CHAPTER TWELVE

THE TYPOLOGY OF POSITION-QUALITY INTERACTIONS IN LOANWORD VOWEL INSERTION[1]

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1. Introduction

The central question of phonology is how speakers generalize beyond the data to which they have been exposed. One fruitful avenue of investigation is through the study of loanwords, since foreign forms often confront speakers with structures that do not appear in their native language. This paper will focus on one problem in the adaptation of borrowed words: how speakers adapt foreign words beginning in consonant sequences when their native language not only lacks complex onsets, but also lacks alternations that would provide evidence favoring any specific repair of such structures. A survey of the adaptation of complex onsets reveals that speakers of a wide range of languages have converged on similar strategies, in which different repairs are used for different types of onset clusters. The emergence of similar adaptation patterns across genetically and geographically diverse languages raises two questions: first, why do certain repair patterns emerge even in the absence of apparent support from the data of either the native or the foreign language? And second, why should these particular patterns be

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widely attested across a range of recipient and source languages, while other logically possible patterns are rare or non-existent?

Speakers of languages that forbid complex syllable onsets have the choice of two major strategies for bringing foreign consonant sequences into conformity with native language restrictions: deletion of consonants or insertion of vowels. Although consonant deletion does occur (e.g., Cantonese [fisa] 'freezer', Yip 1993; Finnish [ranta] 'strand' from Swedish *strand*, Young-Scholten & Archibald 2000), a more common strategy is insertion of a vowel to restructure an onset cluster into separate syllables (Brasington 1981; Uffmann 2006, 2007).[2] Where vowel insertion is the preferred repair for complex onsets, biconsonantal clusters admit two possible positions for an inserted vowel—either before or inside the consonant cluster—while longer onsets admit additional possibilities. Speakers are also faced with a choice in the quality of the inserted vowel, which may be an invariant default, a contextually-determined vowel which copies some or all the features of a nearby vowel and/or a neighboring consonant, or some combination of these options.

A number of studies have focused on the position of inserted vowels (e.g., Broselow1983, 1992a, 1992b; Fleischhacker 2001, 2005), while other studies have examined the quality of inserted vowels in borrowed words (e.g., Kitto & de Lacy 1999; Rose & Demuth 2006; Uffmann 2006, 2007). To date, however, there has been no systematic investigation of the connection between the position of the inserted vowel and its quality. While these two factors, position and quality, are in principle independent, I will present evidence that they do, in fact, interact in many languages, in a specific way: the vowel inserted in pre-cluster position is an invariant default, while the vowel inserted between two initial consonants is contextually determined. This pattern is attested across a range of source and recipient languages, while the opposite pattern appears never to occur. I will investigate possible explanations for this emergent pattern, suggesting that the copy vowels that appear inside onset clusters may arise in the mapping of the foreign surface structure to a phonological representation.

In §2, I review the facts of positional variation in vowel insertion as well as previous accounts of this variation. §3 provides an overview of the interaction between the position and the quality of the inserted vowel, while §4 outlines possible analyses of this interaction, followed by a summary in §5.

[2] This strong preference for vowel insertion over consonant deletion does not extend to coda position (Brasington 1981). The asymmetries in the adaptation of initial and final clusters is another interesting typological question, but beyond the scope of this paper.

2. Position of inserted vowels

Biconsonantal onsets present two possible sites for vowel insertion (where "V" indicates an underlying and "v" an inserted vowel): anaptyxis places the vowel within the cluster (CCV > Cv.CV) while prothesis places the vowel before the cluster (CCV > vC.CV).[3] For languages lacking syllable codas, the only possible vowel insertion site is following each non-prevocalic consonant. The more interesting cases, however, involve languages that permit syllable codas, since such languages in principle permit a choice of insertion site. For speakers whose native language provides no internal evidence for restrictions on possible coda consonants or preference for particular syllable contacts, the following repair strategies should all be feasible:

(1) Logically possible repair patterns

a. consistent Cv.CV
b. consistent vC.CV
c. random choice of Cv.CV or vC.CV

Yet the actual distribution is heavily skewed in favor of anaptyxis (Cv.CV). Fleischhacker's 2005 survey of vowel insertion patterns reveals a number of languages favoring within-cluster insertion, even where the output of prothesis would be well-formed. In contrast, Fleischhacker finds only two candidates for consistent insertion of a vowel before the cluster—Iraqi Arabic and Central SiberianYupik—and in both these languages, the pre-cluster insertion in loanwords appears to reflect a repair that is attested in the native language phonology as well (Broselow 1983; Fleischhacker 2001, 2005). Thus, there is no convincing case of a language in which a consistent strategy of prothesis appears to have arisen spontaneously, independent of the native language grammar.

However, it is not entirely accurate to claim that pre-cluster insertion does not emerge in loanword adaptation. While consistent prothesis is exceedingly rare, mixed systems—with insertion before certain onset

[3] I adopt the terminology of Fleischhacker's (2005) insightful study of epenthesis position. I also limit this study to the adaptation of foreign words beginning in two consonants, since the data illustrating the adaptation of longer clusters are limited, in large part because of the relative scarcity of source words involving initial clusters of three consonants. However, a complete treatment of vowel insertion will ultimately need to account not only for longer initial clusters but also for word-internal and word-final clusters.

cluster types and within other types–are surprisingly common. These patterns do not, however, instantiate possibility (1c) above, as the choice of prothesis vs. anaptyxis is not random, but rather systematic. These cases are discussed in the next section.

2.1 Mixed patterns

As has long been recognized, many languages show adaptation patterns in which the position of an inserted vowel is dependent on the composition of the onset cluster. In Cairene Arabic, for example, a vowel is inserted within an onset cluster of rising sonority (that is, an obstruent followed by a sonorant (resonant) consonant), but before a cluster consisting of /s/-stop:

(2) Cairene Arabic borrowings from English (Broselow 1983; Hinds & Badawy 1986; Galal 2004)

a. firiizar	'freezer'
bilastik	'plastic'
birinter	'printer'
kirimbilin	'Crimplene'
silajd	'slide'
siwetar	'sweater'
b. ʔiskii	'ski'
ʔistadi	'study'
ʔispiriŋ	'spring'

The same pattern appears in Makkan Arabic (Ahyad 2013):[4]

(3) Makkan Arabic borrowings from English

a. birek	'break'
b. ʔiskaib	'skype'

This pattern is not limited to Arabic dialects; similar patterns are found in borrowings from English into two Indo-Aryan languages, Hindi and

[4] In both Cairene and Makkan Arabic, the high round vowel [u] may appear as the anaptyxctic vowel when the next lexical vowel is round. I return to this in the discussion of vowel quality.

Central Pahari, where /s/-stop and /sf/ onsets undergo prothesis while other onsets undergo anaptyxis:

(4) Hindi borrowings from English (Singh 1985)

a. fɪrut	‘fruit’
pɪlɪz	‘please’
sɪlɪper	‘slipper’
b. ɪspɛliŋ	‘spelling’
ɪskul	‘school’
ɪsfiər	‘sphere’

(5) Central Pahari borrowings from English (Sharma 1980)

a. kilip	‘clip’
silet	‘slate’
b. istuul	‘stool’
ispiiʧ	‘speech’

This pattern is surprising, for several reasons. First, speakers of languages with only single-consonant onsets receive no direct evidence for differential treatment of rising sonority vs. falling sonority onset clusters from their native language, where neither type occurs. Nor do the lending languages provide any obvious motivation for distinguishing obstruent-sonorant onsets from obstruent-obstruent onsets, since both types are realized faithfully in the foreign language. While, as Fleischhacker (2005) points out, insertion of a vowel within an /s/-stop onset would in some cases necessitate an additional change—from the unaspirated stop allophone that follows /s/ to the aspirated stop allophone that occurs intervocalically before a stressed vowel–this explanation is specific to English. However, the differential treatment of the two onset types cannot rest solely in the phonetic characteristics of the English clusters, because this asymmetric pattern emerges in a wide range of both borrowing languages and source languages. Borrowings from Sanskrit into Sinhalese, for example, exhibit the same pattern of prothesis before /s/-stop and anaptyxis elsewhere:

(6) Sinhalese, from Sanskrit (Samarajiwa & Abeysekera 1964)

	Sinhalese	Sanskrit	
a.	tijage	tjage	‘gift’
	tirividə	trividə	‘triple’
	sirijavə	srijavə	‘grace’
b.	istiri	stri	‘woman’

The anaptyxis/prothesis pattern is also evidenced in borrowings from French to Wolof (Broselow 1992b; Fleischhacker 2005) and to Fula (Paradis & LaCharité 1997), and from Russian to Kazakh (Fleischhacker 2005) and to Kirgiz (Gouskova 2002). Thus, to maintain an explanation of this pattern as a response to some acoustic or perceptual factors in the signal (channel bias, in the terminology of Moreton 2008), we would need to identify triggering factors that are constant across all these genetically and geographically distinct languages. In the absence of such evidence, the anaptyxis/prothesis pattern presents a paradigm case of an emergent pattern: one that could not be directly learned from the linguistic data available to the speaker.

Furthermore, this asymmetric repair pattern challenges the fundamental Optimality Theory assumption that illegal structures are repaired with minimal violation of faithfulness constraints. In Cairene Arabic, prothesis represents a particularly inefficient repair choice; because vowel-initial syllables are banned in Arabic, pre-cluster insertion necessitates an additional repair, the insertion of a glottal stop before the inserted vowel. No ranking of the familiar markedness constraints *COMPLEXONSET, ONSET, NOCODA and faithfulness constraints DEPV, DEPC will choose the winning forms with pre-cluster insertion, as illustrated by the tableau below, in which the actual output form [ʔis.kii] violates three constraints: the markedness constraint NOCODA and the faithfulness constraints DEPV and DEPC:

(7) Cairene Arabic

/ski/ 'ski'	*COMPLEXONSET	ONSET	DEPV	DEPC	NOCODA
a. skii	*!				
☞b. si.kii			*		
c. is.kii		*	*		*
√d. ʔis.kii			*	*	*

Note that (7b), which should be the winner under any ranking, would constitute an entirely unobjectionable surface structure in this language (cf. [sikitt] 'I became quiet'). Yet apparently there must be some additional factor that favors prothesis in forms beginning in /s/-stop clusters.[5]

One possible explanation of the anaptyxis/prothesis pattern might appeal to universal markedness differences based on sonority. In Broselow (1992b), it is argued that regardless of native language, speakers have knowledge of a universal sonority continuum comprising, in order of increasing sonority, stops-fricatives-nasals-liquids-glides-vowels, along with an inviolable requirement that onset sequences must not fall in sonority (Selkirk 1982; Parker 2008). If these principles are indeed universal, they should lead speakers who encounter falling-sonority onsets to assume that these onsets cannot represent two independent segments, but rather share a linked representation that protects them (like true geminates) from being split by vowel insertion.[6]

While Broselow's analysis rests on the assumption that anaptyxis is the preferred option, Gouskova (2002) argues that the faithfulness constraint CONTIGUITY, which bans insertion within a morpheme, favors pre-cluster insertion. However, Gouskova argues, prothesis may be blocked by a

[5] Repair of triconsonantal onsets also presents a challenge to the principle of minimal change from input to output. While insertion of a single vowel between the first two consonants would yield a legal syllable structure (e.g., street > [sit.riit]), the actual form is [ʔis.ti.riit], with three violations of faithfulness incurred by insertion of two vowels plus insertion of a glottal stop.

[6] Following Browman and Goldstein's (1986) proposal that English onsets allow only a single laryngeal specification, Broselow argued that /s/-stop onsets share a linked laryngeal node.

competing markedness constraint, SYLLABLECONTACT, which bans a coda-onset sequence of rising sonority. The result of prothesis in a heterosyllabic /s/-stop sequence ([is.kii] 'ski') is consistent with both CONTIGUITY and SYLLABLECONTACT, but the latter constraint would block prothesis in a form like [ib.las.tik] 'plastic' due to the illegal syllable contact [b.l].

On both these approaches, the asymmetric insertion pattern represents an emergence of the unmarked effect (McCarthy & Prince 1994)—speakers respond to a markedness constraint for which their native language provides no direct evidence, but which is presumably part of their innate linguistic knowledge. In support of the anaptyxis/prothesis pattern as reflection of universal principles, Broselow (1992b) argued that the same asymmetric pattern is not restricted to loanword phonology; it also appears in a native language, Modern Western Armenian, where surface schwa is inserted between members of onsets of rising sonority (8a) or equal sonority (8b), but before fricative-stop onsets (8c):

(8) Modern Western Armenian (Bardakjian & Thompson 1977; Broselow 1992b)

	Input	Surface	
a.	grag	gərag	'fire'
	vnas	vənas	'harm'
	hnar	hənar	'resource'
	srel	sərel	'sharpen'
b.	nman	nəman	'similar'
c.	stapil	əstapil	'come to one's senses'
	spopel	əspopel	'console'
	skanceli	əskanceli	'wonderful'
	ʃtapel	əʃtapel	'hurry'

However, these emergences of the unmarked accounts face both theoretical and empirical problems. First, in Optimality Theory, constraint rankings are assumed to be learned from the data to which the learner is exposed. Where neither the native nor the foreign language appears to present evidence for crucial loanword rankings, the burden of proof lies on the analyst to explain the source of those rankings.[7]The anaptyxis/prothesis

[7] See, e.g., Peperkamp 2005, Broselow 2009, Kang 2011 for more detailed discussion of the learnability issues surrounding loanword phonology.

pattern requires a number of crucial rankings: not only the ranking of the markedness constraint SYLLABLECONTACT over CONTIGUITY, which favors prothesis, but also the ranking of CONTIGUITY over ANCHOR-LEFT (STEM, PWORD), which demands that the leftmost segment of the stem have a correspondent at the left edge of the word, thereby favoring anaptyxis. To explain how speakers arrive at these rankings, one would need to demonstrate for each adaptation case that each ranking either is learnable from ambient data, or represents a universal default. A full treatment of this issue would require analysis of clusters in all positions within the word.

The purely sonority-based explanations face an empirical problem as well: the distinction between rising vs. falling sonority onsets is not sufficient to account for the range of patterns found across languages. Fleischhacker (2005), in the most extensive survey to date of loanword vowel insertion sites, found that in a number of languages, including Kazakh, Farsi, and the Hindi of some speakers, rising sonority clusters consisting of a sibilant fricative (/s/, /ʃ/) followed by a resonant consonant (nasal, liquid, glide) may undergo prothesis rather than anaptyxis, and that in fact, the same cluster may exhibit variation within a single language. Thus, sonority is not entirely predictive, although is also not entirely irrelevant; fricative-sonorant onsets with a steeper sonority rise (e.g., /s/-glide) are more likely to undergo anaptyxis, while those in which the second consonant has lower sonority (e.g., /s/-nasal) are more likely to undergo prothesis. As the following data illustrate, Fleischhacker's Farsi consultant repaired sibilant-nasal and sibilant-[l] clusters via prothesis and sibilant-[r] and sibilant-[w] clusters via anaptyxis:

(9) Farsi (Fleischhacker 2005)

a. esmintian	'Smintian'
eʃlas	'Schloss'
b. seri laŋka	'Sri Lanka'
sevanhild	'Schwanhild' (~[sowanhild])

Given, as Fleischhacker points out, that the mixed pattern cannot be attributed to a simple categorical difference between falling sonority and rising sonority onsets, some other explanation is necessary. Fleischhacker proposes, following work by Steriade (2001), that the driving force behind the mixed pattern is the imperative to maintain the minimal perceptual distance between input and output. Fleischhacker presents evidence from

a variety of sources, including near puns, alliterative patterns, reduplication, and experimental investigation of similarity judgements, supporting the hypothesis that obstruent-resonant (OR) clusters (i.e., an obstruent followed by a nasal, liquid, or glide) are perceived as more similar to OvR than to vOR, while the same relationship does not hold for sibilant fricative-stop (ST) clusters and SvT. As expected from the variable adaptation of sibilant fricative-resonant clusters like /sm/, listeners vary in their judgements of the similarity of clusters containing sibilant fricatives (/s, ʃ/) followed by resonants vis-à-vis anaptyctic SvT and prothetic vST. Fleischhacker proposes a set of similarity-sensitive correspondence constraints prohibiting the insertion of vowels in specific contexts, with the fixed ranking shown below, where S = sibilant fricative; T=stop, N=nasal, L=liquid, and R=resonant consonant:

(10) Correspondence constraints (Fleischhacker 2001, 2005)

DEP-V/S-T >> DEP-V/S_N >> DEP-V/S_L >> DEP-V/T_R

The point at which CONTIGUITY is ranked within this hierarchy determines the choice of anaptyxis vs. prothesis for individual clusters, but the fixed ranking implies that vowel insertion may not separate /s/-stop clusters unless it also separates other clusters. Zuraw (2007) presents additional evidence of a preference for maintaining contiguity of the members of /s/-stop onsets. In her investigation of Tagalog speakers' preferred placement of VC infixes in non-native words beginning with various cluster types, Zuraw found that placement of the infix within an /s/-stop onset (e.g., *s-VC-pin*) was less likely and was judged less acceptable than placement after the cluster (*sp-VC-in*). In other /s/-consonant onsets, the acceptability of the within-cluster placement tended to increase with increasing sonority of the second consonant.

Fleischhacker's proposal predicts that the preferred repair of a non-native cluster should be the one that is most difficult to discriminate from the original structure. Subsequent research on the relationship between the pronunciation of unfamiliar onset clusters and the discriminability of different repairs by Shaw and Davidson (2011) and Davidson and Shaw (2012) has revealed that such correlations are strong but not perfect. They found, for example, that while the most frequent production error for non-English fricative-nasal sequences was FvN, the most difficult pair for English speakers to discriminate was FN-vFN. Nonetheless, Fleischhacker's insight into the crucial role played by the perceptual distance between original and repaired forms in loan adaptation represents

a significant advance in our understanding of these patterns, one that we will return to in our discussion of the interaction in the position and the quality of the inserted vowel.

3. Interaction of vowel position and vowel quality

As Hall (2011: 1590) notes,

> "the patterns of vowel quality in loanwords are often strikingly complex in ways that are not common (and perhaps not attested at all) in native language epenthesis."

Nonetheless, we may identify some clear trends. First, certain languages have a single preferred default vowel. The identity of this vowel may vary from language to language—for example, /u/ in Japanese and /i/ in SeTswana, as illustrated in their respective adaptations of 'Christmas' as [kurisumasu] and [kirisimasi]. Alternatively, loans may be adapted via insertion of a contextually-determined vowel, which may share some or all features with a nearby vowel, may share features with a neighboring consonant, or may show some combination of the effects of both vowel and consonant context. In these cases, the quality of the inserted vowel is often highly variable and not fully predictable; the reader is referred to Uffmann (2007) for careful case studies of the relationship between vowel quality and context.

Just as many languages exhibit mixed systems in the position of the inserted vowel, many languages also show mixed systems of vowel quality. Furthermore, as with positional variation, the choice among available options—in this case, the choice between a default vowel and a contextually determined vowel—is in many languages largely systematic. Mahato (1974) reports that Bengali (Mahato 1974) exhibits the familiar pattern of anaptyxis in rising sonority onsets but prothesis in fricative-stop onsets. The interesting fact, for our purposes, is that the quality of the vowel varies by position, with [e] inserted within obstruent-resonant clusters, as in (11a), but [i] before S-stop clusters, as in (11b):

(11) Bengali borrowings from English (Mahato 1974)

a. gelaʃ	'glass'
ʃelet	'slate'
b. iʃkul	'school'
istæmp	'stamp'

We see a somewhat different (but ultimately more common) pattern of position-quality interaction in the Dravidian language Telugu (Rao 1986). Telugu shows variation between the two major strategies of complex onset nativization, consonant deletion and vowel insertion. When consonant deletion is employed, it is the more sonorous consonant that deletes: the second in a rising sonority onset, and the first in a fricative-stop onset. When a vowel is inserted, the position of the inserted vowel follows the now familiar anaptyxis/prothesis pattern, and the quality of the inserted vowel varies according to position: the anaptyctic vowel is a copy of the following vowel, while a prothetic vowel is a default [i]:

(12) Telugu borrowings from English (Rao 1986)

a. galasu ~ gasu	‘glass’
b. isteʃ ənu ~ teʃ ənu	‘station’

This pattern–insertion of a copy vowel within clusters, but insertion of a default vowel before clusters–turns out to be surprisingly common across a wide range of genetically distinct language families. We find the same pattern in borrowings from French into the Niger-Congo language Fula (Paradis & LaCharité 1997):

(13) Fula borrowings from French (Paradis & LaCharité 1997)

	Fula	French	
a.	birikɛt	brikɛ	‘lighter’ (‘briquet’)
	kala:s	klas	‘class’ (‘classe’)
	darapɔ	drapo	‘flag’ (‘drapeau’)
b.	istati	staty	‘statue’ (‘statue’)

Furthermore, the same pattern appears in borrowings from English into the Sino-Tibetan language Sherpa, in which the only possible complex onset in native words is a consonant followed by a glide (Sherpa 2012). In a study of established loanwords, Sherpa (2012) found that English consonant-glide onsets were preserved (the only examples in the database contained [sw]). Complex onsets were otherwise repaired by vowel insertion which varied in both position and quality. The database contained thirteen forms adapted from English words beginning in stop-liquid clusters and one beginning in fricative-liquid, all of which were

adapted by insertion of a copy vowel between the onset consonants, and four English words beginning in /s/-stop, all adapted by insertion of [i] before the onset cluster:

(14) Sherpa (Sherpa 2012)

a. balaŋket	‘blanket’
baljakʈi	‘black tea’
palan	‘plan’
palasʈik	‘plastic’
berek	‘break’
poroʈin	‘protein’
porogaram	‘program’
ʈeren	‘train’
ʈarak	‘truck’
ɖaram	‘drum’
kalaimet	‘climate’
kilinik	‘clinic’
kirismas	‘Christmas’
ʃirim	‘shrimp’
b. iskuʈar	‘scooter’
iskin	‘skin’
iskil	‘skill’
iskalarʃip	‘scholarship’

The single form based on an English word beginning with a sibilant-liquid cluster (‘shrimp’) patterns with other obstruent-resonant clusters in taking an anaptyctic vowel, although this vowel cannot be clearly identified as either a copy or default vowel, since the following vowel is /i/, which also appears as the default vowel before /s/-stop. Unfortunately the database does not contain adaptations of initial /s/-nasal or /s/-liquid clusters, the structures most likely in Fleischhacker’s data to exhibit variability in the position of the inserted vowel, and the medial /sm/ in ‘Christmas’ is syllabified as coda plus onset.

The link between quality and position exhibited in Bengali, Telugu, Fula, and Sherpa–a copy vowel inside the cluster and a default vowel before the cluster–would be most firmly established if we were able to find that variation in position is accompanied by variation in quality. Fortunately, such evidence does exist. Ka (1985) and Sy (2013) report the now-familiar pattern of sonority-driven positional variation in borrowings

from French into Wolof (a Niger-Congo language), with a copy vowel inserted inside a rising sonority onset and a mid front default vowel before S-stop onsets. While Ka represents [e] as the uniform prothetic default, Sy (2013) claims that the prothetic vowel agrees in [ATR] (tongue root position) with the following vowel; transcriptions in (15b) are from Sy (2013):

(15) Wolof borrowings from French (Ka 1985; Ka personal communication, Sy 2013)

	Wolof	French	
a.	kalas	klas	'class' ('classe')
	giri	gri	'gray' ('gris')
	silip	slip	'slip' ('slip')
	sonob	snob	'snob' ('snob')
b.	ɛstʌti	staty	'statue' ('statue')
	ɛspɔ:r	spɔr	'sports' ('sport')
	esteno:	steno	'stenographer' ('steno')
	estilo	stilo	'pen' ('stilo')

For onsets consisting of sibilant fricatives followed by a nasal or liquid, Fleischhacker (2005) reports variation in insertion position–and strikingly, this positional variation is accompanied by variation in vowel quality. While S-initial clusters may undergo either anaptyxis or prothesis, the connection between position and quality remains: when the inserted vowel appears within the cluster, it is a copy of the following vowel, and when it precedes the cluster, it is the default mid vowel (transcriptions are from Fleischhacker, who does not distinguish the [ATR] variants):

(16) Wolof borrowings from French (Fleischhacker 2005)

a.	somokiŋ	'smoking jacket'
	silip	'slip' (undergarment)
b.	esmok	'smoke'
	eslepnir	'Sleipnir' (name, elicited by Fleischhacker)

Thus, the same onset cluster may undergo anaptyxis with a copy vowel, or prothesis with a default vowel. This pattern of variation makes clear the

link between position and quality.

The Wolof cases, which involve borrowings from French, demonstrate that the pattern of anaptyctic copy vowel/prothetic default vowel is not confined to words borrowed from any single language. Additional evidence of the same doubly-mixed pattern comes from borrowings from Russian into the Turkic language Uyghur:

(17) Uyghur borrowings from Russian (Fleischhacker 2005; Hahn 1991)

	Uyghur	Russian	
a.	kulub	klub	‘club’
b.	istatistika	statistika	‘statistics’

Russian borrowings also show a mixed pattern of adaptation in Samoyedic Uralic languages. In his discussion of consonant clusters in Nenets, Enets, Nganasan, and Selkup, all of which lack complex onsets, Varnái (2012) reports that word-initial clusters in Russian borrowings show a variety of repairs, including consonant deletion or CV metathesis. The most frequent repair of obstruent-resonant onsets is insertion of a vowel within the cluster that is “the same as the vowel of the next syllable.” However, when vowel insertion applies to onsets consisting of a voiceless sibilant fricative plus a stop, the inserted vowel appears before the cluster, and this prothetic vowel has a fixed quality, [a] in Nenets and Nganasan and [i] in Selkup:

(18) Samoyedic borrowings from Russian (Varnái 2012)

	Samoyedic	Russian	
a.	xaram (Nenets)	gram	‘gram’
	xurupa (Nenets)	krupa	‘cereals’
	torob (Nenets)	drob^{j}	‘barrel’
	birigadə (Nganasan)	brigada	‘brigade’
	burukəʔ (Nganasan)	br^{j}uki	‘trousers’
	kurus (Selkup)	gruz	‘cargo’
b.	askola (Nenets)	ʃkola	‘school’
	askolə (Nganasan)	ʃkola	‘school’
	iskamɛjka (Selkup)	skamejka	‘bench’

A partial relationship between vowel quality and position is found in Farsi, according to Shademan (2002). In the dialect of Farsi discussed by Shademan, all /s/-stop onsets are repaired via prothesis, while all other obstruent-resonant onsets are repaired by anaptyxis. While anaptyctic vowels may be either a copy of the following vowel or a default [e], the prothetic vowel is always the default [e]:

(19) Farsi borrowing from English, French (Shademan 2002)

a. terafik	'traffic'
pelastik	'plastic'
korom	'chrome'
buluz (French)	'blouse'
b. eski	'ski'
eslav	'Slav'
estop	'stop'
esport	'sport'

Thus, the interaction between position and quality appears across a range of recipient and source languages, invariably in the same direction: an anaptyctic copy vowel alongside a prothetic default vowel. The next section outlines the typological findings.

4. Typological generalizations

The table below summarizes the logical possibilities for insertion site, where the upper case letters indicate lexical segments. "T", "R", and "S" represent the class of stops, resonants (nasals, liquids, and glides), and sibilant fricatives, respectively, "V" represents a lexical vowel, and lower case "v" represents an inserted vowel.

(20) Possible positions for inserted vowel

Position	**anaptyxis** **TvRV, SvTV**	**prothesis** **vTRV, vSTV**	**Mixed position, type 1 TvRV, vSTV**	**mixed positio, type 2 vTRV, SvTV**
Japanese	√			
Iraqi Arabic (NL pattern)		√		
Cairene Arabic			√	
No language?				

Of these four logical possibilities, examples of only three have been attested (Fleischhacker 2005). In particular, mixed pattern type 1, in which a vowel is inserted within obstruent-resonant clusters (with the possible exception of those beginning with sibilant fricatives) but before S-stop clusters (and possibly some or all S-resonant clusters) are common, while the reverse pattern is unattested. There is no obvious reason why the type 1 pattern should emerge among speakers whose native languages contain no clusters of either type, and whose exposure to the foreign language includes clusters of both types—on the face of it, the type 2 mixed pattern should be equally likely to emerge.

Considering only the attested mixed position pattern (mixed position, type 1), we find four logical possibilities for interaction between insertion site and vowel quality, schematized in the table below. Here, upper case "A" represents a lexical vowel, lower case "a" represents a copy vowel, and lower case "i" a default vowel:

(21) Possible interactions between mixed positions type 1 pattern and quality of inserted vowel

	default quality **TiRA, iSTA**	**mixed quality, type 1** **TaRA, iSTA**	**copy quality** **TaRA, aSTA**	**mixed quality, type 2** **TiRA, aSTA**
Cairene	√			
Bengali, Telugu, Fula, Wolof, Sherpa, Uyghur, Samoyedic, Farsi		√		
No languages?				

Only two of the four logically possible interactions appear to be attested: use of a default vowel in both positions and use of a copy vowel within the cluster but a default vowel before the cluster. We should note, however, that at least for some speakers of both Cairene and Makkan Arabic, there is a tendency to insert a round vowel within obstruent-resonant clusters when the following vowel is round (Galal 2004; Ahyad 2013), suggesting that there may not, in fact, be clear cases of pure default systems.

In §2, we considered several explanations that have been proposed for the emergence of the apparently unmotivated mixed type 1 pattern and the absence of the unattested pattern. We are now in a position to connect the facts of positional variation with the interaction between position and quality. The generalization that emerges in consideration of mixed quality systems is that copy vowels are favored when the inserted vowel is directly followed by a resonant consonant. In fact, the preference for copy vowels in the obstruent-resonant position is not limited to languages with positional variation. In the Austronesian language Dehu, onset clusters are consistently resolved via anaptyxis, but the quality of the inserted vowel varies according to the composition of the cluster. Tryon (1970: 434)

describes the Dehu pattern, illustrated in (22), as follows:

> "With consonant clusters, CC > CVC. The V tends to harmonize with either the preceding or following V, except that sC > siC, regardless of surrounding vowels."

(22) Dehu borrowings from English (Tryon 1970)

a.	peleit	'plate'
	gilis	'grease'
	galas	'glass'
	balaiket	'blanket'
	faraig	'franc'
	falawa	'bread' (possibly through Samoan)
b.	sipö	'spur'
	sipun	'spoon'
	sitima	'steamer'

Unfortunately, Tryon provides no examples of cases involving sC onsets where the second consonant is a resonant. However, the existing data are consistent with the generalization that copying of vowel features is far more likely across resonant consonants than across obstruents.[8] In the following section I consider possible explanations for this generalization.

5. Explaining the position-quality interaction

In this section I outline two possible accounts of the widespread emergence of type 1 mixed systems, in which a copy vowel is used to repair obstruent-resonant onsets but not S-stop (or in some cases S-C) onsets: a production-based approach based on the resistance of certain consonant classes to copy of vowel features, and a perception-based approach in which copy vowels reflect listeners' misinterpretation of the foreign structures. While a full exploration of these approaches is beyond the scope of this paper, I will briefly sketch the possibilities and their potential fit with the facts we have uncovered.

One possible explanation is that the mixed pattern of prothetic default/anaptyctic copy vowel arises from universal principles disfavoring copying of vowel features across obstruents, but not across resonant

[8] The one example Tryon provides that involves neither copy nor default vowel insertion is [θeri] 'three'.

consonants. If the failure to copy vowel features across obstruents is viewed as an emergence of the unmarked effect, we would hope to find an implicational relationship between copying across obstruents vs. resonant consonants. A number of researchers have explored the role of consonants in either facilitating or blocking the copying of vowel features (see, e.g., McCarthy 1998; Gafos & Lombardi 1999; Kitto & deLacy 1999; Mahanta 2007), but no clear consensus has emerged on a universal hierarchy of blocking effects. Obstruents do not uniformly block copying; in Makassarese native phonology, for example, inserted vowels copy their features across /s/ (as well as /r/ and /l/, Basri et al. 2012). Nor do resonant consonants uniformly allow the spreading of vowel features; in a study of the role of intervening consonants in vowel harmony, Mahanta (2007) argues that it is actually consonants with higher sonority that are most likely to interfere with vowel harmony. This is obviously a question that deserves further study, and a definitive answer lies beyond the scope of this paper.

For an alternative explanation of the emergence of copy vowels in the obstruent-resonant context, we return to Fleischhacker's discussion of the perceptual similarity between obstruent-resonant and obstruent-vowel-resonant structures. Fleischhacker presents a wealth of evidence for the perceptual similarity of OR and OvR, including a survey of partial puns in which she finds considerably more pairs like *broke-baroque* and *slammed-salaamed* than pairs like *sport-support*. While Fleischhacker argues that loanword adapters accurately perceive the foreign forms, and then adapt them to the closest possible legal native structure (OvR for obstruent-resonant onsets), the evidence for the perceptual similarity of OR and OvR could equally be taken to support an alternative hypothesis: rather than accurately perceiving OR onsets but adapting them to the perceptually most similar structure, listeners actually misperceive OR as OvR. This misperception would be consistent with the findings of Dupoux et al. (1999) that listeners tend to perceive an illusory vowel in clusters that are illegal in their native language. If misperception plays a role in the appearance of loanword vowel insertion, the questions that arise in conjunction with the typological generalizations outlined in the preceding section are the following: (1) is there reason to believe that an illusory vowel might be more likely within an obstruent-resonant onset than within a fricative-stop onset?; and (2) is there reason to believe that the illusory vowel within an obstruent-resonant onset might be likely to be perceived as a copy of a following vowel?

Fleischhacker's (2005) findings on near puns and on similarity judgments speak to the first question, since they suggest that OvR and OR

are more similar than SvT and ST. The inherent difficulty of discriminating OR and OvR is also supported by the finding of Werker et al. (1998) that babies prior to age 10 months in an English-speaking environment do not successfully discriminate pairs like *clone-cologne*.[9] Given the considerable body of evidence that babies younger than 10 months display sensitivity even to distinctions that are not contrastive in their native language (e.g.,Werker 1995), this is significant support for the inherent confusability of (at least) OR and OəR.

Support for the susceptibility of OR sequences to being perceived as containing a vowel comes from Hall's (2003, 2006) extensive study of what she terms "intrusive vowels"–elements of the speech signal that are perceived as vowels but do not appear to add to the syllable count. Hall argues that listeners may perceive loose coordination between consonantal gestures as an intervening (intrusive) vowel. She demonstrates that intrusive vowels are most likely to arise in two contexts: adjacent to resonant consonants and adjacent to glottal consonants ([h] and glottal stop). Since none of the source language onsets in our data include a glottal consonant, the latter context is not relevant for our study. Hall argues that resonant consonants are more subject to the misinterpretation that gives rise to a vowel percept than are obstruents, because the landmarks for the onset and offset of resonant consonants are less clear than for stops and fricatives (see also, for example, Davidson 2007).

Thus, a tendency to misinterpret OR onsets as OvR onsets could plausibly arise from two factors: the tendency to hear illusory vowels between clusters that are illegal in one's native language, and the tendency to interpret loosely coordinated consonantal gestures as separated by an intervening vowel. The acoustics of the source language might also play a role, as English speakers, at least, appear to exercise a good deal of freedom in the timing of both OR and OvR sequences. In a study of the pronunciation of /l/ in words ORV words like *blow* and OəRV words like *below*, Huffman (1997) found considerable variability in the timing of the liquid gestures, with a vowel-detection algorithm finding no vowel in some *below*-class tokens and finding evidence of a vowel in some *blow*-class tokens. The wide range of acceptable variation in the timing of consonant-liquid onsets is illustrated by the common pronunciation of *please* as bisyllabic (often written as *puh-leeze*). Thus, it seems quite

[9] Coetzee (2011) found that English speakers tended to perceive an illusory vowel in word-initial sequences of /s/ followed by an aspirated stop. This effect was presumably a function of the participants' knowledge of English, in which stops following /s/ are never aspirated, and one would not expect to find the same perceptual pattern among speakers for whom [sT^{h}] is a licit word-initial sequence.

plausible that a listener whose native language does not permit, e.g., word-initial /pl/ should interpret loosely-coordinated /pl/ as /pvl/.

However, if we concede the plausibility of the hypothesis that listeners whose language lacks OR onsets might perceive an illusory vowel in O_R, we are still left with the question of why the illusory vowel should be perceived as a copy vowel, identical in some or all features to the next vowel. On this question, too, Hall's work provides an explanation. Hall (2003, 2006) identifies two types of intrusive vowels: reduced (schwa-like) vowels and contextually determined vowels displaying the features of a neighboring vowel or consonant. Because illusory vowels seem to correspond to some member of the borrowing language's vowel inventory (Dupoux et al. 1999), we would not expect listeners whose phoneme inventory does not contain schwa to perceive the loose transition between obstruent and resonant as a schwa (and indeed, the lack of schwa appears to be a characteristic of the languages discussed above which display the anaptyctic copy/prothetic default pattern). In the absence of schwa, perception of the illusory vowel in the O_R context as a copy vowel has a reasonable explanation, arising from two interacting factors. First, as a reviewer pointed out, the overlapping vowel gesture may, in Hall's words, "color the acoustic release" of the initial obstruent (Hall 2006: 412). Second, as we have seen, there appears, at least in English, to be some freedom in the timing of the resonant gestures in OR clusters, and a delay in the resonant gesture may lead to a period in which the vocalic gestures are perceptible both before and after the resonant. It is precisely such a delay, according to Steriade (1990), that gave rise to the historical change called Dorsey's Law. Dorsey's Law describes the emergence of a copy vowel between sequences of voiceless obstruent followed by resonant consonant in Winnebago (e.g., historically prior /pra/ became /para/). While these copy vowels are perceived as clearly present, they do not participate in the stress system in the same way as do other vowels, as is characteristic of intrusive vowels. Steriade (1990) has analyzed the Dorsey's Law change as a result of changes in the timing of the consonantal and vocalic gestures: "a delay in the onset of the liquid can create a sequence in which the vowel gesture begins to "show" between the consonant gestures." Steriade schematizes the timing adjustment that gave rise to the change from /pra/ to /para/ as follows:

(23) Dorsey's Law (Steriade 1990)

Tiers	Gestures
tongue body	[_____a_____]
tongue tip	[____r____] → [_____r____]
lip	[____p_____]

Thus, the appearance of a copy vowel in the onset-resonant context is consistent with an account in which these vowels arise from listeners' misperceptions of the foreign sequences. For example, we can envision the development of Farsi [korom] 'chrome' as follows: the gestures involved in the first three segments of the source [krom] will normally overlap to some extent, and a slight delay in the liquid gestures relative to the vowel might lead to sufficient liquid-vowel overlap in that a listener could plausibly interpret the intended target as [korom]. The connection between preferred position and preferred quality of inserted vowels in rising sonority onsets is thus a function of the possibility of overlap in the production of the resonant and vowel gestures. In contrast, we would not expect the same sort of misperception to arise with obstruent-obstruent onsets such as /s/-stop, because obstruents provide much clearer landmarks indicating the onset and offset of their gestural targets, making their sequencing much more difficult to misinterpret (Davidson 2007).

To summarize, then, I suggest that the appearance of copy vowels in obstruent-resonant but not in obstruent-obstruent onsets in loanword adaptation is consistent with what we know about the robustness of the acoustic cues associated with the two onset types. Obstruent-resonant onsets give less clearly defined cues to the relative timing of the CCV gestures, opening the possibility that listeners unaccustomed to distinguishing OR and OvR will misinterpret the former as the latter. In contrast, obstruent-obstruent onsets are more difficult to misinterpret as containing a vowel. What remains to be explained, however, is the appearance of default vowels in mixed systems. One possible explanation is that these default vowels are true phonologically inserted vowels, arising not from misperception but from a repair imposed in the production grammar.

6. Conclusion

Investigation of the adaptation of word-initial biconsonantal clusters across a number of source and recipient languages has provided evidence for the emergence of a fairly common pattern in which the position and the quality of the vowel differ according to the class of consonants making up the cluster. In many languages, the vowel inserted inside a stop-resonant cluster constitutes a copy of some or all of the following vowel's features. In contrast, the vowel inserted before a sibilant-stop cluster represents an invariant default. Clusters consisting of a sibilant fricative followed by a resonant show variation, patterning in some cases with stop-resonant and in others with /s/-stop onsets. The emergence of this systematic pattern is intriguing, since neither the source nor the recipient languages present any obvious motivation for distinguishing different cluster types, since both rising and falling sonority onsets are present in the source language and absent in the recipient language. The emergence of only a subset of the logically possible position-quality interactions is surely telling us something significant about human linguistic behavior. I have outlined two possible hypotheses concerning the preference for anaptyctic copy vowels in OR clusters and prothetic default vowels in S-stop clusters. The first approach ascribes the preference for copy vowels in OR but not S-stop to a universal dispreference for spreading vowel features across obstruents. The second analyzes copy vowels within obstruent-resonant clusters as a result of listeners' misinterpretation of the acoustics of the foreign language; specifically, to gestural overlap between the resonant and the following vowel, which encourages the perception of a copy vowel preceding the resonant. In contrast, I suggest that obstruent-obstruent sequences are much less subject to misinterpretation, so the default vowels associated with these onsets are more likely the result of true vowel insertion in the production grammar. These hypotheses await careful experimental investigation.

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