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Loan Phonology Is Not All Perception: Evidence from Japanese Loan Doublets

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1. Introduction¹

When loanwords from a source language (L_s) enter a borrowing language (L_b), they may be altered to conform to L_b phonology. This phenomenon, known as **loanword adaptation**, has long been considered a source of evidence about the phonological grammar of L_b . However, Peperkamp & Du-poux (2003, Peperkamp to appear) have developed an alternative proposal, in which loanword adaptation takes place, *not* in the UR→SR mapping of the phonological grammar, but at the level of speech perception.

This paper presents evidence from English-to-Japanese **loan doublets**, L_s words with two L_b outcomes, showing that the perception-only model of loanword adaptation is too restrictive. While perceptual factors are important, the phonological grammar must play a role in loanword adaptation as

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well. (For additional discussion supporting this claim, see Yip 2002, Kenstowicz 2004, Smith in prep.) First, the traditional phonological approach to loanword adaptation and the alternative perception-only approach are summarized in §2 and §3 respectively. §4 then presents the loan-doublet evidence and discusses the problems that it raises for the perception-only model. Finally, §5 outlines a new phonological approach based on output-output faithfulness (Benua 1997).

2. The phonological approach to loanword adaptation

Much previous work holds that loanword adaptation is carried out by the **phonological grammar** of *L_b* (Hyman 1970, Lovins 1975, Yip 1993, Jacobs & Gussenhoven 2000, Shinohara 2004). The underlying representation (UR) of a loanword in *L_b* closely resembles the *L_s* form, at least for those speakers who first borrow a given word through contact with *L_s* (the situation may be different for subsequent generations of monolingual *L_b* speakers). The *L_b* phonological grammar then maps that UR to a surface representation (SR). As part of this mapping, the loanword may be altered—that is, adapted—to better satisfy *L_b* phonological requirements.

For example, English *cream* [kri:m] is borrowed as Japanese *kuriimu*. In the phonological approach to loanword adaptation, shown in (1), the Japanese UR is /kri:m/. Constraints (defined in (2)) against onset clusters and certain codas compel epenthesis, producing the SR [ku.ri:.mu]. (In candidate (1c) and subsequent examples, deletion sites are indicated with ‘_’.)

- (1) Loanwords: { *COMPONS, CODACOND, MAX-IO } >> DEP-IO

/kri:m/ ‘cream’	*COMP ONS	CODA COND	MAX- IO	DEP- IO
a. kri:m	*(!)	*(!)		
► b. ku.ri:.mu				**
c. _fi:_			*!*	

- (2) Constraint definitions

- a. *COMPLEXONSET Onset clusters are prohibited
- b. CODACONDITION Codas with Place features are prohibited
- c. MAX-IO ('no deletion') Input segments have output correspondents
- d. DEP-IO ('no epenthesis') Output segments have input correspondents
(Prince & Smolensky 1993; Itô 1989; McCarthy & Prince 1995)

A crucial aspect of (1) is the ranking MAX-IO >> DEP-IO, which ensures that epenthesis, not deletion, is the preferred repair strategy.

However, this ranking leads to a problem for the view that loanword adaptation is entirely driven by the *L_b* phonological grammar. In the nonloan

phonology of Japanese, the preferred repair is deletion (McCawley 1968), as shown by the verb-suffix alternations in (3).

(3) Deletion repairs in Japanese nonloan phonology

a. Vowel-final verbs: Suffixes surface unchanged

	<i>nonpast /-ruw/</i>	<i>causative /-sase/</i>
‘see’	/mi. <u>ru</u> / [mi. <u>ru</u>]	/mi. <u>sase</u> / [mi. <u>sase</u>]
‘eat’	/tabe. <u>ru</u> / [ta.be. <u>ru</u>]	/tabe. <u>sase</u> / [ta.be. <u>sase</u>]

b. Consonant-final verbs: Suffix consonants delete

‘read’	/jom- <u>ru</u> / [jo.m_u]	/jom-sase/ [jo.m_a.se]
‘fly’	/tob- <u>ru</u> / [to.b_u]	/tob- <u>sase</u> / [to.b_a.se]
‘wait’	/mat- <u>ru</u> / [ma.t ^s _u]	/mat- <u>sase</u> / [ma.t_a.se]

Here, because deletion is chosen, the opposite ranking would have to hold between the faithfulness constraints: DEP-IO >> MAX-IO.

(4) Nonloans: { *COMPONS, CODACOND, DEP-IO } >> MAX-IO

/jom- <u>sase</u> / ‘read-CAUS’	*COMP ONS	CODA COND	DEP- IO	MAX- IO	
a. jom.sa.se		*			
b. jo.m V.sa.se			*		
► c. jo.m_a.se				*	

The fact that Japanese uses epenthesis repairs only for loanwords, while preferring deletion repairs in the nonloan phonology, turns out to be part of a larger pattern. Paradis & LaCharité (1997), in their cross-linguistic survey of loanword adaptation repairs, have discovered a strong cross-linguistic tendency to avoid deletion repairs for loanwords (which they name the Preservation Principle). The ranking paradox illustrated in (2) and (4) above represents the most extreme manifestation of this tendency: a language that uses deletion as the default repair in nonloan phonology, but chooses epenthesis repairs *specifically* for loanword adaptation. Korean shows similar behavior, in that the native phonology uses feature change or deletion repairs, but loanword adaptation involves epenthesis (Kang 2003, Kenstowicz 2004; for additional discussion of languages with loan-specific repair strategies, see also Yip 2002, Smith 2004, Peperkamp to appear).

Languages like Japanese, with epenthesis only for loanwords, are significant because they clearly demonstrate that the nonloan phonology cannot be the only mechanism responsible for loanword adaptation—if it were, then

the same repair strategy that is used for the nonloans would be chosen for loanwords as well. The question remains, however, just what factors beyond the native L_b phonology are responsible for adaptation effects. Some researchers have proposed adding loanword-specific principles or constraints to the phonological system (Silverman 1992, Paradis & LaCharité 1997, Yip 2002, Kang 2003). But Peperkamp & Dupoux (2003, Peperkamp to appear) take a different approach, which is summarized in the following section.

3. The perception-only approach to loanword adaptation

Peperkamp & Dupoux (2003, Peperkamp to appear) develop a model of loanword adaptation in which all adaptation occurs **during perception**. On this view, there is no UR→SR mapping regulated by the L_b phonology that turns L_s -based source forms into L_b outputs. The L_b phonology is involved in loanword adaptation only in that it determines how L_s words are (mis-)perceived by a native speaker of L_b , as shown in (5).

(5) Perception of a nonnative form (Peperkamp & Dupoux 2003)

- a. L_s **acoustic signal** (Eng. *cream*, [kri:m])
- b. L_b speaker's **phonetic decoding module** maps acoustic signal to **closest native phonetic categories** (Jpn. SR [ku:.ri:.mu:])
- c. L_b speaker's **phonological decoding module** maps surface phonetic representation to a corresponding UR (Jpn. UR /kuri:mu:/)

Step (5b), where the L_s acoustic signal is mapped onto L_b phonetic categories, models a psycholinguistic effect known as **perceptual assimilation**: the tendency for one's native phonology to distort the perception of nonnative forms. In particular, a form that is illicit in language L is hard for speakers of L to distinguish from a similar, legal form (Best 1994, Hallé et al. 1998, Dupoux et al. 1999, Moreton & Amano 1999, Kabak 2003, Mielke 2003). Peperkamp & Dupoux (2003:369) emphasize that perceptual assimilation can occur even with prosodic constituents such as syllables. For example, Dupoux et al. (1999) and Dehaene-Lambertz et al. (2000) find that Japanese listeners have difficulty distinguishing between auditory stimuli with illicit VCCV versus well-formed VC[w]CV sequences; this suggests that the Japanese phonetic decoding module maps both VCCV and VC[w]CV onto VC[w]CV. That is, VCCV is perceived as VC[w]CV—a type of perceptual assimilation that can be called **perceptual epenthesis**.

According to the perception-only model of loanword adaptation, the very same effect is responsible for the ‘epenthetic’ vowels that appear in loanwords in Japanese. The presence of these non- L_s vowels is held to be an automatic consequence of the way that illicit codas or consonant clusters in

the L_s form are perceived by an L_b speaker. On this view, Japanese listeners directly perceive English *cream* as *kuriimu*, so their UR is already /kuri:mu/ with the ‘epenthetic’ vowels included, and no UR→SR process involving epenthesis need be postulated. It is important to note that the perception-only model does not require all loanword adaptation to occur by epenthesis; it is an empirical question what the ‘closest available native phonetic category’ for an illicit syllable type would be in each language. However, since Japanese loanwords *are* productively repaired by epenthesis, the perception-only model views the presence of those non-L_s vowels as the consequence of perceptual assimilation.

As Peperkamp (to appear) argues, a major advantage of adopting the perception-only model for Japanese loanwords is that it can straightforwardly account for the mismatch between loanword epenthesis and nonloan deletion repairs. If loanword adaptation is not a UR→SR mapping, then all repairs that *are* driven by a UR→SR mapping (that is, nonloan repairs) consistently involve deletion. There would be no need to complicate the phonological grammar with loanword-specific mechanisms.

However, there is some reason to question the ultimate success of the perception-only approach. For one thing, as Kenstowicz (2003) observes, if Japanese loanwords gain vowels as a direct consequence of perception, then such vowels could not have a phonological status different from the non-‘epenthetic’ vowels in loanwords—but this prediction is contradicted by Shinohara (2000), who shows that Japanese loans from French have an accent assignment process that treats inserted and L_s-based vowels differently.

The following section presents a new set of data that pose a problem for the perception-only approach to loanword adaptation in Japanese: loanwords that have doublet forms, one with epenthesis and one with deletion.

4. Evidence from loan doublets

Epenthesis is by far the most productive repair strategy in Japanese loanword adaptation for L_s forms containing L_b-illicit codas or consonant clusters. However, there are also cases of adaptation involving deletion. Typically, loanwords with deletion repairs have doublet forms with epenthesis. This section argues that in such doublets, it is the deletion form that more closely reflects perceptual factors, so perceptual assimilation cannot be responsible for all epenthesis repairs in loanwords.

Examples of deletion/epenthesis loan doublets are given in (6). The deletion forms are from Arakawa 1977, Ichikawa 1929, and Miura 1993. The epenthesis forms are either from the same source as the corresponding deletion form, or from Arakawa (1977).

(6) Deletion/epenthesis loanword doublets (19th-20th century loans)²

- a. Onset cluster simplification by deletion *epenthesis form*

[_ri.su.rin]	< <i>glycerine</i>	I25	[gu.ri.se.rin]
[_wai.sa.t ⁵ w]	< <i>white shirt</i>	'white/dress shirt' I8	[ho.wai.to]
- b. Final coda deletion

[d ⁵ i.ru.ba_]	< <i>jitterbug</i>	A577	[d ⁵ it.ta:.bag.gui]
[pok.ke_]	< <i>pocket</i>	I7	[po.ket.to]
[fa.mu.ne_]	< <i>lemonade</i>	'l.-flavor drink' I3,M171	[re.mo.ne:.do]
[han.ke.t ⁵ i_]	< <i>handkerchief</i>	I7, M136	[han.ka.t ⁵ i:.fu]
♦[o:.rai_]	< <i>all right</i>	I32	[o:.ru.rai.to]
- c. Final coda-cluster simplification by deletion

[ka.ran_]	< <i>crank</i>	I26	[ku.ran.kui]
[ne.ba:.ma.in_]	< <i>never mind</i>	(cheer a team) M28	[ne.ba:.ma.in.do]
[se.men_]	< <i>cement</i>	I26	[se.men.to]
♦[bo:.ru_]	< <i>board</i>	'pasteboard' I30	[bo:.do]/[bo:.ru.do]
♦[ro:.su_]	< <i>roast</i>	'meat for roast' I3,M135	[ro:.su.to]
- d. Coda [ŋ] as [N], not [ngui]

[pui.rin]	< <i>pudding</i>	I3	[pu.din.gui]
[tan]	< <i>tongue</i>	(food) I4, M177	[o.kui.su.tan.gui]
[sa:.fin]	< <i>surfing</i>	M139	[sa:.fiN.gui]
- e. Medial coda deletion

[he_.bon]	< <i>Hepburn</i>	'(J.C.) Hepburn' M58 (Katharine, Audrey)	[he.piu.ba:N]
[wai_.sa.t ⁵ w]	< <i>white shirt</i>	'white/dress shirt' I8	[ho.wai.to]
♦[bi_.su.te.ki]	< <i>beefsteak</i>	I2	[bi:.fu.su.te:.ki]
♦[don_.mai]	< <i>don't mind</i>	(cheer a team) M28	[don.to.mai.N.do]
♦[o:.rai]	< <i>all right</i>	I32	[o:.ru.rai.to]

²The symbol ‘♦’ in (6) indicates a deletion form that only differs from its epenthesis doublet form in having the prosodic shape [(μμ)(μμ)] or [(μμ)μ], and moreover matches the epenthesis form at the left edge(s) of the L_s morpheme(s). A case like this may have an alternative analysis as a metrically motivated truncation of the epenthesis form (see Itô 1990 on the phonology of loan truncation). But if a deletion form that meets these prosodic criteria has different counterparts to the L_s vowels than the epenthesis form has (especially L_s reduced vowels), this is taken as evidence of auditory borrowing rather than metrically motivated truncation; such cases are not marked with ‘♦’. Finally, the form [sa:.fin] ‘surfing’ in (6d) does have the prosodic shape of a possible truncation form, but Miura (1993: 139) explicitly labels this as a likely auditory loan, noting that other sport-name loans consistently have [...in.gui].

Since most loanwords show epenthesis, why are there cases like (6) with deletion doublets? Additional examples of deletion loans, shown in (7) and (8) below, help answer this question. It is well known that loanwords usually enter Japanese through written materials rather than spoken English (Lovins 1975, Miura 1993). But the forms in (7) and (8) involve borrowing situations that are probably auditory, and thus less likely to have been determined by English orthography. ('Standard' Japanese epenthesis forms from Arakawa (1977) are also listed in (7) and (8) where applicable.)

The examples in (7) are English loanwords into Hawai'ian Japanese, the language of a population that would have interacted with English speakers directly rather than primarily through English-language written materials.³

(7) English loanwords in Hawai'ian Japanese (Higa 1970)

- a. Deletion of final voiced stop, V_# (H137)

<i>[in.sai_]</i>	'inside'	cf. <i>[in.sai.<u>do</u>]</i>
<i>[au.sai_]</i>	'outside'	cf. <i>[au.to.sai.<u>do</u>]</i>
- b. Deletion of final voiced stop, N_# (H131)

<i>[ha.zuu.ben_]</i>	'husband'	cf. <i>[ha.zuu.ban.<u>do</u>]</i>
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- c. Deletion of final voiceless stop, S_# (H136)

<i>[ne.ki.suu_(i.ja)]</i>	'next (year)'	cf. <i>[ne.ki.su.<u>to</u>]+generation</i>
<i>[fa.suu_(i.ja)]</i>	'last (year)'	cf. <i>[fa.suu.<u>to</u>]</i>
- d. Deletion of medial-coda voiceless stop (H137)

<i>[au_.sai]</i>	'outside'	cf. <i>[au.<u>to</u>.sai.do]</i>
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The examples in (8) are from English phrasebooks written for 19th-century merchants interacting with English speakers in the ports newly open to foreign trade. As Kamei et. al (1965) note, the users of these books were not involved in the academic study of English-language materials; they were simply interested in communicating with English-speaking customers.

(8) Items from 19th-century English phrasebooks (Kamei et al. 1965)

- a. Final coda deletion

<i>[wa.r.i.waN.]</i>	K147
gloss: <i>nan de gozaru</i> 'what is it?' probable source: <i>what (do) you want</i>	

³It is possible that the Hawai'ian Japanese examples in (7) were borrowed from English indirectly, by way of Hawai'ian Creole English (Hawai'ian Pidgin), which also has deletion repairs. Therefore, we cannot be absolutely certain that these forms are true examples of deletion repairs *in Japanese*. But this point actually brings up another problem for the perception-only model of loanword adaptation: If the cross-linguistic preference for epenthesis repairs in loanword adaptation is an automatic consequence of perceptual epenthesis, then why are deletion repairs quite commonly found in situations of pidgin and creole formation? See Smith (in prep.) for additional discussion of deletion repairs in pidgins and creoles.

[nai_] K148, from *Nihon gaikoku syounin dokutuusi*
gloss: *yoru* ‘evening, night’ probable source: *night*; cf. [nai.to]

b. Medial coda (geminate) simplification by deletion

[gor_-de:.mu] K148, from *Nihon gaikoku syounin dokutuusi*
gloss: *okoru* ‘become angry’ prob. src: *goddamn*; cf. [god.de.mu]

Thus, the items in (7), and especially in (8), provide examples of how loanwords from English were represented by Japanese speakers who presumably encountered those English forms in spoken-language contexts. These examples indicate that when the influence of English orthography is lessened or removed, deletion repairs can be found. An auditory-borrowing explanation is also likely for many of the deletion loans in (6) (see also Ichikawa 1929, Miura 1993 for discussion of some of these examples). In support of this claim, we may note that other differences between the deletion loans in (6) and their epenthesis doublet forms are also consistent with an auditory source for the deletion form and an orthographic source for the epenthesis form. For example, the penultimate vowel in the deletion loan [ri.su.rin] <*glycerine*> is similar to the English reduced vowel in that syllable, while the corresponding vowel in the epenthesis doublet [gu.u.ri.se.rin] is more consistent with English orthography than with English pronunciation. Other examples from (6) in which deletion loans represent English reduced vowels more accurately include [d³i.ru.ba] vs. [d³it.ta**u**.bag.gu] <*jitterbug*> and [fa.mu.ne] vs. [re.mo.ne:e.do] <*lemonade*>. Deletion loans are also more likely to represent an English intervocalic flap as [r] instead of [t] or [d]; compare [pu.u.ru.in] vs. [pu.u.du.in.gu] <*pudding*> and, again, [d³i.u.ba] vs. [d³it.ta**u**.bag.gu] <*jitterbug*>⁴.

Summing up the results of this section, we find that although epenthesis is by far the most common repair strategy for loanwords in Japanese, there are examples of deletion repairs as well—particularly when the medium of borrowing is auditory rather than orthographic. This indicates that the outcome of actual auditory perception of English L_s forms by Japanese L_b speakers, at least in certain contexts, often involves **perceptual deletion** rather than perceptual epenthesis. Another, nonperception explanation is needed for the prevalence of epenthesis repairs, especially for cases with known deletion doublet forms.

5. An OO-Faith account of Japanese loanword adaptation

The preceding section has shown that the prevalence of epenthesis repairs for Japanese loanwords, far from being an automatic consequence of the

⁴S. Kawahara (p.c.) notes that English loans in Japanese rap songs may also involve deletion repairs; this is plausibly another context in which auditory similarity to English is valued.

perception of a nonnative form by a Japanese speaker, is actually related to the availability of L_s orthographic forms. In particular, L_s consonants that might not have been perceived in auditory input become accessible when the input is orthographic. The difference between perceptually based deletion and orthographically influenced preservation of a word-final coda is illustrated with the loan doublet *jiruba/jittaabaggu* from English *jitterbug* in (9).

(9) Deriving the doublet from L_s *jitterbug*

- a. **Auditory** borrowing (following perception model from (5))
 - i. L_s phonetic form [dʒɪ.tɔ̃.bʌg̩]
 - ii. L_b phonetic decoder [dʒi.ru.ba_] ([g]→Ø: **perception**)
 - iii. L_b underlying form /ziruba/
 - iv. L_b surface form [dʒi.ru.ba]
- b. **Orthographic** borrowing
 - i. L_s spelling <*jitterbug*>
 - ii. Assumed target → UR /dʒit.ta:.bag(g)/ (via orthography)
 - iii. L_b surface form [dʒit.ta:.bag.gu] (Ø→[u]: **phonology**)

Crucially, the form in (9b) provides evidence for *phonological* epenthesis. The final [g] in the L_s form is ‘perceived’ on the basis of orthographic decoding; therefore, it can be represented in the L_b UR. However, the final [u] that appears in the L_b surface form is not provided by the English orthography. On the contrary, the orthography provides evidence that the L_s form does *not* end in a vowel. The best explanation for the presence of this non-L_s vowel is the Japanese phonotactic constraint that makes [g] an illicit final coda. That is, the epenthetic vowel is the result of a UR→SR mapping; it is supplied by the **phonological grammar**. This means that the perception-only view of loanword adaptation, according to which ‘loanword adaptations are not due to the phonological grammar’ (Peperkamp & Dupoux 2003:367), is too strong.⁵

Having concluded that at least some instances of epenthesis repairs in Japanese loanwords are the effect of the phonological grammar, however, we must now address the problem outlined at the end of section 2: How can there be phonological epenthesis in loanword adaptation, if deletion is the

⁵Peperkamp & Dupoux (2003:369) acknowledge orthography as a possible *confound* in the investigation of loanword adaptation, noting that ‘orthography can be expected to play a role in all adaptations that are either based on written input or done by speakers who know the spelling of the loanwords in the source language.’ However, they do not consider cases comparable to orthographically borrowed loans in Japanese, where orthographic information sets the stage for *subsequent phonological adaptation* that is not itself motivated by the orthography.

default repair in the nonloan phonology? A number of researchers have proposed that the phonological UR→SR mapping involved in loanword adaptation is regulated not only by the constraints relevant for the native phonology of L_b , but also by constraints that enforce similarity to L_s forms (Yip 2002, Kang 2003, Kenstowicz 2003)—such constraints account for loan-specific repair strategies as seen in Japanese. Smith (in prep.) shows that these L_s - L_b similarity constraints can be systematically formalized as **output-output (OO) faithfulness constraints** (Benua 1997), requiring only a minimal extension to the phonological framework.

Invoking the independently motivated OO-FAITH system allows us to define a correspondence relation (call it the *SB relation*) between L_s output forms as perceived by L_b speakers (pL_s forms), which may include information gleaned from orthography as well as from auditory perception, and L_b outputs. One faithfulness constraint on the SB relation is the anti-deletion constraint MAX-SB, which penalizes L_b output forms when they lack segments found in their corresponding pL_s forms. Because MAX-SB is vacuously satisfied for nonloans (which, by definition, have no pL_s correspondents), the ranking MAX-SB >> { DEP-SB, {DEP-IO >> MAX-IO} } produces a grammar where loans have epenthesis repairs, because MAX-SB dominates both DEP constraints (10a), but nonloans have deletion repairs, because DEP-IO dominates MAX-IO (10b).

(10) SB-FAITH constraints and loanword-specific epenthesis in Japanese

a.	/best/ ‘best’ pL_s form: <Eng [best]	CODA COND	MAX- SB	DEP- SB	DEP- IO	MAX- IO
i.	best	*!				
► ii.	be.su.to			**		
iii.	be_ _		**!			**

b.	/jom-sase/ ‘read-CAUS’ pL_s form: <i>none</i>	CODA COND	MAX- SB	DEP- SB	DEP- IO	MAX- IO
i.	jom.sa.se	*!				
ii.	jo.m V.sa.se				*!	
► iii.	jo.m_a.se					*

The OO-FAITH approach to loanword adaptation captures the fact that adaptation often includes an attempt to match the perceived L_s form, but also that this process is driven by violable constraints, rather than being a mandatory outcome of speech perception as the perception-only approach to adaptation would require. (See Smith, in prep., for further discussion of this

point; for more evidence that L_s similarity in loanword adaptation is violable and interacts with other aspects of the phonological grammar, see Davidson & Noyer 1997, Yip 2002, Kang 2003, Kenstowicz 2004.)

In conclusion, perception is certainly influenced by native-language phonology, but perceptual assimilation is not the only force in loanword adaptation. A phonological analysis that includes OO-FAITH between L_s forms (as perceived by L_b speakers) and L_b forms is able to model the diverse forces that influence loanword phonology—including not only perceptual effects, but also orthographic information, and even interactions between loanword adaptation and other phonological constraints active in L_b.

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