tableaux below, candidates are listed across the top row and constraints down the leftmost column, instead of vice versa as is traditional in OT literature; this is done simply to make it possible to see the action of a large set of constraints within one tableau.

(19) *COMPLEX-ONSET >> DEP-IO

bɹeik 'brake'	bɹeiʔ	☞ bə.ɹeiʔ
*COMPLEX-ONSET	*!	
DEP-IO		*

(20) IDENT[ATR] >> DEP-IO

bɪ.skɪt 'biscuit'	bɪʔ.sə.ki	bi.sə.kɪʔ	☞ bɪʔ.sə.kɪʔ
IDENT[ATR]	*!	*!	
DEP-IO	*	*	**

(21) *CODA[place], DEP-IO, MAX-IO >> MAX-PLACE

k^hejk 'cake'	keik	kei	kei.kə	☞ keiʔ
*CODA[place]	*!			
DEP-IO			*!	
MAX-IO		*!		
MAX-PLACE				*

(22) *CODA[place], *FREE-LOW-DIPHTHONG, *FINAL-SCHWA >> DEP-IO >> MAX-IO

maɪ.kəl 'Michael'	maiʔ.kel	mai.ke	maiʔ.kə	maiʔ.kə.lə	maiʔ.ke.le	☞ maiʔ.ke
*CODA[place]	*!					
*FREE-LOW-DIPHTHONG		*!				
*FINAL-SCHWA			*!	*!		
DEP-IO			*	**	**!	*
MAX-IO		*	*			*

(23) *FINAL-SCHWA, ***COMPLEX-ONSET >> DEP-IO >> MAX-IO**

slow.vɑ.ki.jə 'Slovakia'	slou.ba.ki.ja	sə.lou.ba.ki.jə	sə.lou.ba.ki	☞ sə.lou.ba.ki.ja
*FINAL-SCHWA		*!		
*COMPLEX-ONSET	*!			
DEP-IO		*	*	*
MAX-IO			*!	

(24) *CODA[place], *FINAL-SCHWA, **ONSET, *COMPLEX-CODA >> DEP-IO**

ij.dʒɪpt 'Egypt'	ʔi.dʒɪp	ʔi.dʒə	ʔi.dʒɪʔ.pə.tə	ʔi.dʒɪʔʔ	i.dʒɪʔ	☞ ʔi.dʒɪʔ
*CODA[place]	*!*					
*FINAL-SCHWA		*!				
ONSET					*!	
*COMPLEX-CODA				*!		
DEP-IO	*	*	**!**	*		*
MAX-IO		**				*

(25) *CODA[place], *FINAL-SCHWA, MAX-NASAL, FREE-TENSE-VOWEL >> IDENT[ATR]

k^hwijn 'queen'	kwi	kwi.nə	kwɪn	kwĩ	☞ kwĩ
*CODA[place]			*!		
*FINAL-SCHWA		*!			
MAX-NASAL	*!				
FREE-TENSE-VOWEL				*!	
IDENT[ATR]			*		*

(26) IDENT[ATR], **MAX-CODA-OBS >> DEP-IO**[139]

vijt 'veet' (pseudoword)	vɪt	vi.tə	viʔ	vi	vi.ti	vɪʔ	☞ vi̯
*CODA[place]	*!						
*FINAL-SCHWA		*!					
FREE-TENSE-VOWEL			*!				
IDENT[ATR]	*					*!	
MAX-CODA-OBS				*!			
DEP-IO		*			*!		
MAX-IO				*			*

(27) *CODA[place], *FINAL-SCHWA, ***[ɔ]-AND-GLOTTAL >> IDENT[ATR]**
>> IDENT[back, high]

fɔɹd 'Ford'	p^hɔd	p^hɔ.də	p^hɔʔ	p^hauʔ	☞ p^hʊʔ
*CODA[place]	*!				
*FINAL-SCHWA		*!			
*[ɔ]-AND-GLOTTAL			*!		
IDENT[ATR]				*!	
IDENT[back, high]					*

[139] The constraint MAX-CODA-OBS may also be ranked higher; that is, the tableau in (26) will work out even if MAX-CODA-OBS is ranked up with the highest-ranking group of constraints. However, in the absence of evidence for MAX-CODA-OBS outranking IDENT[ATR], it is assumed to dominate only DEP-IO and the constraints below DEP-IO.

(28) *CODA[place], *FINAL-SCHWA, ****NASAL-MID-VOWEL >> IDENT[ATR]** >> IDENT[back, high][140]

fɔɹm 'form'	$p^hɔm$	$p^hɔ.mə$	$p^hɔ̃$	☞ $p^haũ̯$
*CODA[place]	*!			
*FINAL-SCHWA		*!		
*NASAL-MID-VOWEL			*!	
IDENT[ATR]				*
IDENT[back, high]				*

(29) *CODA[place], *FINAL-SCHWA, *NASAL-MID-VOWEL >> **IDENT[ATR] >> DEP-IO >> IDENT[back, high], MAX-IO**

sɛp.$t^hɛ$m.bəɹ 'September'	sɛp.tɛm.ba	sɛʔtɛ̃ba	sɛʔtĩbə	se.pə.tĩ.ba	sɛʔ.pə.tĩ.ba	☞ sɛʔ.tĩ.ba
*CODA[place]	*!*					
*FINAL-SCHWA			*!			
*NASAL-MID-VOWEL		*!				
IDENT[ATR]				*!		
DEP-IO				*	*!	
IDENT[back, high]		*	*	**	**	**
MAX-IO		*	*	*	*	*

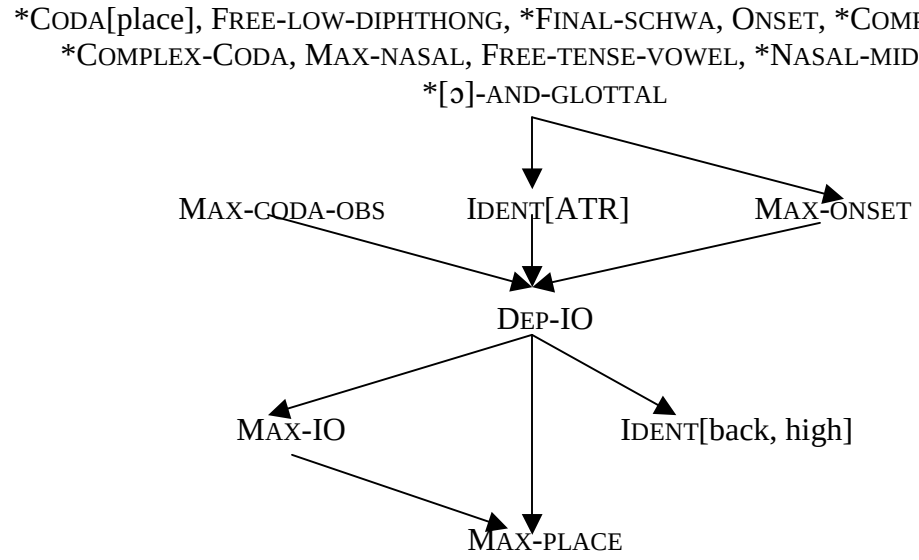
(30) FREE-LOW-DIPHTHONG, *FINAL-SCHWA, FREE-TENSE-VOWEL >> **IDENT[ATR], MAX-ONSET >> DEP-IO**

ɑɪ.skɹijm 'ice cream'	ʔaiʔ.sə.kə	ʔai.sə.kə.ji.mi	ʔaiʔ.sə.kə.j̃i	ʔaiʔ.kə.j̃i	☞ ʔaiʔ.sə.kə.j̃i
*FREE-LOW-DIPHTHONG		*!			
*FINAL-SCHWA	*!				
FREE-TENSE-VOWEL			*!		
IDENT[ATR]	*			*	*
MAX-ONSET				*!	
DEP-IO		***	***	*	***
IDENT[back, high]					
MAX-IO	**				

The information gathered from the tableaux above lead to the following constraint ranking.

[140] Note that the possible candidate [$p^hõ$] is not chosen as the optimal candidate. The final choice here must be attributed to a ranking of perceptually-based correspondence constraints of the kind: *([ɔm]=[õ]) >> *([ɔm]=[ãũ]).

(31) Full constraint ranking



8.1.3. Knowledge of Input Syllabification

At this point one should return to the issue raised in § 7.3 of whether Burmese speakers handle input with syllabification actually specified (either specified already in the input or spontaneously imposed upon the input prior to adaptation) or a speech signal that gets parsed only up to the segmental level. In other words, is knowledge of input syllabification structure necessary for the pattern of adaptation carried out in Burmese? The answer appears to be yes.

If one assumes that speakers have no knowledge of syllabification and that the only prosodic boundaries they can recognize in novel input are word boundaries, then one should modify the definitions of all constraints referring to syllable boundaries to refer now only to word boundaries, such that *CODA[place], for example, will ban place specification only for word-final consonants or sequences of consonants instead of syllable-final ones.[141] Let us examine the effect of this modification in constraint

[141] Remember the point made in §7.3 that the alternative of a scanning algorithm, or in OT terms, scanning constraints, that could create the pattern of changes resolving consonant sequences attested in the loanword corpus is doomed to failure because it would require information about how to parse different sequences of segments that essentially equates to knowledge of syllabification.

definitions. For a heterosyllabic sequence, it does not present a problem; in the following tableaux, the correct candidate is chosen in both scenarios, with or without input syllabification knowledge.

(32) Heterosyllabic coda-onset sequence treated as heterosyllabic[142]

mɛk.sʰɪ.kʰow 'Mexico'	mɛk.sʰi.kou	mɛ.ksʰi.kou	mɛʔ.ʔi.kou	mɛʔ.sʰi.kou	mɛ.sʰi.kou	mɛʔ.kə.sʰi.kou	☞ mɛʔ.sʰi.kou
*CODA[place]	*!						
*FREE-LOW-DIPH							
*FINAL-SCHWA							
ONSET							
*COMPLEX-ONSET		*!					
*COMPLEX-CODA			*!				
MAX-NASAL							
FREE-TENSE-V				*!			
*NASAL-MID-V							
*[ɔ]-AND-[ʔ]							
MAX-CODA-OBS					*		
IDENT[ATR]	*	**	*	**	*!*	*	*
MAX-ONSET			*				
DEP-IO			*			*!*	
MAX-IO					*		
IDENT[back, high]							
MAX-PLACE			**	*			*

Here with syllabification specified in the input, the correct candidate is chosen, but when there is no syllabification in the input to indicate that the coda-onset sequence is heterosyllabic, the actual output still wins.

(33) Optimal candidate chosen without knowledge of syllabification

[142] Note that aspiration on the fricative is contained in the input as the end product of the initial scansion of the English acoustic signal. Furthermore, the possible candidate [mɛʔ.sʰɪʔ.kou] does not represent the actual output. As mentioned above in §4.4, there may be an additional constraint limiting the occurrence of vowel-laxing-motivated glottal epenthesis, which does not occur in the very similar [dʒɛʔsǐkà] 'Jessica', either, for example.

mɛksɪk^{h}ow ‘Mexico’	mɛk.si.kou	me.ksi.kou	mɛʔ.ʔi.kou	mɛʔ.si.kou	me.si.kou	mɛʔ.kə.si.kou	☞ mɛʔ.si.kou
*CODA[place]	*!						
*FREE-LOW-DIPH							
*FINAL-SCHWA							
ONSET							
*COMPLEX-ONSET		*!					
*COMPLEX-CODA			*!				
MAX-NASAL							
FREE-TENSE-V				*!			
*NASAL-MID-V							
*[ɔ]-AND-[ʔ]							
MAX-CODA-OBS							
IDENT[ATR]	*	**	*	**	**!	*	*
MAX-ONSET							
DEP-IO			*			*!*	
MAX-IO					*		
IDENT[back, high]							
MAX-PLACE			**	*			*

However, problems arise in the case of onset clusters. In the following tableau, the candidate representing the actual output is eliminated, while a tie remains between two candidate forms that are unattested.

(34) Optimal candidate eliminated without knowledge of syllabification[143]

ɪŋglən ‘England’	ʔɪ.gə.lan	ʔɪ.gə.lə.nə	ɪ̃.gə.lã	ʔɪ.glã	ʔɪʔ.lã	ʔɪ.gə.la	ʔɪ.gə.lã	ʔɛ̃.gə.lã	☞? ʔɪ̃.gã	☞? ʔɪ̰.lã	☹ ʔɪ̃.gə.lã
*CODA[place]	*!										
*FREE-LOW-DIPH											
*FINAL-SCHWA		*!									
ONSET			*!								
*COMPLEX-ONSET				*!							
*COMPLEX-CODA					*!						
MAX-NASAL						*!					
FREE-TENSE-V							*!				
*NASAL-MID-V								*!			
*[ɔ]-AND-[ʔ]											
MAX-CODA-OBS											
IDENT[ATR]											
MAX-ONSET											
DEP-IO	**	**	**	**	**	**	**	**			*!
MAX-IO									*	*	
IDENT[back, high]	*		*	*	*	*	*	*	*	*	*
MAX-PLACE	*	*	**	**	**	*	**	**	**	**	**

[143] ☞? = optimal candidate, but does not occur. ☹ = actual output, but not picked as optimal candidate. (☞ = optimal candidate, which does occur.)

Here the actual output is ruled out as a result of epenthesis into an onset cluster, while two other candidates that eliminate an onset consonant survive; moreover, the repairs that are applied in these wrong choices (outright deletion of a pre-vocalic consonant and deletion of a post-nasal consonant with creaky phonation of the preceding nasalized vowel) are not attested anywhere in the corpus.

However, if, with knowledge of syllabification, the grammar preferentially preserves segments recognized as onsets, the correct result follows.

(35) Optimal candidate chosen with knowledge of syllabification

ɪŋ.glən ‘England’	ʔɪ.gə.lan	ʔɪ.gə.lə.nə	ɪ.gə.lã	ʔɪ.glã	ʔɪʔ.lã	ʔɪ.gə.la	ʔɪ.gə.lã	ʔɛ̃.gə.lã	ʔĭ.gã	ʔĭ.lã	☞ ʔĭ.gə.lă
*CODA[place]	*!										
*FREE-LOW-DIPH											
*FINAL-SCHWA		*!									
ONSET			*!								
*COMPLEX-ONSET				*!							
*COMPLEX-CODA					*!						
MAX-NASAL						*!					
FREE-TENSE-V							*!				
*NASAL-MID-V								*!			
*[ɔ]-AND-[ʔ]											
MAX-CODA-OBS											
IDENT[ATR]											
MAX-ONSET									*!	*!	
DEP-IO	**	**	**	**	**	**	**	**			*
MAX-IO									*	*	
IDENT[back, high]	*		*	*	*	*	*	*	*	*	*
MAX-PLACE	*	*	**	**	**	*	**	**	**	**	**

Thus, it appears that knowledge of input syllabification is necessary for the observed patterns of consonant sequence resolution. Furthermore, the constraint ranking without input syllabification knowledge is biased to handle consonant sequences as coda-onset, even though what is coda-onset in the input may in actuality be treated as an onset cluster.

(36) Coda-onset sequence treated as coda-onset, without syllabification knowledge

mɑzdə 'Mazda'	maz.da	ma.zə.də	ma.zda	mazd.ʔa	ma.da	☞? maʔ.da	☹ ma.zə.da
*CODA[place]	*!						
*FREE-LOW-DIPH							
*FINAL-SCHWA		*!					
ONSET							
*COMPLEX-ONSET			*!				
*COMPLEX-CODA				*!			
MAX-NASAL							
FREE-TENSE-V							
*NASAL-MID-V							
*[ɔ]-AND-[ʔ]							
MAX-CODA-OBS							
IDENT[ATR]							
MAX-ONSET							
DEP-IO		*		*			*!
MAX-IO					*!		
IDENT[back, high]							
MAX-PLACE						*	

As mentioned in §7.3, it appears that Burmese speakers may overgeneralize input syllabification patterns with the result that more consonant sequences are interpreted as onset clusters than actually are (e.g., the status of [st] as a possible onset cluster is extended to the corresponding voiced sequence [zd]).

(37) Coda-onset sequence interpreted as onset cluster in input syllabification

mɑ.zdə 'Mazda'	maz.da	ma.zə.də	ma.zda	mazd.ʔa	ma.da	maʔ.da	☞ ma.zə.da
*CODA[place]	*!						
*FREE-LOW-DIPH							
*FINAL-SCHWA		*!					
ONSET							
*COMPLEX-ONSET			*!				
*COMPLEX-CODA				*!			
MAX-NASAL							
FREE-TENSE-V							
*NASAL-MID-V							
*[ɔ]-AND-[ʔ]							
MAX-CODA-OBS							
IDENT[ATR]							
MAX-ONSET					*!	*!	
DEP-IO		*		*			*
MAX-IO					*		
IDENT[back, high]							
MAX-PLACE						*	

Here the appropriate input syllabification results in the attested treatment of medial [zd].

8.2. Rule-Based Approach

The predecessor of and main alternative to OT analysis in terms of ranked constraints is an approach based on ordered rules. Loanword adaptation patterns in Burmese may be summarized by the following set of rules. First, a list is given in (38) of segmental mappings that occur everywhere; next, a set of rules that apply in more restricted environments is given in (39); and finally, crucial orderings between the rules in (39) are given in (40).

(38) Segmental mappings from English to Burmese[144]

a. [p^h]-Transformation: 'Deaspirate [p^h] everywhere.'
   [p^h] → [p]

[144] More straightforward mappings (e.g., [ɑɪ] → [ai], [aʊ] → [au], [ow] → [ou], [ej] → [ei], [b] → [b], etc.) have been omitted for simplicity's sake.

b. [f]-Transformation: ‘Turn [f] into [p^h] everywhere.’
   [f] → [p^h]

c. [ʒ]-Transformation: ‘Turn [ʒ] into [ʃ] everywhere.’
   [ʒ] → [ʃ]

d. [θ]-Transformation: ‘Turn [θ] into [t̪θ] everywhere.’
   [ʌ] → [a]

e. [s]-Transformation: ‘Turn [s] into [s^h] everywhere.’
   [s] → [s^h]

f. [ʌ]-Transformation: ‘Turn [ʌ] into [a] everywhere.’
   [ʌ] → [a]

(39) Rules of Burmese loanword adaptation

a. Laryngeal Neutralization: ‘Turn a coda obstruent into [ʔ].’
   T → [ʔ] / ___ $]_\sigma$[145]

b. [ɔ]-Diphthongization: ‘Turn [ɔ] into [ou] before coda [ɹ].’
   [ɔ] → [ou] / ___[ɹ] $]_\sigma$

c. Schwa Strengthening: ‘Turn [ə] into [a] before coda [ɹ] and at the end of a word, into [e] before coda [l], and into some full vowel[146] before a syllable-final nasal.’
   [ə] → [a] / ___[ɹ] $]_\sigma$
   ___ $]_{PrWd}$
   [ə] → [e] / ___[l] $]_\sigma$
   [ə] → [αback, βhigh] / ___N $]_\sigma$

d. Liquid Deletion: ‘Delete a liquid at the end of a syllable or before another consonant.’
   R → Ø / ___ $]_\sigma$[147]
   ___C

e. Stop Deaspiration: ‘Deaspirate [t^h] and [k^h] everywhere except before [ɹ].’

---

[145] This formulation leads to the result that all obstruents left which are specified for [place] will automatically be onsets. In other words, the rule “filters” out the coda obstruents, making further reference to syllabification unnecessary in later rules that target onset obstruents.
[146] The choice of vowel is idiosyncratic and appears to be heavily influenced by orthography.
[147] Here, again, all liquids left after the application of this rule will automatically be onsets.

$T_{[+spread\ glottis]} \rightarrow$ [-spread glottis] / ¬ ___[ɹ]

f. [v]-Transformation: 'Turn [v] into [bw] before [i], and into [b] everywhere else.'
   (i) [v] → [bw] / ___[i] $]_\sigma$[148]
   (ii) [v] → [b]

g. Lax Vowel Glottal Epenthesis: 'Epenthesize [ʔ] after a lax vowel.'[149]
   Ø → [ʔ] / $V_{[-ATR]}$___

h. [æ]-Transformation: 'Turn [æ] into [e] in open syllables.'
   [æ] → [e] / ___ $]_\sigma$

i. Vowel Tensing: 'Make lax vowels tense in open syllables.'
   V → [+ATR] / ___ $]_\sigma$

j. [ɒ]-Transformation: 'Turn [ɒ] into [u] or [au][150] before an obstruent or nasal coda.'
   [ɒ] → [u]/[au] / ___T $]_\sigma$
   ___N $]_\sigma$

k. Coda Cluster Simplification: 'Delete a coda obstruent before another coda obstruent.'
   T → Ø / ___T $]_\sigma$

l. Nasal Epenthesis: 'Insert a nasal between [ai] or [au] and a following voiced onset consonant.'
   Ø → N / $V_{[+low]}V_{[+high]}$ ___ $]_\sigma[_\sigma$ $C_{[+vcd]}$[151]

m. Low Diphthong Glottal Epenthesis: 'Epenthesize [ʔ] after [ai] or [au] in an open syllable.'
   Ø → [ʔ] / $V_{[+low]}V_{[+high]}$___$]_\sigma$

n. Vowel Nasalization: 'Nasalize a vowel before a coda nasal.'
   V → [+nas] / ___N $]_\sigma$

---

[148] These two transformations of [v] are crucially ordered with respect to each other, so that the second rule applies in all other environments.

[149] Note that this rule does not apply in the environment between [ɪ] and [k] (e.g., *Jessica*, *Mexico*).

[150] These two segments also appear to be in free variation as the substitution for [ɒ].

[151] The conditioning environment here makes the inclusion of a complementary conditioning environment for the following glottal epenthesis rule unnecessary, as long as the glottal epenthesis rule is ordered after the nasal epenthesis rule. Note that the order could be reversed with the appropriate switch in conditioning environment for the nasal epenthesis rule. However, it really appears to be the presence of voicing in the following consonant that motivates nasal epenthesis over glottal epenthesis, as nasal epenthesis avoids the difficulty of voicing a stop consonant following a glottal stop.

o. Vowel Laxing: ‘Make tense monophthongs lax in closed syllables.’
$V \rightarrow [\text{-ATR}] / \_\_\_]_{\sigma}$

p. Creaky Phonation with Coda Cluster: ‘Assign creaky tone to a vowel followed by a coda nasal and obstruent.’
$V \rightarrow \underset{|}{V} / \_\_NT]_{\sigma}$
Cr

q. Mid Vowel Raising: ‘Raise mid vowels in closed syllables (except [ɛ] before an obstruent).’
$V_{[\text{-high, -low}]} \rightarrow [\text{+high}] / \_\_\_N]_{\sigma}$
$[ɔ] \rightarrow [\text{+high}] / \_\_\_T]_{\sigma}$

r. Nasal Deletion: ‘Delete a coda nasal after a nasalized vowel.’
$N \rightarrow Ø / V_{[+nas]}\_\_\_]_{\sigma}$

s. Creaky Phonation of [ɔ]: ‘Assign creaky tone to [ɔ] before coda obstruent.’
$[ɔ] \rightarrow [ɔ] / \_\_T]_{\sigma}$
V V
Cr

t. Pre-Creaky Coda Deletion: ‘Delete a coda obstruent following a vowel with creaky tone.’
$T \rightarrow Ø / V\underset{|}{\_\_}]_{\sigma}$
Cr

u. Onset Cluster Epenthesis: ‘Epenthesize [ə] into an onset cluster.’[152]
$Ø \rightarrow [ə] / [_{\sigma}\ C\_\_\_C_{[+cons]}V$

v. [ɹ]-Transformation: ‘Turn [ɹ] into [j] or [ɾ][153] everywhere.’
$[ɹ] \rightarrow [j]/[ɾ]$

w. Fricative Deaspiration: ‘Make aspirated fricatives unaspirated before [ə] and high front vowels.’

---

[152] But remember that most obstruent-glide clusters are permitted, thus $C_{[+cons]}$ for C_2 in the C_1C_2 cluster.
[153] There appears to be free variation between these two segments, which is the only reason this rule has been ordered with respect to the other rules in (39) instead of included among the set of segmental mappings in (38). As [ɹ] is a part of the conditioning environment for other rules, ordering [ɹ]-Transformation after the rules that refer to [ɹ] allows these other rules to refer to just one segment instead of two.

$[s^h] \rightarrow$ [-spread glottis] / $[_\sigma$ ___[ə]
$[_\sigma$ ___$V_{[+high, -back]}$

x. Onset Glottal Epenthesis: 'Insert [ʔ] before an onsetless vowel.'
Ø → [ʔ] / $[_\sigma$ ___V

(40) Crucial rule orderings

a. Laryngeal Neutralization [ɔ]-Diphthongization
[ɹ]-Transformation

b. Lax Vowel Glottal Epenthesis
[æ]-Transformation
Vowel Tensing

c. Schwa Strengthening
Liquid Deletion
Nasal Deletion [ɹ]-Transformation

d. Creaky Phonation with Coda Cluster Creaky Phonation of [ɔ]
Pre-Creaky Coda Deletion

e. Nasal Epenthesis
Low Diphthong Glottal Epenthesis
Vowel Nasalization
Vowel Laxing
Mid Vowel Raising
Nasal Deletion

f. Creaky Phonation with Coda Cluster [ɒ]-Transformation
Nasal Deletion

g. Stop Deaspiration
Onset Cluster Epenthesis
[ɹ]-Transformation Fricative Deaspiration

h. not crucially ordered:
Coda Cluster Simplification
[v]-Transformation
Onset Glottal Epenthesis

Below are a few sample derivations using these rules.

(41) Derivation[154] of *ice cream*: [ɑɪ.skɹijm] mapped onto [ai.skɹim]

INPUT	[ai.s^{h}kɹim]
Laryngeal Neutralization	does not apply
[ɔ]-Diphthongization	does not apply
Schwa Strengthening	does not apply
Liquid Deletion	does not apply
Stop Deaspiration	does not apply
[v]-Transformation	does not apply
Lax Vowel Glottal Epenthesis	does not apply
[æ]-Transformation	does not apply
Vowel Tensing	does not apply
[ɒ]-Transformation	does not apply
Coda Cluster Simplification	does not apply
Nasal Epenthesis	does not apply
Low Diphthong Glottal Epenthesis	[aiʔ.s^{h}kɹim]
Vowel Nasalization	[aiʔ.s^{h}kɹ̃im]
Vowel Laxing	[aiʔ.s^{h}kɹ̃ĩm]
Creaky Phonation with Coda Cluster	does not apply
Mid Vowel Raising	does not apply
Nasal Deletion	[aiʔ.s^{h}kɹ̃ĩ]
Creaky Phonation of [ɔ]	does not apply
Pre-Creaky Coda Deletion	does not apply
Onset Cluster Epenthesis (x 2)	[aiʔ.s^{h}ə.kə.ɹ̃ĩ]
[ɹ]-Transformation	[aiʔ.s^{h}ə.kə.j̃ĩ]
Fricative Deaspiration	[aiʔ.sə.kə.j̃ĩ]
OUTPUT	[aiʔ.sə.kə.j̃ĩ]

(42) Derivation of *golf*: [gɒlf] mapped onto [gɒlp^{h}]

INPUT	[gɒlp^{h}]
Laryngeal Neutralization	[gɒlʔ]

[154] Rules that do not apply are included in this derivation just so they can all be seen at once. They have been omitted in (42) and (43).

Liquid Deletion	[gɒʔ]
[ɒ]-Transformation	[gauʔ]
OUTPUT	[gauʔ]

(43) Derivation of *September*: [sɛp.tʰɛm.bəɹ] mapped onto [sɛp.tʰɛm.bəɹ]

INPUT	[sɛp.tʰɛm.bəɹ][155]
Laryngeal Neutralization	[sɛʔtʰɛm.bəɹ]
Schwa Strengthening	[sɛʔtʰɛm.baɹ]
Liquid Deletion	[sɛʔtʰɛm.ba]
Stop Deaspiration	[sɛʔtɛm.ba]
Vowel Nasalization	[sɛʔ.tɛ̃m.ba]
Mid Vowel Raising	[sɛʔ.tĩm.ba]
Nasal Deletion	[sɛʔ.tĩ.ba]
OUTPUT	[sɛʔ.tĩ.ba]

Revisited next is tone, which has been left out of the analysis until now.

8.3. Tone Assignment

The assignment of high tone versus low tone in loanwords seems completely idiosyncratic at first glance, but some general patterns emerge upon closer inspection of the data. First, it should be emphasized again that tone in Burmese involves not only pitch, but also phonation, duration, intensity, and vowel quality (Green 2002). Therefore, tone assignment in loanwords may actually correlate with a number of factors presented here again.

(44) Correlations of tone in loanwords

Tone	Correlations
Glottal	presence of coda obstruent, lax/short vowel
Creaky	presence of coda obstruent, lax/short vowel, morphological suffixes
High	word stress, sonorous length, morphological suffixes
Low	default tone

[155] Here English [s] → Burmese [s], in contrast the usual mapping of [s] → [sʰ].

In both the Optimality-Theoretic and rule-based analyses above, creaky tone and glottal tone are introduced as ways of manifesting the presence of a coda obstruent in an English syllable, but the assignment of high tone versus low tone seems mostly related to stress and length considerations. First, stress in pseudo-words is adapted as high tone (e.g., *LEEvee* [líbì] vs. [lìbí] *leeVEE*). Stress in loanwords also surfaces as high tone much of the time (e.g., [dʒóús^{h}ɛʔ] 'Joseph', [déíbɪʔ] 'David'). But the correlation of high tone with stress is not absolute, as there are many exceptions where a stressed syllable is not assigned high tone (e.g., [dɔ̀là] 'dollar'), where high tone surfaces on an unstressed syllable (e.g., [sələ̀ùbákíjá] 'Slovakia'), or both (e.g., [ʔɪ̃ dəjú] 'Andrew'). As for surrounding consonants, they do not appear to play a role, as high tone and low tone both occur before and after voiced and voiceless obstruents of all places of articulation as well as sonorants and nasals. To encode the assignment of high tone, we might formulate rules such as the following.

y. High Tone Assignment: 'Assign high tone to a stressed vowel.'
V́ → V
|
H

z. Low Tone Assignment: 'Assign low tone to remaining non-[ə] syllables.'
$V_{[\alpha back, \beta high]}$ → $V_{[\alpha back, \beta high]}$
|
L

And in addition to the case of word stress, we might add high tone assignment rules to cover the cases of length preservation and of spread from an adjacent high syllable. However, so many exceptions to these generalizations exist that any formulation will be unable to account for a good number of tone assignments. A prosodic analysis (e.g., Leben 1996 with English loans in Hausa, Shinohara 2002 with English loans in Japanese,

Kenstowicz and Sohn 2000 with English loans in North Kyungsang Korean) also comes up short. Ultimately, the correlations of tone are best left as general tendencies, as many tone assignments appear to be idiosyncratic.

8.4. Rules vs. Constraints

Some differences between a rule-based analysis and an OT analysis should be noted. First, in the rule-based analysis, it is possible to make less reference to syllabification via the appropriate ordering of rules that handle a certain segment in different ways according to whether it is an onset or coda (e.g., neutralization or deletion of a coda vs. transformation of an onset); however, without rule orderings, syllabification must be referred to in all of these cases.

Next, with regard to compensatory lengthening via high tone assignment after sonorous coda deletion, how can the deletion of one or many coda consonants be encoded? In OT, we might posit a constraint maximizing sonorous length, such as MAX-SON-LENGTH. However, with rules we would order the high tone assignment before coda deletion, letting it "measure" the sonorous length of a syllable in determining whether the syllable is long enough to merit high tone; on the other hand, we could also order coda deletion before high tone assignment and posit the existence of phonological "traces" scanned by the rule in determining whether compensatory lengthening via high tone assignment is necessary. In fact, the second option may be preferable if we are motivated to group tonal rules separately from segmental rules, which there is some reason to do, as tones and segments are represented separately on different tiers in autosegmental phonology, for instance.

Finally, it should be noted that the very nature of loanword phonology makes OT analysis more elegant in a way. A rule-based approach has the disadvantage of formulating phonological processes that do not necessarily apply in the native lexicon; thus, some rules are created just for the purpose of loanword adaptation out of general principles of UG. On the other hand, OT markedness constraints arise out of phonotactic

patterns which are already present in the native language; this advantage, however, is not so significant if the machinery handling loanwords is considered a phonological module separate from the native phonology. In any case, rules and constraints both do a fairly good job of accounting for the modifications made to loanwords.

8.5. Discussion

As is mentioned in §1.3.1, the level of representation of the input and the output is an important question with regard to loanwords, and Burmese loanword adaptation is no exception. In the case of Burmese, the evidence from loanwords suggests, first, that details of the source language that are non-phonemic in the source language do not form part of the input. For example, the aspiration that occurs on all voiceless stop onsets of stressed syllables in English does not translate to aspiration on the correspondents of these stops in Burmese loanword adaptations, even though aspiration is present and even phonemic in Burmese. In addition, details of the source language L2 which are non-phonemic in the native language L1 are recognized in the input, as shown by the treatment of vowel tenseness, which is not phonemic in Burmese,[156] but consistently distinguished in loanword output via glottal epenthesis. Thus, details are perceived in the foreign input that are non-phonemic in the native language; L1 phonemic categories do not filter out the non-phonemic information. The situation that obtains in Burmese loanword adaptation therefore appears to be phoneme-to-phone mapping.[157]

Another variable in loanword adaptation introduced in §1.3.2 is the source of the input. Orthography is prone to having an influence on the final adapted output if the input comes mostly in written form. With regard to the influence of orthography, Win (1998) says that foreign language films are shown in Burma without subtitles or dubbing; thus, one source of foreign input at least is devoid of orthography. However, the

[156] The tense and lax members of a pair of vowels, e.g., [i] and [ɪ], occur in complementary distribution—the tense vowel in open syllables and the lax vowel in closed syllables.
[157] The setting of English phonemic boundaries is presumably accomplished via a type of statistical analysis, as done in loanword adaptation by Korean speakers (Kang 2002).

informant tells me that in recent years, movie titles have been transcribed in Burmese with unsyllabifiable consonants put in parentheses. This transcription is done presumably by speakers with knowledge of English orthography; thus, movies may conversely perpetuate the influence of English orthography as well. In any case, as mentioned throughout § 4, the influence of orthography appears to be a factor in the adaptation of many loanwords (e.g., the different realizations of pre-nasal [ə]). Another factor confounding a clear conception of the source is that the input may not come from the source language directly. This point is raised several times in §4-7, as a number of loanwords display unexpected segments, for instance, suggesting they did not come from English directly, but through an intermediate language. In addition, some of the English loanwords in the corpus are actually borrowings in English themselves (e.g., *café, Yeshua*), thus making it even more likely that these words are borrowed into Burmese from another language besides English.

Next, the point is raised in §1.3.4 that the level of phonetic detail present in the input will depend on the speech register of the input: the more careful the register, the less likely segments and features will be lost in the input. But some features are naturally less perceptually salient than others, and when such a feature is expected in the output but is instead absent, it may be that it was simply not perceived in the input. For example, post-nasal coda [d] and [k] do not have a reflex (e.g., creaky tone) in loanword output (e.g., [bà̰] ‘bank’, [dʒà̰ʃɪ̰.ʔeiʔ] ‘Junction Eight’, [pʰɪ̰là̰] ‘Finland’, [wɪ̰̀sʰà] ‘Windsor’). We could account for the absence of a reflex by positing a rule deleting these segments after a nasal at the end of a syllable, but what seems more likely is that these segments were simply not present in the input, as post-nasal stops are not very salient to begin with and become even less salient when they agree in place and voicing with the preceding nasal. Unfortunately, there are not many examples of this type in the corpus, but the explanation referring to their absence in the input would be able to handle

possible exceptions in which they do appear to be present, in that such exceptions could be based on carefully articulated input forms.

In §1.3.5, chronology is acknowledged to have an effect on loanword adaptations. In Burmese certain groups of loanwords display different treatments of English segments, implying that these words come from two chronologically distinct waves of loans. For instance, the adaptation of the English affricate [dʒ] occurs with Burmese [dʒ] in almost all loanwords, but in the class of month names, the substitute segment is [z] (e.g., [zùlàɪ̯̃] 'July', [zʊ̃] 'June', [zà̰nəwàɾi̯] 'January'). In addition, the labiodental [v] is almost always adapted with a [b] in Burmese, but it is adapted with [w] in *Victoria*, which comes out as [wɪ̯tòùɾɪ̯jə̰], displaying a different adaptation of lax vowels and coda obstruents in the first syllable that appears to be a relic of an earlier treatment (see §3.7).

Finally, we must examine the question of whether all loanword adaptation in Burmese can be accounted for by referring to native Burmese constraints. With regard to segmentals, the answer appears to be yes. All of the segmental changes that occur are in accordance with either active processes of Burmese (e.g., vowel laxing in closed syllables) or static patterns of the language (e.g., *ɔʔ, *ai]$_{\sigma}$), under the principles of phoneme-to-phone mapping and the maintenance of English phonemic distinctions in the output. However, we may need some help from UG to interpret the pattern of tone assignment. Perhaps the action of a set of universal markedness principles governing tone or an "interlanguage" system combining universal markedness principles with Burmese tone laws is obscuring what would be otherwise be a perfect set of correlations.[158]

[158] This is the intuition of the researcher, which is supported by the fact that the informant says she "hears" the tones in English and also by the fact that there is at least one case of a Taiwanese speaker who is able to spontaneously impose tones upon "English" phonetic output (Bruce Hayes, p.c.).

9. Conclusion

This study is not without its methodological shortcomings. First, having an informant who was fluent in English, the language of the researcher, was a big help in determining glosses, and her knowledge of linguistics in particular greatly assisted in identifying and distinguishing aspects of the Burmese language. At the same time, her knowledge of English provided some interference in the production of accurate renditions of Burmese-adapted forms of English borrowings. She would sometimes indicate that she would never use Burmese phonology to pronounce certain English words because she herself possessed an English phonology. In addition, it is unclear whether some of the forms elicited may be unreliable as representatives of English borrowings; for example, the names of the Asian countries do not necessarily need to have come into Burmese, the language of a country located in Southeast Asia, from English. Finally, the relatively small size of the corpus left some gaps in the phonological spectrum that could only be filled by reference to other sources or extrapolation from existing patterns. More data from a greater number and variety of speakers would help confirm these patterns or introduce other contradictory forms to force a revision in the conception of the adaptation mechanism.

Nonetheless, the changes imposed upon English loanwords in Burmese emphasize significant differences between the two languages. Phonological inventory differences between the two languages have been made apparent (e.g., the absence of the English classes of labiodentals and rhotics in Burmese). One would probably have been able to make these sorts of conclusions about the Burmese phonetic inventory on the basis of native Burmese data alone, but the results of Burmese nativization of English forms provides solid confirmation. After all, one cannot be completely sure of the lack of particular segments in a system, for example, just because native forms elicited do not contain them; perhaps the researcher has happened somehow to unfortunately bypass words that do contain such phones. However, a speaker's active conversion of foreign

phones to different phones in their native language is concrete evidence that the lack of these phones is a systematic, rather than accidental, gap in the speaker's language. Similarly, the presence of predominantly open syllables in the words of a corpus indicates that there are most likely constraints against syllable codas in the language, but a speaker's active transformation of closed syllables from a foreign language provides further evidence for postulated syllable structure conditions. In this way, the data in this study constitute strong support for the reality of Burmese phonological constraints that might be formulated from static patterns in a native Burmese data set.

The effect of native Burmese phonotactics is seen to prevail in this study. Upon analyzing the data, one finds that a recurring theme is the non-trivial nature of projecting input forms. It is not as simple as assuming that Burmese speakers perceive an English form the same way English speakers do, as there are a number of ways in which the "obvious" input form departs from the English representation and realization, such as missing segments and additional phonological features like aspiration on fricatives. It appears the English acoustic signal is mapped onto a segmental string on a phoneme-to-phone basis, and this mapping forms the input to the Burmese loanword phonology, almost in exact agreement with the two-stage model of adaptation of Silverman (1992). After the relevant segmental correspondences are identified, phonetic and perceptual factors are the key considerations in formulating the most probable input form, supporting the emphasis of Kenstowicz (2001) and Steriade (2002) on the importance of perceptual salience in loanword adaptation. Orthography and chronology can also play a role in the final shape of the adaptations. On the other hand, counting up the number of repair steps within a constraint domain as in Paradis (1996) does not appear to be relevant here. Coda consonants are deleted even when they would only require two steps to fix. For example, [ɔt] could be repaired by (1) Vowel Epenthesis and (2) Schwa Strengthening, but *[ɔ.ta] does not occur; instead [ɔt] → [ɔ̯].

Of course, still more work needs to be done on the topic of loanwords in Burmese. A sufficiently general explanation could not be found for tone assignment in loanwords, and whether there is a more regular pattern that remains undiscovered or whether this process is truly idiosyncratic is a question that must be left for future research.

Appendix: Loanword Data[159]

Collected Loanwords

Form	*Gloss*
1. [ʔə.kè.ɾə.mì]	‘academy’
2. [ʔà.pʰə.ɾi̯.ka̰]	‘Africa’
3. [ʔə.mèi.jí.ká] ~ [ʔə.mèi.jí.ka̰][160]	‘America’
4. [ʔè.mǐ]	‘Amy’
5. [ʔɪ̃.də.jú]	‘Andrew’
6. [ʔèi.pjĩ]	‘April’
7. [ʔà.teiʔ t̪θə.mouʔ.də.jà][161]	‘Arctic Ocean’
8. [ʔà.dʒɪ̃.tí.ná]	‘Argentina’
9. [ʔà.ʃa̰]	‘Asia’
10. [ʔaʔ.tə.lɑ̃.teiʔ t̪θə.mouʔ.də.jà][162]	‘Atlantic Ocean’
11. [ʔɔ̀.gouʔ]	‘August’
12. [ʔɑ̃.tĩ]	‘auntie’
13. [ʔɔ̀.sə.téi.li̯.ja̰] ~ [ʔɔ̀.sə.téi.lí.já]	‘Australia’
14. [bì.ʔèi]	‘B.A.’ (degree)
15. [bì.ʔɛʔ.sì]	‘B.Sc.’ (degree)
16. [bɔ̀ lóṵ][163]	‘ball’
17. [bèɪ̃.gə.là.dɛʔ] ~ [bɑ̃.gə.là.dɛʔ]	‘Bangladesh’
18. [bɑ̃]	‘bank’
19. [bá]	‘bar’ (place to drink, law school exam)
20. [bà.bə.jà]	‘Barbara’
21. [bì.jà]	‘beer’
22. [bɛʔ.t̪θə.li̯.hɑ̃]	‘Bethlehem’
23. [bàɪ̃.sə.kè]	‘bicycle’
24. [bì.lə.kə.li̯ɪ̃.tĩ]	‘Bill Clinton’

[159] Following the standard IPA system, low tone is marked with a grave accent [à], high tone with an acute accent [á], creaky (phonetically high) tone with a tilde below the vowel [a̰], and glottal (phonetically high) with a glottal stop [aʔ]. Items are listed in alphabetical order by gloss.

[160] In most cases, including the case of *America*, a glide adaptation [j] of English /ɹ/ is interchangeable with a flap adaptation [ɾ] and vice versa. Transcriptions include the segment produced by the informant, but tokens where one adaptation is clearly preferred have been marked as such.

[161] [t̪θəmouʔdəjà] ‘ocean’.

[162] [t̪θəmouʔdəjà] ‘ocean’.

[163] [lóṵ] = classifier for round objects.

25. [bɪʔ.sə.kɪʔ][164]	‘biscuit’
26. [bóũ̃]	‘bomb’
27. [bʊʔ pʰə.naʔ][165]	‘boot’
28. [bɔ̀.sə.tʊ̃̀]	‘Boston’
29. [bwáĩ̃][166]	‘boy’
30. [bə.ɾeiʔ]	‘brake’
31. [bɨ̀.ɾɔ̀]	‘bureau’
32. [bʌʔ.sə.ká] < *bus* + *car*	‘bus’
33. [kə.pʰé] ~ [kə.pʱ̃i]	‘café’
34. [keiʔ]	‘cake’
35. [kɛʔ.pə.tèĩ̃]	‘captain’
36. [ká]	‘car’
37. [kaʔ pjá][167]	‘card’
38. [kɛʔ.sʰɛʔ]	‘cassette’
39. [sɨ̀.ði]	‘CD’
40. [ʃã̀.péĩ̃]	‘champagne’
41. [tʃʰá]	‘Charles’
42. [tʃʰè.bɨ̀]	‘Chevy’
43. [tʃʰɔ́.kə.lɛʔ][168]	‘chocolate’
44. [kʰə.ɾɪʔ][169]	‘Christ’
45. [sɨ́.kə.ɾɛʔ]	‘cigarette’
46. [sɪʔ.tɨ́.maʔ] ~ [sɪʔ.tɨ̃.maʔ]	‘City Mart’ (store name)
47. [kə.lɪʔ]	‘clip’ (for hair)
48. [kə.lʌʔ]	‘club’
49. [kə.lʌʔ]	‘clutch’ (in a car)
50. [kòù.kà.kòù.là]	‘Coca-Cola’
51. [kɔ̀.pʱ̃i]	‘coffee’
52. [kwàĩ̃ tɛʔ.tè][170] < *coil* + verb	‘to get in hot water’

[164] Win (1998) has [bi.sə.kʊʔ].
[165] [pʰənaʔ] ‘footwear’.
[166] Used most often in the term [bwàĩ̃ kəlaʔ] ‘Indian manservant’. Note the tonal alternation.
[167] [pjá] = classifier for flat objects.
[168] Green (2002) has [tʃʰo̰.kə.lɛʔ], with creaky tone on the first vowel, while Win (1998) has [tʃʰɔ́.kə.lɛʔ], as above.
[169] The adaptation with a flap, [kʰəɾɪʔ], is more common than that with a glide, [kʰəjɪʔ].
[170] The form [kwàĩ̃] (< *coil*) is only used in the expression [kwàĩ̃ tɛʔtè] ‘to get in hot water, get in trouble’, slang usage that extends the meaning of *coil* from its original reference to the heating coil of a stove. The verb [tɛʔtè] literally means ‘to climb, go up’.

53. [kɔ́.leiʔ]	‘college’
54. [kòùˇ.pjù.tà]	‘computer’
55. [kʰə.jĭˇ.sʰòù.dà]	‘cream soda’
56. [déí.bɪʔ]	‘David’
57. [đi.zĭˇ.bà]	‘December’
58. [dàĭˇ.jà.nà]	‘Diana’
59. [dàĭˇ.jà.jĭ]	‘diary’
60. [dàĭˇ.nòù.sɔ́]	‘dinosaur’
61. [dà.ɾaiʔ.tà]	‘director’
62. [dɪʔ.sə.kòù]	‘disco’
63. [dʒù.ťi.kouʔ] < *duty coat*	‘doctor’s coat’
64. [dɔ̀.là]	‘dollar’
65. [də.ɾàĭˇ.βà]	‘driver’
66. [də.ɾàˇ]	‘drum’
67. [ʔi.dʒɪʔ]	‘Egypt’
68. [ʔi.lɪʔ.zə.bɛʔ]	‘Elizabeth’
69. [ʔi.méí]	‘e-mail’
70. [ʔĭˇ.gə.làˇ]	‘England’
71. [ʔĭˇ.gə.leiʔ]	‘English’
72. [ʔi.kwèĭ.tà]	‘equator’
73. [ʔi.t̪θi.jɔ́.pí.já]	‘Ethiopia’
74. [ʔù.jɔ́.pa̱]	‘Europe’
75. [pʰèi.pʰə.wà.ɾĭ]	‘February’
76. [pʰàĭˇ]	‘file’ (of papers)
77. [pʰə.lĭˇ]	‘film’ (for camera)
78. [pʰĭˇ.làˇ]	‘Finland’
79. [pʰʊʔ]	‘Ford’
80. [pʰàùˇ]	‘form’ (to fill out)
81. [gɛʔ]	‘gas’ (for stove)
82. [dʒɔ̱]	‘George’
83. [dʒà.mə.nĭ]	‘Germany’
84. [gauʔ]	‘golf’
85. [gĭ.tà]	‘guitar’
86. [hàˇ.bà.gà]	‘hamburger’
87. [há.bʌʔ]	‘Harvard’

88. [pʰóú] < *four*[171]	‘heroin’
89. [hʊ̃˨˩.dà]	‘Honda’
90. [hɔ̰˨˩.dɔ̰]	‘hot dog’
91. [ʔaiʔ.sə.kə.jɪ̃˥]	‘ice cream’
92. [ʔɛ̀ɪ̃˨˩.də.ɾḭ.ja̰]	‘India’
93. [ʔɪ̃˨˩.dòù.nî.ʃá]	‘Indonesia’
94. [pʰi.lɪ̃˥] < *feeling*	‘inspiration’[172]
95. [ʔɪʔ.zə.jéî]	‘Israel’
96. [dʒɛʔ]	‘Jack’
97. [dʒɛʔ.kɛʔ][173]	‘jacket’
98. [zà˨˩˦.nə.wà.ɾi]	‘January’
99. [dʒə.pà˨˩˦]	‘Japan’
100. [dʒɪ̃˥]	‘jeans’
101. [jɛ̀i.jṵ.wa̰.lɪ̃˥]	‘Jerusalem’
102. [dʒɛʔ.sì.kà]	‘Jessica’
103. [jè.ʃṵ] < *Yeshua*	‘Jesus’
104. [dʒʊ̃˥]	‘John’
105. [dʒɔ̀.nǐ]	‘Johnny’
106. [dʒóú.sʰɛʔ]	‘Joseph’
107. [dʒwáɪ̃˥]	‘Joy’ (restaurant name)
108. [zù.làɪ̃˥]	‘July’
109. [dʒà˨˩˦.ʃɪ̃˨˩˦.ʔeiʔ]	‘Junction Eight’ (store name)
110. [zʊ̃˥]	‘June’
111. [kɛʔ.t̰θə.jɪ̃˥]	‘Katherine’
112. [kɪ̃˥]	‘king’
113. [lɔ́]	‘Laos’
114. [lɪ̃.bà.t̃i] ~ [lè.bà.t̃i]	‘liberty’
115. [lɪʔ.bɪ̃˨˩˦.kà.là]	‘Living Color’ (store name)
116. [meiʔ.kʌʔ]	‘make-up’
117. [mə.léî.ʃá]	‘Malaysia’
118. [maʔ]	‘March’
119. [mà.gə.jɛʔ]	‘Margaret’

[171] Referring to the fourth stage of purification of heroin.
[172] Slang usage.
[173] This alternates with the less common [dʒàkɪ̃˥] < *gherkin* (a type of light rain jacket).

120. [mèi]	‘May’
121. [mà.zə.dà]	‘Mazda’
122. [hauʔ.sʰà.dʒĭ˜] < *house surgeon*	‘medical resident’
123. [mà.sì.tí]	‘Mercedes’
124. [mɛʔ.t̪θə.dɪʔ]	‘Methodist’
125. [mɛʔ.sʱi.kòù][174]	‘Mexico’
126. [maiʔ.kè.dʒɛʔ.sʱĭ˜]	‘Michael Jackson’
127. [mɔ̀.tɔ̀.bouʔ]	‘motorboat’
128. [nèi.ʃĭ˜.nè]	‘national’
129. [nè.ðà.lã˜]	‘Netherlands’
130. [nə.jú.jauʔ]	‘New York’
131. [nì.kóú]	‘Nicole’
132. [naiʔ.kə.lʌʔ]	‘nightclub’
133. [nì.sʰã́˜]	‘Nissan’
134. [nòù.wĭ˜.bà]	‘November’
135. [nã˜.bʌʔ]	‘number’
136. [nàĭ˜.lŭ˜]	‘nylon’
137. [ʔauʔ.tòù.bà]	‘October’
138. [pə.s̪i̪.pʰeiʔ][175]	‘Pacific’
139. [bɔ́.pĭ˜] < *ball(point) pen*	‘pen’
140. [pĭ˜.gwĭ˜]	‘penguin’
141. [pɛʔ.pə.sì] ~ [pɛʔ.sì]	‘Pepsi’
142. [pʱi.lɪʔ.pàĭ˜]	‘Philippines’
143. [pʰóú˜]	‘phone’
144. [pì.zà]	‘pizza’
145. [pə.laʔ.sə.tɪʔ]	‘plastic’
146. [pòù.lã˜]	‘Poland’
147. [pòù.là.bé]	‘polar bear’
148. [pə.leiʔ]	‘police’
149. [pàŭ˜.dà]	‘powder’
150. [kwèi.kà.ʔouʔ][176]	‘Quaker Oats’
151. [kwĭ˜]	‘queen’

[174] In fast speech, the glottal stop disappears, leaving [mɛsʱikòù].
[175] Always occurs with [t̪θəmouʔdəjà] ‘ocean’.
[176] In fast speech, [kwèikàouʔ].

152. [jèǐ.đi.jòù]	‘radio’
153. [ɾàǐ̃.pʰè]	‘rifle’
154. [ɾà.bà]	‘rubber’
155. [jà̃]	‘rum’
156. [jʉ̟.ʃá]	‘Russia’
157. [sə.kɔ̟]	‘Scott’
158. [sɛʔ.tǐ̃.bà]	‘September’
159. [ʃʌʔ ʔéǐ̃.dʒǐ][177]	‘shirt’
160. [ʃú pʰə.naʔ][178]	‘shoe’
161. [sʰaiʔ.ká]	‘sidecar’ (bike with seat attached on side)
162. [sǐ̃.gà.pù]	‘Singapore’
163. [sʰaiʔ]	‘size’
164. [sə.kʌʔ]	‘skirt’
165. [sə.lòù.bá.kǐ.já] ~ [sə.lòù.bɛʔ.kǐ.já]	‘Slovakia’
166. [sə.pèǐ̃]	‘Spain’
167. [sə.pà.kə.lǐ̃]	‘sparkling’ (soda)
168. [sə.pə.jaiʔ]	‘Sprite’
169. [t̪θǐ.ɾi̟.lǐ̃.gà]	‘Sri Lanka’
170. [sə.teiʔ.ʃóú]	‘stage show’ (concert)
171. [sə.tǐ.jà.ɾàǐ̃]	‘steering wheel’
172. [sə.tóú]	‘store’
173. [sə.tàǐ̃]	‘style’
174. [sʰwè.tà]	‘sweater’
175. [sʰwǐ.zà.là̃]	‘Switzerland’
176. [tǐ.bǐ] ~ [tǐ.bwǐ] < *T.V.*	‘television’
177. [tʰáǐ̃] ~ [jóú.đǐ.já][179]	‘Thailand’
178. [t̪i̟.bɛʔ]	‘Tibet’
179. [tà.jà]	‘tire’ (of a car)
180. [tòù.jòù.tà]	‘Toyota’
181. [tʰə.ɾʌʔ.ká] < *truck* + *car*	‘truck’
182. [ʔà̃.kè]	‘uncle’
183. [jù.nǐ.bà.sǐ.tǐ]	‘university’

[177] [ʔéǐ̃ dʒǐ] ‘top, shirt’.
[178] [pʰənaʔ] ‘footwear’.
[179] [jóúđíjá] < Sanskrit *ayodhya*.

184. [bi̋.đi.jɔ̀] ~ [bwi̋.đi.jɔ̀] < *video*	‘VCR’, ‘videotape’
185. [wi̯.tòù.ɾi̯.ja̯]	‘Victoria’
186. [wi̋.sə.ki̋]	‘whiskey’
187. [wi̋˜.dà.mi̋.jà]	‘Windermere’ (street name)
188. [wi̋˜.sʰà]	‘Windsor’
189. [wàĩ˜]	‘wine’

Online Adaptations

190. [bɛʔ]	‘bad’
191. [kã̯ũ̯]	‘count’
192. [dʒɛʔ.sʰi̋˜]	‘Jetson’
193. [sə.pʰĩ̯]	‘Sphinx’

Pseudowords

194. [pʰɛʔ]	‘fet’ [fɛt]
195. [pʰouʔ]	‘fode’ [fowd]
196. [pʰóú]	‘fole’ [fowl]
197. [pʰouʔ]	‘fote’ [fowt]
198. [pʰáũ˜]	‘fow’ [faʊ]
199. [pʰáũ˜]	‘fown’ [faʊn]
200. [gɛʔ]	‘gad’ [gæt]
201. [gɛʔ]	‘gat’ [gæt]
202. [gə.lɛʔ]	‘glab’ [glæb]
203. [hĩ̯.s]	‘hanst’ [hænst]
204. [hʌʔ.s]	‘hulst’ [hʌlst]
205. [hʌʔ.s]	‘hults’ [hʌlts]
206. [dʒáĩ˜]	‘jigh’ [dʒɑɪ]
207. [dʒáĩ˜]	‘jine’ [dʒɑɪn]
208. [lĩ˜.sʰ]	‘lants’ [lænts]
209. [la̯.s]	‘larst’ [lɑɹst]
210. [la̯.s]	‘larts’ [lɑɹts]
211. [laʔ]	‘lasked’ [læskt]
212. [li̋.bá]	‘leeba’ [lij.ˈbɑ]

213. [lǐ.bà]	‘leeba’ [ˈlij.bɑ]
214. [lǐ.bǐ]	‘leevee’ [lij.ˈvij]
215. [lǐ.bǐ]	‘leevee’ [ˈlij.vij]
216. [lɪ̀.s]	‘lixed’ [lɪkst]
217. [lí.s] ~ [lɪʔ.kə.sə.t̪θaʔ]	‘lixth’ [lɪksθ]
218. [kwî]	‘queel’ [kʰwijl]
219. [sə.lɛʔ]	‘slag’ [slæg]
220. [swáĩ̃]	‘swile’ [swɑɪl]
221. [beiʔ]	‘vade’ [vejd]
222. [beiʔ]	‘vate’ [vejt]
223. [b̪i]	‘veed’ [vijd]
224. [bǐ.lǐ]	‘veelee’ [vij.ˈlij]
225. [bǐ.lǐ]	‘veelee’ [ˈvij.lij]
226. [b̪i]	‘veet’ [vijt]
227. [bɪʔ]	‘vid’ [vɪd]
228. [baiʔ]	‘vide’ [vɑɪd]
229. [bɪʔ]	‘vit’ [vɪt]
230. [baiʔ]	‘vite’ [vɑɪt]
231. [bóũ̃]	‘vome’ [vowm]
232. [bóũ̃]	‘vone’ [vown]
233. [bʊʔ]	‘vood’ [vʊd]
234. [bʊʔ]	‘voot’ [vʊt]
235. [bɔ́]	‘vore’ [vɔɹ]
236. [bauʔ]	‘voud’ [vaʊd]
237. [bauʔ]	‘vout’ [vaʊt]
238. [b̪u]	‘vude’ [vuwd]
239. [b̪u]	‘vute’ [vuwt]

Data from Green (2002)

240. [ʔə.pə.ɾǐ.ʃə.jeiʔ]	‘appreciate’
241. [bouʔ.d̪a][180] < Pali *buddha*	‘Buddha’
242. [kɛʔ]	‘cap’
243. [kouʔ]	‘coat’

[180] Win (1998) has [bouʔdá], with high tone instead of creaky on the last vowel.

244. [sʰàĩ̃.kə.lóṵ́̃]	‘cyclone’
245. [ʔḭ̃̃.dʒḭ̃̃]	‘engine’
246. [tʰà.pə.nà] < Pali *hapanā*	‘enshrine’
247. [gə.laiʔ.dà]	‘glider’
248. [ʔàĩ̃.ʔɔ̀.dḭ̃̃]	‘iodine’
249. [nɛʔ.tàĩ̃]	‘necktie’
250. [pã̰ĩ]	‘pint’
251. [ʔà.kà.t̪θa̰] < Pali *ākāsa*	‘space, universe’
252. [tjù.lɪʔ][181]	‘tulip’
253. [taiʔ.pʰʊ̰̃]	‘typhoon’

Data from Win (1998)

254. [kʊ̰̃.pə.ɾḭ̃̃]	‘conference’
255. [kʊ̰̃.gə.ɾɛʔ]	‘Congress’
256. [kə.jáṵ́̃]	‘crown’
257. [dè.l̃i.geiʔ]	‘delegate’
258. [dàĩ̃.à.kʰ̃i]	‘diarchy’
259. [dḭ̃̃.ná.pà.l̃i]	‘dinner party’
260. [dɔ̀.mĭ.nĭ.jà̰̃]	‘dominion’
261. [dʒĭ.sĭ.bĭ.è]	‘G.C.B.A.’
262. [l̃ḭ̃̃.đi.pḭ̃̃.dḭ̃̃]	‘independent’
263. [kḭ̃̃.dʒo̰]	‘King George’
264. [l̃i.mʊ̰̃]	‘lemon’
265. [mà.nè.dʒà]	‘manager’
266. [mʊ̰̃.tè.gù]	‘Montague’
267. [mà.ðà.bà.mà]	‘Mother Burma’
268. [mjù.nĭ.sĭ.pè]	‘municipal’
269. [nə.jú]	‘new’
270. [a.wa.dé]	‘Our Day’
271. [pè.nə.sə.l̃ḭ̃̃]	‘penicillin’
272. [pə.là.sə.tà]	‘plaster’

[181] The informant indicated that she would not produce this form. The forms [tə.jú.lɪʔ], [tʃú.lɪʔ], and [tú.lɪʔ] are all preferable.

273. [pà.wà]	‘power’
274. [kwɪ̃.dʒɚ.mè.ɾi]	‘Queen George Mary’
275. [sʰà.kə.ɾɛʔ.dauʔ]	‘Sir Craddock’
276. [tè.li.pʰóũ˜]	‘telephone’
277. [tè.li.bè.ʃɪ̃˜]	‘television’
278. [bwàɪ̃˜.ɔ.lɛʔ]	‘violet’
279. [bɔ̀.là˜.ti.jà]	‘volunteers’
280. [ʍ̥aiʔ.kɔ̀.mɪ̀.ti]	‘White Committee’

References

Armstrong, Lilias and Pe Maung Tin. 1925. *A Burmese Phonetic Reader*. London: University of London Press.

Beckman, Jill. 1998. *Positional Faithfulness*. Amherst, MA: University of Massachusetts, Amherst, Ph.D. dissertation.

Blevins, Juliette. 2003. "Consonant Epenthesis: Natural and Unnatural History." Talk given at "Explaining Linguistic Universals: Historical Convergence and Universal Grammar" workshop. University of California, Berkeley, 7 Mar. 2003.

---. 1995. "The Syllable in Phonological Theory." *The Handbook of Phonological Theory*. Ed. John A. Goldsmith. Cambridge: Blackwell, 206-44.

Broselow, Ellen. 2000. "Stress, Epenthesis, and Segment Transformation in Selayarese Loans." Ms., State University of New York, Stony Brook.

Broselow, Ellen, Su-I Chen and Chilin Wang. 1998. "The Emergence of the Unmarked in Second Language Phonology." *Studies in Second Language Acquisition* 20, No. 2, 261-280.

Burenhult, Niclas. 2001. "Loanword Phonology in Jahai." *Lund University Working Papers* 48, 5-14.

Burling, Robbins. 1967. "Proto Lolo-Burmese." *International Journal of American Linguistics* 33, No. 2, 13-15.

Clements, G. 1990. "The Role of Sonority Cycle in Core Syllabification." *Between the Grammar and the Physics of Speech*. Ed. J. Kingston and M. Beckman. New York: Cambridge University Press.

Cornyn, William. 1944. "Outline of Burmese Grammar." *Language* 20, No 4., suppl. 3-34. Baltimore: Waverly Press.

Danesi, Marcel. 1985. "Loanwords and Phonological Methodology." *Studia Phonetica* 20, 1-58.

Dell, G., K. Reed, D. Adams and A. Mejer. 2000. "Speech Errors, Phonotactic Constraints and Implicit Learning: A Study of the Role of Experience in Language Production." *Journal of Experimental Phonology* (LMC) 26, No. 6, 1355-1367.

Dupoux, E., K. Kakehi, Y. Hirose, C. Pallier and J. Mehler. 1999. "Epenthetic Vowels in Japanese: A Perceptual Illusion?" Ms., EHESS-CNRS Paris, Nagoya University, City University of New York.

Fleischhacker, Heidi. 2002. "Cluster-Dependent Epenthesis Asymmetries." Ms., University of California, Los Angeles.

Floccia, Caroline, Jeremy Goslin, Naanaa Bouketir, and Joël Bradmitz. "Consonant Cluster Syllabification in Pre-Literate Children." Ms., Université de Franche-Comté, France; Université de Genève, Switzerland; University of Sheffield, UK.

Fukazawa, Haruka. 1998. "Multiple Input-Output Faithfulness Relations in Japanese." Ms., University of Maryland, College Park.

Gouskova, Maria. 2002. "Falling Sonority Onsets, Loanwords, and Syllable Contact." *CLS 37: The Main Session, Papers from the 37th Meeting of the Chicago Linguistics Society* 1. Ed. Mary Andronis, Christopher Ball, Heidi Elston and Sylvain Neuvel. Chicago: Chicago Linguistics Society.

Green, Antony Dubach. 2002. "Word, Foot, and Syllable Structure in Burmese." Ms., University of Potsdam.

---. 1995. "The Prosodic Structure of Burmese: A Constraint-Based Approach." *Working Papers of the Cornell Phonetics Laboratory* 10, 67-96.

Hale, Mark and Charles Reiss. 2000. "Phonology as Cognition." Ms., Concordia University, Montréal.

---. 1997. "Formal and Empirical Arguments Concerning Phonological Acquisition." Ms. Concordia University, Montréal.

Haugen, E. 1950. "The Analysis of Linguistic Borrowing." *Language* 26, 210-31.

Haunz, Christine. 2002. "The Role of Speech Perception in the Adaptation of Loanwords." Ms., University of Edinburgh.

Hyman, Larry. 1970. "The Role of Borrowings in the Justification of Phonological Grammars." *Studies in African Linguistics* 1, 1-48.

Inkelas, Sharon. 1998. "Phonotactic Blocking Through Structural Immunity." Ms., University of California, Berkeley.

Itô, Junko, Armin Mester and Jaye Padgett. 1995. "NC: Licensing and Underspecification in Optimality Theory." Ms., University of California, Santa Cruz.

Jones, Robert. 1960. "Prolegomena to a Phonology of Old Burmese." *Southeast Asian History and Historiography*. Ed. C. D. Cowan and O. W. Wolters. Ithaca, NY: Cornell University Press, 43-50.

Jones, Robert and U Khin. 1953. *The Burmese Writing System*. Washington, DC: American Council of Learned Societies.

Kager, René. 1999. *Optimality Theory*. Cambridge: Cambridge University Press, 91-140.

Kang, Yoonjung. 2002. "Perceptual Similarity in Loanword Adaptation: The Case of Adaptation of English Post-Vocalic Word-Final Stops to Korean." Ms., State University of New York, Stony Brook.

Kenstowicz, Michael. 2003. Lecture. 24.964 "Topics in Phonology," Massachusetts Institute of Technology, 4 Mar. 2003.

---. 2002. Review of Hume and Johnson 2001, *The Role of Speech Perception in Phonology*, Academic Press.

---. 2001. "The Role of Perception in Loanword Phonology." Ms., Massachusetts Institute of Technology, Institut de Linguistique et Phonétique Générales et Appliquées. Review of Flavien Gbéto, *Les emprunts linguistiques d'origine européenne en Fon*.

Kenstowicz, Michael and Hyang-Sook Sohn. 2000. "Accentual Adaptation in North Kyungsang Korean." *Ken Hale: A Life in Language*. Ed. Michael Kenstowicz. Cambridge, MA: MIT Press.

Khin, U. 1976. *Spoken Burmese*. Vol. 1. Washington: Department of State Foreign Service Institute.

LaCharité, Darlene and Carole Paradis. 2002. "Addressing and Disconfirming Some Predictions of Phonetic Approximation for Loanword Adaptation." *Langues et linguistique* 28, 71-91.

Leben, William. 1996. "Tonal Feet and the Adaptation of English Borrowings into Hausa." *Studies in African Linguistics* 25, 139-54.

Lee, Juhee. 2001. "Systematic Patterns of Epenthetic Vowels with Special Reference to English Loanwords in Korean." Ms., University of Essex.

Mînn Latt, Yêkháun. 1966. *Modernization of Burmese*. Prague: Oriental Institute in Academia.

Okell, John. 1969. *A Reference Grammar of Colloquial Burmese*. London: Oxford University Press, 241.

Paradis, Carole. 1996. "The Inadequacy of Filters and Faithfulness in Loanword Adaptation." *Current Trends in Phonology: Models and Methods*. Ed. Jacques Durand and Bernard Laks. Salford: University of Salford Publications, 509-34.

Paradis, Carole and Darlene LaCharité. 2001. "Guttural Deletion in Loanwords." *Phonology* 18, 255-300.

Pater, Joe. 1996. "Austronesian Nasal Substitution and Other NÇ Effects." Ms., McGill University.

Peperkamp, Sharon. 2002. "On the Learnability of Loanword Adaptations." Ms., University of Paris.

Peperkamp, Sharon and Emmanuel Dupoux. 2001. "Loanword Adaptations: Three Problems for Phonology (and a Psycholinguistic Solution)." Ms., Laboratoire de Sciences Cognitives et Psycholinguistique, Paris, Université de Paris 8.

Prince, Alan and Paul Smolensky. 1993. "Optimality Theory: Constraint Interaction in Generative Grammar." *Rutgers University Center for Cognitive Science Technical Report* 2.

Salanova, Andrés Pablo. 2002a. "Differential Rates of Compliance to Phonotactic Constraints in Loanword Adaptation." Ms., Massachusetts Institute of Technology.

Salanova, Andrés Pablo. 2002b. "Some Remarks on Loanword Nativization, Prompted by Davidson & Noyer's *Loan Phonology in Huave*." Ms., Massachusetts Institute of Technology.

Shinohara, Shigeko. 2002. "Accentual Adaptations of Foreign Words in Japanese." Workshop on "Integrating foreign words" at the 24th Annual Meeting of DGfS 27 Feb – 1 Mar 2002.

---. 2000. "Emergence of Universal Grammar in Foreign Word Adaptations." Ms., University of Paris.

Silverman, David. 1992. "Multiple Scansions in Loanword Phonology: Evidence from Cantonese." *Phonology* 9, 298-328.

Smith, Samuel F. 1862. "The English Instructor." Newton Centre.

Smolensky, Paul, Lisa Davidson and Peter Jusczyk. 2002. "The Initial and Final States: Theoretical Implications and Experimental Explorations of Richness of the Base." Ms., Johns Hopkins University.

Steriade, Donca. 2003a. Lecture. 24.964 "Topics in Phonology," Massachusetts Institute of Technology, 4 Feb. 2003.

---. 2003b. Lecture. 24.964 "Topics in Phonology," Massachusetts Institute of Technology, 11 Feb. 2003.

---. 2002. "The Phonology of Perceptibility Effects: The P-Map and Its Consequences for Constraint Organization." Ms., University of California, Los Angeles.

---. 2001. "Directional Asymmetries in Place Assimilation: A Perceptual Account." *The Role of Speech Perception in Phonology*. Ed. Elizabeth Hume and Keith Johnson. San Diego, CA: Academic Presse.

Stewart, J. A. 1936. *An Introduction to Colloquial Burmese*. Rangoon: British Burma Press, 1-17.

Tonks, Patrick and Katherine Demuth. 2002. "Sesotho Loanwords: Morphophonological versus Semantic Incorporation." Workshop on "Integrating foreign words" at the 24th Annual Meeting of DGfS 27 Feb – 1 Mar 2002.

Uffmann, Christian. 1999. "Vowel Epenthesis in Loanword Adaptation." Ms., McGill University, Philipps-Universität Marburg.

Ussishkin, Adam and Dafna Graf. 2002. "Loanword Phonology in Modern Hebrew." Workshop on "Integrating foreign words" at the 24th Annual Meeting of DGfS 27 Feb – 1 Mar 2002.

Vaux, Bert. 2003. "Syllabification in Armenian, Universal Grammar, and the Lexicon." *Linguistic Inquiry* 34, No. 1, 91-125.

---. 2002. "Markedness Relations Among Laryngeal Features." Ms., Harvard University.

---. 1998. "The Laryngeal Specifications of Fricatives." *Linguistic Inquiry* 29, No. 3, 497-511. Cambridge, MA: MIT Press.

Wheatley, Julian. 1987. "Burmese." *The World's Major Languages*. Ed. B. Comrie. New York: Oxford University Press, 834-854.

Win, Than Than. 1998. *Burmese-English Accent: Description, Causes, and Consequences*. Dekalb, IL: Northern Illinois University, Ph.D. dissertation.

Yu, Alan. 2002. "Explaining Coda Voicing in Lezgian." Ms., University of California, Berkeley.