

# *The emergence of phonological adaptation from phonetic adaptation : English loanwords in Korean\**

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This paper provides a detailed diachronic account of the adaptation of the English posterior coronal obstruents /ʃ tʃ ʤ/ in Contemporary Korean. These consonants are variably adapted with a glide (/j/ or /w/), and the distribution of the glides is conditioned by phonetic and phonological characteristics of the English input, as well as native phonotactic restrictions. The diachronic change in the occurrence of /w/ serves as an example of a variable phonetic detail in the input that is faithfully represented in loans in earlier stages, but which is subsequently eliminated in the emerging norm. Given this data, I propose how what, on the surface, may appear to be a ‘phonological’ adaptation can arise through regularisation of what is essentially a ‘phonetic’ adaptation. This study highlights the complexity of loanword adaptation and the importance of examining all of the different factors shaping this process.

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## **1 Introduction**

The current paper examines the adaptation of the English obstruents /ʃ tʃ ʤ/ to Contemporary Korean (1890–present) and investigates how the adaptation pattern evolved from Enlightenment Period Korean (1890–1910), which marked the beginning of Contemporary Korean and also the onset of substantial contact between English and Korean, through 1930s Korean, to Present-day Korean (1990–present). While the demarcation of PDK is driven by the loanword data we examine, 1990s is also

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the decade when South Korea began to encounter substantial *direct* contact with English after hosting the Olympic Games in 1988 and with the lifting of restrictions on foreign travel in 1989.

The English posterior coronal obstruents /ʃ tʃ ʤ/ are often adapted with a /j/ or /w/.<sup>1</sup> The palatal glide /j/ mimics the posterior constriction and the accompanying fronted tongue-body position in the English posterior coronals (Lass 1976, Ladefoged & Maddieson 1996, Stevens 1998, among others), whereas /w/ reflects the lip-rounding gesture that often accompanies the same consonants in English (Jones 1950, Gimson 1980, Rogers 2000, among others). However, Korean has a series of co-occurrence restrictions involving glides, and as a result, the distribution of the glides is conditioned by the interaction of the native language's phonotactic constraints and the demand for faithful preservation of the particular characteristics of the sound in the input language. The primary empirical focus of the current study is the distribution of the labial-velar glide /w/. Since the lip-rounding gesture in the English posterior coronal consonants is considered to be a surface enhancement, an analysis of the loanword data can inform the debate on whether the input to adaptation includes these kinds of phonetic details or not.

The lip-rounding gesture in English posterior coronal consonants is a surface enhancement of the primary place feature and does not itself constitute a phonologically distinctive feature (Keyser & Stevens 2006). Differing views on the nature of the input to loanword adaptation make different predictions about how such surface phonetic attributes are treated in adaptation. Some have argued that the input is the phonological representation in the source language, devoid of redundant phonetic details (Paradis & LaCharité 1997, 2008, 2009, Shinohara 2004, LaCharité & Paradis 2005, Paradis & Tremblay 2009), and they predict the lip-rounding gesture to be unrepresented in the loanword adaptation. One cannot evaluate this view without a definitive statement on what counts as being part of the phonological representation and what counts as being redundant phonetic details (see Y. Kang 2008a for related discussion). However, it seems reasonable to assume that most theories of phonology that make a distinction between abstract phonological features and surface phonetic details would treat the lip rounding in these consonants as being external to the phonological representation proper.

Others, on the other hand, have assumed that the input to adaptation is the acoustic representation in the source language, including all phonetic details of the source language sounds, regardless of their phonological status in the input language (Silverman 1992, Yip 1993, Peperkamp 2005, Iverson & Lee 2006, Peperkamp *et al.* 2008, Boersma & Hamann 2009, among others), and this latter view predicts that the lip rounding will be represented in the adaptation.

<sup>1</sup> English /ʃ tʃ ʤ/ have variably been described in the literature as postalveolars, palato-alveolars, alveolo-palatals, palatals and palatalised alveolars, among others. I refer to them here as posterior coronals.

However, as has been pointed out by Rose & Demuth (2006), some of the disagreements in the debate on the nature of loanword phonology may stem from the different methodological approaches used by researchers and, in a related manner, differing assumptions regarding what counts as a loanword. Some linguists focus on online adaptations (by monolinguals or bilinguals), which would correspond to the initial stage of loanword adaptation, whereas others focus on established loanwords which have been sanctioned by norms of the community. Although these two end-points are expected to be closely related, we find varying degrees of variability and sometimes different patterns of adaptation (cf. Haugen 1950, Y. Kang 2009). Also, given the same two languages, depending on the sociolinguistic circumstances of the contact and the channel of borrowing, the outcome of adaptation can differ significantly (Yip 2002, Smith 2006, Heffernan 2007, Friesner 2009a, Y. Kang, forthcoming). Moreover, adaptations of both types – phonological and phonetic – are often attested within a single contact situation (Friesner 2009a, b, Chang, to appear, Y. Kang, forthcoming). In other words, there is growing awareness of the multi-faceted nature of loanword phenomena in the field, and in order to gain a comprehensive understanding of loanwords, it is informative to examine how adaptation forms are transmitted through the community (cf. Poplack & Sankoff 1984, Davidson 2007 and Friesner 2009a, among others) and are transformed over time (cf. Sicoli 2000, Crawford 2007, 2008, Y. Kang *et al.* 2008, among others). The current study contributes toward this end.

Specifically, I examine how lip rounding in English posterior coronals is treated in the adaptation process during different periods of Contemporary Korean: Enlightenment Period Korean (EPK), 1930s Korean and Present-day Korean (PDK). We will see that in PDK loans the rounding in English posterior coronal affricates is mostly unrepresented, in agreement with previous studies (Iverson & Lee 2006, H. Kim 2009); thus this appears to be a good example of ‘phonological’ adaptation. However, when we examine data from earlier stages of the adaptation, we will see that the rounding was actually often represented. Based on this data, I propose a model of how an apparent case of ‘phonological’ adaptation can arise over time from what was essentially a ‘phonetic’ adaptation.

The paper is organised as follows: §2 provides background on Korean phonology, §3 presents the empirical findings of the study, §4 provides a discussion of the results and §5 concludes the paper.

## **2 Background**

In this section, I will provide an overview of the relevant aspects of Korean phonology. Except for the minor changes that will be discussed below, the phonology of Korean has not changed significantly from Enlightenment Period Korean, which marked the beginning of

Contemporary Korean, to Present-day Korean. The phoneme inventory of Korean is provided in (1).<sup>2</sup>

(1) *Phoneme inventory of Korean*

i	i̥	u	p	p <sup>h</sup>	p'	t	t <sup>h</sup>	t'	k	k <sup>h</sup>	k'
e	ɛ	o				ts	ts <sup>h</sup>	ts'			
(æ)	a							s	s'	h	
			m				n	ŋ			
j	w					l/r					

Korean has a three-way laryngeal distinction of lenis, aspirated and fortis obstruents. In PDK, the English voicing contrast in stops and affricates is adapted as an aspiration contrast, as in *date* → /teit<sup>h</sup>i/. In 1930s Korean, voiced stops and affricates were adapted as their Korean fortis counterparts word-initially, and this pattern persisted into PDK for certain lexical items, such as *game* → /k'eim/ (Choi 2001, 2002, Y. Kang 2008b). The voicing contrast in coronal fricatives, however, is adapted as a manner contrast in PDK – the English voiceless fricative /s/ is adapted as one of the Korean fricatives /s/ or /s'/, whereas the voiced fricative /z/ is adapted as the lax affricate /ts/, as in *size* → [s'aitsi]. Unlike the general pattern in PDK, /z/ was often adapted as /s/ or /s'/ in EPK and the 1930s (Y. Kang 2009). See Kenstowicz (2005), Iverson & Lee (2006) and H. Kim (2009) for an overview of consonant adaptation from English to PDK. The adaptation of posterior affricates and fricatives of English, which is the focus of this paper, will be discussed in detail below.

The syllable template of Korean is CGVC. There are various co-occurrence restrictions on the glide and its adjacent segments. The restrictions on glide + vowel (GV) sequences are summarised in (2). The high central vowel /i̥/ is not allowed with either glide – \*/j̥i̥/, \*/w̥i̥/. In addition, /j/ cannot occur with /i/, and /w/ cannot occur with /u/ or /o/. These restrictions hold categorically as morpheme-structure constraints and surface level constraints both in native words and loanwords.

(2) *Co-occurrence restrictions on glide + vowel sequences*

(Cho 1988, H.-S. Kang 1997)

*ji̥	*j̥i̥	ju	wi	*w̥i̥	*wu
je	j̥ɛ	jo	we	w̥ɛ	*wo
(jæ)	ja			(wæ)	wa

<sup>2</sup> In PDK, the distinction between /e/ and /æ/ has essentially been lost, even though it is retained in the orthography (Hong 1988, Choi 2002, Silva & Jin 2008). The merger of /e/ and /æ/ is a fairly recent development, only dating back to the 1950s in the standard dialect (Y.-B. Kim 2000, Chung 2002); the two vowels were reliably distinguished in 1930s Korean (Han 2005) and in EPK (K.-Y. Park 2005, Han 2007b).

The precise place of articulation of the Korean affricates has been the subject of much debate. Here, the affricates are represented by /ts ts<sup>h</sup> ts'/, but the discussion that follows does not crucially hinge on the exact place of articulation of Korean affricates.

There are also co-occurrence restrictions against certain consonant + glide (CG) sequences. For example, there are morpheme-structure constraints against sequences of a labial consonant and /w/ and sequences of a coronal obstruent and /j/, as summarised in (3). These sequences may nevertheless arise in the output via morphophonological derivation.

(3) *Morpheme structure constraints on consonant + glide sequences*

(H. Kim 1994)

a. \*Pw

Labial consonants do not precede rounded glides.

(P = /p p<sup>h</sup> p' m/)

b. \*Tj

Coronal obstruents do not precede front glides.

(T = /t t<sup>h</sup> t' ts ts<sup>h</sup> ts' s s'/)

In addition to these categorical restrictions, glides are frequently deleted in casual speech in postconsonantal position. The palatal glide is systematically deleted postconsonantly before a front vowel (Hong 1994, H.-S. Kang 1997, Choi 2002, Chung 2002, Cha & Ahn 2004); H.-S. Kang (1997) found that /j/ is deleted before /e/ 90% of the time postconsonantly in PDK. Chung (2002) analysed recordings of news broadcasts from the 1950s to 2000s, and found that the rate of /j/-deletion before a front vowel was as high as 80% even in the 1950s, which indicates that postconsonantal /j/-deletion before a front vowel is not a recent change. In fact, this deletion was also attested in 1930s Korean (Han 2005) and EPK (Y.-B. Kim 2000). Henceforth, I will refer to this restriction against postconsonantal /j/ before a front vowel as \*Cje.

The labial-velar glide /w/ is frequently deleted postconsonantly and most notably following a labial consonant (Silva 1991, H.-S. Kang 1997, J. Lee 2004, Cha & Ahn 2004). H.-S. Kang (1997) reports an 81% rate of /w/-deletion following a labial consonant, but a much lower rate of deletion following coronal consonants: 11% for affricates and 23% for other coronal consonants. There is disagreement as to whether the backness feature of the following vowel has any effect on the rate of postconsonantal /w/-deletion. Silva (1991) and J. Lee (2004) found that /w/-deletion was more likely to occur before front vowels than before back vowels, whereas H.-S. Kang (1997) found a statistically non-significant trend in the opposite direction. Whatever the following vowel effect may be (if any), we can safely assume that /w/-deletion following vowel non-labial consonants is not as systematic as the postconsonantal /j/-deletion that occurs before front vowels (\*Cje). For our purposes, we can simply note that there are no systematic restrictions against coronal obstruent + /w/ sequences, nor are there any systematic co-occurrence restrictions against /w/ and any following vowels, other than the categorical restrictions noted in (2).

Before we turn to the diachronic data on the adaptation of English posterior coronal obstruents, I will discuss how current normative

conventions dictate how these consonants should be adapted and transcribed (Ministry of Education 1986).<sup>3</sup> In *Hangul*, the native Korean alphabet, letters are written in blocks, each block roughly correspondingly to a syllable. The separation of blocks is represented by a period in this paper, and orthographic representations are given in < >.

First, English /ʃ/ is adapted as Korean <s> before /i/ and as <sj> before other vowels. Both are pronounced as [ʃ] on the surface, due to an allophonic palatalisation rule in Korean (Hwang 2004, K.-S. Kang 2009, H. Kang 2010). Examples are provided in (4a). Korean does not allow fricatives in non-prevocalic position; when /ʃ/ occurs word-finally an epenthetic vowel /i/ is inserted, and when /ʃ/ occurs before /ɹ/ an epenthetic vowel /u/ is inserted, as shown in (4b). It is notable that sequences of a coronal fricative and /j/, not found within native morphemes (cf. \*Tj in (3)), are nevertheless allowed in loanwords.<sup>4</sup>

(4) *Adaptation of English /ʃ/ according to normative conventions*  
(Ministry of Education 1986)<sup>5</sup>

a. shank	<sjæŋ.k <sup>h</sup> i>	[ʃæŋk <sup>h</sup> i]
shopping	<sjɔ.p <sup>h</sup> iŋ>	[ʃɔp <sup>h</sup> iŋ]
fashion	<p <sup>h</sup> æ.sjʌn>	[p <sup>h</sup> æʃʌn]
shim	<sim>	[ʃim]
b. flash	<p <sup>h</sup> iL.Læsi> <sup>6</sup>	[p <sup>h</sup> iɭlæʃi]
shrub	<sju.Lʌp>	[ʃurʌp]

According to the convention, English /tʃ/ is adapted as Korean /ts<sup>h</sup>/ and English /dʒ/ and /ʒ/ are both adapted as Korean /ts/. As with /ʃ/, in non-prevocalic position an epenthetic vowel /i/ is added following these consonants. Some examples are provided in (5).

(5) a. *Adaptation of English /tʃ/ according to normative conventions*

chart	<ts <sup>h</sup> a.t <sup>h</sup> i>	[ts <sup>h</sup> at <sup>h</sup> i]
switch	<si.wi.ts <sup>h</sup> i>	[siwits <sup>h</sup> i]

b. *Adaptation of English /dʒ/ according to normative conventions*

virgin	<pʌ.tsin>	[pʌtsin]
bridge	<pɪ.Li.tsi>	[pɪritsi]

c. *Adaptation of English /ʒ/ according to normative conventions*

vision	<pi.tsʌn>	[pitsʌn]
mirage	<mi.La.tsi>	[miratsi]

<sup>3</sup> Available (April 2010) at [http://www.korean.go.kr/09\\_new/dic/rule/rule\\_foreign\\_0201.jsp](http://www.korean.go.kr/09_new/dic/rule/rule_foreign_0201.jsp).

<sup>4</sup> Sequences of a coronal stop and /j/ are also allowed in loanwords, as in *tuna* → /t<sup>h</sup>juna/ and *duo* → /tjuo/.

<sup>5</sup> Transcription conventions do not provide phonetic transcriptions of how these words are, or should be, actually pronounced. Phonetic representations are based on the regular application of allophonic rules of Korean to the underlying representation, as expected from the orthographic representation.

<sup>6</sup> <L> represents the liquid phoneme that is realised as [l] or [r] allophonically.

Previous descriptions of the adaptation of English posterior coronal obstruents in the literature generally agree with normative conventions (Oh 1992, Hahn 2005, Iverson & Lee 2006, H. Kim 2009, H. Kang 2010, Heo 2010, among others), but there are some important exceptions.<sup>7</sup> First, many observe that /ʃ/ is adapted as /sw/, with a labial-velar glide, before /i/, and as /sj/ elsewhere (Hahn 2005, Iverson & Lee 2006). A slightly different generalisation is given by H. Kim (2009), who states that /ʃ/ is adapted as /sj/ before all back vowels, and as /sw/ before all front vowels.

The pattern for affricates found in loanwords is somewhat ambiguous. Contrary to normative conventions, in actual usage these affricates are often transcribed with palatal glides (i.e. <tsj> and <ts<sup>h</sup>j>) (Shin 1998, K.-S. Kang 2006), as the examples in (6) illustrate.<sup>8</sup>

(6) *Sequences of affricates and /j/ in loanwords*

choice <ts<sup>h</sup>jo.i.si> ~ <ts<sup>h</sup>o.i.sɨ>

junior <tsju.ni.ʌ> ~ <tsu.ni.ʌ>

The phonological and phonetic status of <j> in these words is unclear, and slightly different descriptions of the facts are found in the literature. H. Kim (2009) states that English posterior coronal affricates are adapted as sequences of affricates and /j/ before back vowels. K.-S. Kang (2006, 2009), on the other hand, argues that the affricate + <j> sequences are acoustically and perceptually indistinguishable from their corresponding simple affricates. As we will see below in Fig. 2, there is a clear asymmetry between the adaptation of the posterior coronal fricative /ʃ/ and affricates in terms of the distribution of <j>, but at the same time, <j> occurs substantially often enough not to be dismissed as a spurious spelling effect. For the purposes of the present study, I will simply assume that the <j> spelling in the adaptation of these affricates has some phonological reality. As for /w/, the literature is in agreement that it does not occur in affricate adaptations in PDK. Given this background, we will now examine the distribution of glides, in particular <w>, in the adaptation of English posterior coronals in the three time periods of Contemporary Korean.

<sup>7</sup> English /ʃ/ and /dʒ/ are sometimes realised as fortis obstruents in Korean in actual pronunciation, as in *fashion* [p<sup>h</sup>æʃʌŋ] and *jam* [tsʰæm] (Choi 2001). Normative conventions discourage the use of fortis consonants in loanword transcriptions, thus written forms usually do not reflect distinctions between fortis and lenis consonants in the actual pronunciation of the loanwords. The main concern of the paper is the occurrence of glides in posterior coronal obstruent adaptations, and we will therefore abstract away from the issue of laryngeal adaptation.

<sup>8</sup> There are additional variant spellings for these particular English words, but only two representative forms that are relevant for the purposes of our discussion are shown here.

### 3 Data

#### 3.1 Data sources

During the Enlightenment Period, many Western words entered Korean. Many of the borrowings during this period were transmitted to Korean through Japanese or Chinese and transliterations based on Sino-Korean characters were quite common, as in *Spain* /s.ʌpana/ (西班牙) and *Turkey* /t<sup>h</sup>oiki/ (土耳其) (M.-R. Kim 2000). Purely sound-based transliterations were also found, and increased over time (J.-Y. Lee 2008). For the purposes of the present study, we will focus on cases of sound-based transliterations only. The data for EPK come from three loanword lists: Y.-H. Kang (1971), Y.-S. Park (1997) and Han (2007a).

Y.-H. Kang (1971) provides a list of Western, mostly English, sound-based loans used in 37 textbooks published during the Enlightenment Period. The list contains over 900 items and provides the source language's input word for each item. Y.-S. Park (1997) gives a book-length list of loanwords compiled from textbooks, newspapers and novels published during the Enlightenment Period. From this list, I selected purely sound-based loanwords for which the source language input word was clearly indicated. Han (2007a) provides a list of loanwords gathered from three major newspapers published during EPK.<sup>9</sup> Here also, I selected only the sound-based loanwords for which the source language's input word was clearly specified. There were very few examples of /ʒ/ adaptations in these lists and in the lists from other periods, so we leave aside the adaptation of /ʒ/ in the present study.

The data for the 1930s loanwords come from the *Modern Chosun loanword dictionary* (J.-K. Lee 1937). This dictionary is a compilation of over 18,000 loanwords found in written materials published in the 1930s. The dictionary was published before the establishment of the first systematic guidelines on foreign word transcription, *Conventions for loanword transcription*, by the Korean Language Society in 1941 (Chosun Hakhoy 1941). Thus the influence of normative conventions is assumed to be relatively small (Yu 1988, M.-R. Kim 2000).

The data from PDK were drawn from two sources: *A survey of current loanword usage*, published by the National Institute of the Korean Language (NIKL 1991), and Google searches (July–August 2009). NIKL (1991) is a compilation of loanwords used in major newspapers and magazines published in 1990. The list contains some 5000 loanwords, mostly of English origin. While the loanwords in the NIKL list tend to adhere to normative conventions on foreign language transcription (Ministry of Education 1986), there is a substantial degree of deviation as well (see also Y. Kang 2003).

To complement the NIKL (1991) list, which was largely influenced by normative conventions, I also conducted Google searches

<sup>9</sup> I thank Professor Han Sung-Woo for generously allowing me to access this valuable list, which he compiled from original sources.

(July–August 2009) of loan forms of 183 English words containing one of the three posterior coronal obstruents under investigation, controlling for context, i.e. the following vowel. For each English input word, the rates of adaptation with <j> and <w> were calculated (see the Appendix for the full list of search results). To minimise the number of homophones being included in the total count, words with native or loanword homophones were avoided, and the English input word was entered along with the search term. For example, searches for *jazz* consisted of the following: ‘*jazz* <tsæ.tsi> 재즈’, without any glides, ‘*jazz* <tsjæ.tsi> 재즈’, with the glide <j>, and ‘*jazz* <tswæ.tsi> 재즈’, with the glide <w>. The Internet contains writings of various degrees of formality, and, as expected, Google search results showed more deviations from the norm than NIKL (1991). It is also possible that the loanwords may have undergone changes during the two decades between the publication of NIKL (1991) and the Google searches reported here. However, given the expected disparity between the two types of data sources, it is hard to make inferences about any actual changes that may have taken place during this period. Here, we will be mainly interested in changes from earlier periods to PDK.

All data were entered into a spreadsheet, and loan forms from these sources containing one of the English posterior obstruents were further coded for various characteristics. The number of relevant forms from each source is summarised in Table I.

	/ʃ/	/tʃ/	/tʃʃ/
EPK (Y.-H. Kang 1971, Y.-S. Park 1997, Han 2007a)	66	63	158
1930s (Lee 1937)	798	540	714
PDK (NIKL 1991)	285	210	215
PDK (Google search)	47	74	62

*Table I*

Number of loan forms in the four sources containing a posterior coronal obstruent.

### 3.2 Results

Based on normative conventions on loanword transcriptions, we would not expect <w> to occur in adaptations of English posterior coronal consonants. However, it has been observed that /w/ often occurred in adaptations of /ʃ/ before front vowels in PDK (Hahn 2005, Iverson & Lee 2006, H. Kim 2009). In this section, we will see that <w> indeed occurs quite frequently in /ʃ/ adaptations throughout Contemporary Korean. <w> also occurred in affricate adaptations in earlier periods (EPK and 1930s Korean), but in PDK the affricates are rarely transcribed with <w>. Examples of transcriptions with <w> in different time periods are given in (7).

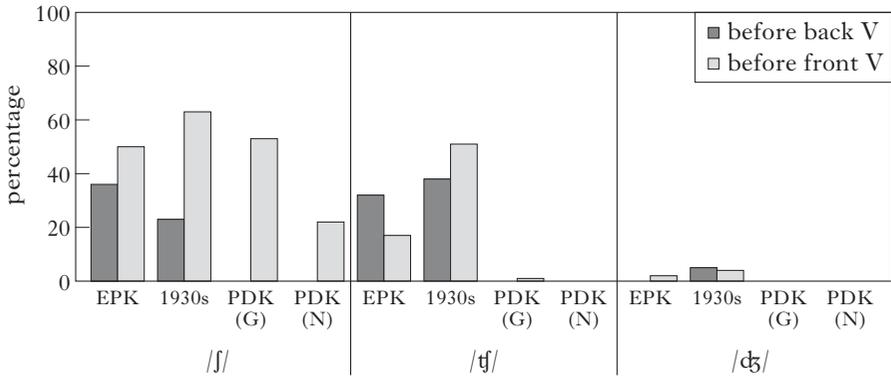


Figure 1

The rate of occurrence of <w> in the adaptation of English /f tʃ ɕ/ in different time periods of Contemporary Korean. PDK (G) gives the average of rates for individual English input words from the Google search; PDK (N) the rate across all items from NIKL (1991). EPK and 1930s also give the rates across all items.

(7) <w> in adaptations of /tʃ ɕ f/ in Contemporary Korean

a. EPK

- /tʃ/ chain <ts<sup>h</sup>we.in> ~ <ts<sup>h</sup>je.in>
- /ɕ/ Virginia <p<sub>Λ</sub>.tswi.ni.a> ~ <p<sub>Λ</sub>.tsi.nij.a> ~ <p<sub>Λ</sub>.tsi.ni.a> ~ <p<sub>Λ</sub>.tj.j.ni.a>
- /f/ Washington <waswiŋton> ~ <wasɪŋton> ~ <wasɪŋton>

b. 1930s

- /tʃ/ chance <ts<sup>h</sup>wan.si> ~ <ts<sup>h</sup>wan.s'i> ~ <ts'jan.s'i> ~ <ts<sup>h</sup>jan.s'i> ~ <ts<sup>h</sup>an.si> ~ <ts<sup>h</sup>æn.s'i>
- /ɕ/ G <ts'wi> ~ <ts'i>
- /f/ rush <L<sub>Λ</sub>.swi> ~ <L<sub>Λs</sub>.swi> ~ <L<sub>wΛ</sub>.swi> ~ <L<sub>as</sub>.swi> ~ <L<sub>æ</sub>.swi> ~ <L<sub>a</sub>.swi> ~ <L<sub>a</sub>.sju> ~ <L<sub>as</sub>.sju> ~ <L<sub>Λs</sub>.sju>

c. PDK

- /f/ leadership <Li.t<sub>Λ</sub>.swip> ~ <Li.t<sub>Λ</sub>.sip>
- milkshake <miL.k<sup>h</sup>i swe.i.k<sup>h</sup>i>

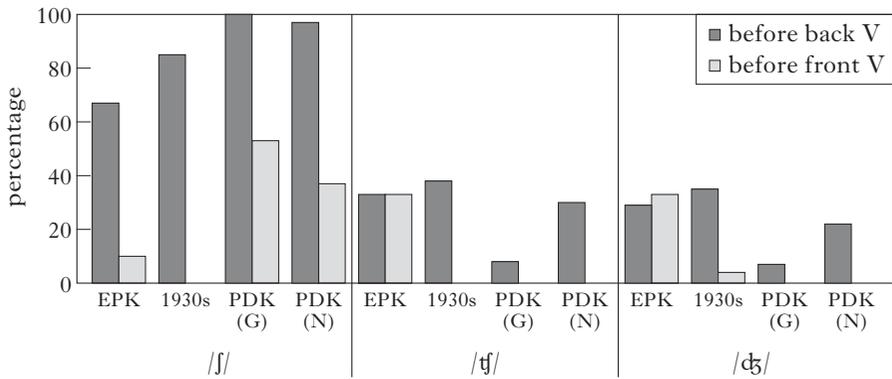
The rate of <w> spellings was calculated for cases where the following vowel allows <w> orthographically and phonologically, i.e. when the following vowel in the Korean adapted form is one of /a ʌ i e æ/. Data from all time periods are summarised in Fig. 1 by input consonant, time period and backness of the following vowel. Three general trends can be observed. First, in earlier periods, i.e. EPK and the 1930s, <w> was attested at substantial rates for /tʃ/ and marginally for /ɕ/, but in PDK <w> is categorically absent in affricate adaptations. The rate of <w> occurrences

has also decreased for /ʃ/ adaptations in PDK compared to earlier periods, but not to the same degree. Secondly, <w> occurs more frequently for the fricative /ʃ/ than for the English affricates, and <w> occurs more often for the voiceless affricate /tʃ/ than for the voiced affricate /dʒ/. The only exception is found for /ʃ/ and /tʃ/ before a back vowel in the 1930s (23% *vs.* 38%), which is likely due to the fact that /ʃ/ was adapted with <j> at a very high rate, and thus the co-occurrence restriction limited the possibility of <w> in the /ʃ/ adaptations. Thirdly, the distribution of <w> for /ʃ/ shows a systematic effect for vowel backness; <w> is found at a higher rate before a front vowel than before a back vowel in EPK and the 1930s, and <w> is found exclusively before a front vowel in PDK. However, the distribution of <w> in affricate adaptations does not show any systematic effect for vowel backness.

Before we turn to the proposed explanation for the drastic decrease in the occurrences of <w> in affricate adaptations, I will consider some possible alternative explanations, which will be rejected in turn.

The first possibility is that the categorical absence of <w> in affricate adaptations in the PDK data is due to normative conventions in spelling introduced in the latter half of the 20th century (cf. (4a, b)). However, this explanation is inadequate, given that <w> continued to occur at a substantial rate for /ʃ/, despite not being sanctioned by convention. Moreover, there is evidence that the absence of <w> in the spelling reflects the actual pronunciation of the loanword. In a survey of loanword pronunciations for the National Institute of the Korean Language (Choi 2001), English posterior coronal affricates were almost never pronounced with lip rounding. The survey included 13 English words with English affricates in contexts where <w> potentially could have occurred; out of the 5343 (13 words × 411 speakers) responses, only 14 responses (0.3%) reflected the lip rounding. This is in contrast with English /ʃ/, which was often produced with lip rounding before a front vowel (Choi 2001, 2002). Thus we can be fairly certain that the absence of <w> in the written data for affricate adaptations reflects the actual pronunciation of the loanword, and cannot be attributed solely to normative spelling conventions.

Secondly, the drastic decrease in the occurrence of <w> for the English affricates can also not be explained by any phonotactic restrictions or diachronic changes internal to Korean. An anonymous reviewer suggests the possibility that the distribution of <w> in affricate adaptation may be constrained by vowel backness, but there is no systematic vowel backness effect in the distribution of <w> in the affricate adaptations, as can be seen in Fig. 1, nor is there any clear effect for vowel backness on the distribution of [w] in native words, as discussed in §2. In addition, although [w] optionally deletes postconsonantly in casual speech in PDK, the rate of deletion following affricates is lowest (at 11%) compared to following other consonants (H.-S. Kang 1997). Therefore, the native process of [w]-deletion in casual speech is not systematic enough to account for the categorical absence of <w> in affricate adaptations in PDK.



*Figure 2*

The rate of occurrence of <j> in the adaptation of English /ʃ tʃ ʤ/ in different time periods of Contemporary Korean. PDK (G) gives the average of rates for individual English input words from the Google search; PDK (N) the rate across all items from NIKL (1991). EPK and 1930s also give the rates across all items.

A third possibility is that the decrease in the occurrence of <w> in the adaptation of these consonants is an epiphenomenon of an increase in the occurrence of <j> in the adaptation of the same consonants. Since Korean does not allow two glides to occur in the same syllable, an increase in the occurrence one glide can lead to a decrease in the other. To test this hypothesis, I examined diachronic trends of the occurrence of <j> in these consonants, which is summarised in Fig. 2. The rate of <j> spellings was calculated for cases where the following vowel allows <j> orthographically and phonologically, i.e. when the following vowel in the Korean adapted form is one of /a ʌ o u æ e/. For /ʃ/, occurrences of <j> increased over time and there was also a strong tendency to avoid <j> before a front vowel (cf. \*Cje, discussed in §2). In other words, <w> and <j> seem to be in complementary distribution in /ʃ/ adaptations. Thus the interpretation that the decrease in <w> occurrences in /ʃ/ adaptations is due to the increase in <j> occurrences is viable. The drastic decrease in the occurrence of <w> for affricates, on the other hand, cannot be explained by changes in the occurrence of <j>, since, if anything, <j> also decreased in PDK as compared to earlier periods. In addition, the overall higher occurrence of <w> in fricative /ʃ/ vs. affricate /tʃ ʤ/ adaptations cannot be attributed to the difference in rates of <j> occurrence either; <j> occurred more consistently for /ʃ/ than for affricates, and <w> also occurred more frequently for /ʃ/ than for affricates.

Finally, I consider the possibility that the change in Korean loanwords reflects changes in the English input from the early 20th century to PDK. In other words, it may be the case that the lip rounding accompanying the English posterior coronal obstruents used to be much stronger and consistent in the dialect(s) of English in contact with Korean in the early 20th

century than in dialect(s) in contact with PDK. Also, it might be the case that British English, which was likely the dominant dialect of English in the late 19th and early 20th centuries, has stronger lip rounding than American English, which is the dominant influence on loanwords in PDK.

Unfortunately, instrumental studies of labialisation in posterior coronal consonants are limited to the English voiceless fricative [ʃ] (Perkell *et al.* 1979, cited in Keyser & Stevens 2006) and there are no instrumental studies of diachronic changes or dialectal variation in lip rounding in English posterior coronal obstruents that I am aware of. I therefore examined the impressionistic descriptions of the consonants in different time periods; these are summarised below. In short, there is no evidence that the change in the dialect of English used as the input for loanwords in Korean is responsible for the changes in the Korean adaptation.

Descriptions of lip rounding in posterior coronal consonants in the late 19th and early 20th centuries, many of which are comparative descriptions of English *vs.* German and French, vary significantly. Scholle & Smith (1907) do not mention any lip gesture for these consonants, whereas Lloyd (1899) and Viëtor (1899) explicitly note that, for English /ʃ/, lips are 'passive', unlike for German *sch* (/ʃ/). On the other hand, Soames (1891), Grandgent (1892), Sweet (1908) and Jones (1914) note that a lip gesture is present for the posterior coronal fricatives /ʒ/, but most still acknowledge the existence of inter-speaker variation and the fact that the rounding is less pronounced than that found in German *sch*. None of the descriptions examined explicitly mention lip rounding for the affricates at all in this time period.<sup>10</sup>

Descriptions in the latter part of the 20th century are similarly variable, and there is no indication that the rounding gesture became any less noticeable over time. In later literature, lip rounding is explicitly mentioned for affricates (Hubbell 1950, Jones 1950, Kurath 1964, Gimson 1980, Rogers 2000, Liker *et al.* 2007, Collins & Mees 2008, among others), as well as fricatives (Jones 1950, Bronstein 1960, Kurath 1964, Gimson 1980, Ladefoged 1975, Ladefoged & Maddieson 1996, Small 1999, Roach 2000, Rogers 2000, Keyser & Stevens 2006, Collins & Mees 2008). Many mention the variability of rounding in these consonants. As mentioned above, Keyser & Stevens (2006: 40) note that 'the degree of rounding of /ʃ/ is more variable than that in a featurally initiated rounding such as that in /u/'. Ladefoged (1982) and Roach (2000) also note inter-speaker variation. Ladefoged (1982: 59) states that '*most* people find that their lips move ... quite considerably in any word containing /ʃ/ ... and /ʒ/' (emphasis added). Roach (2000) mentions that most 'BBC speakers' produce lip rounding for the posterior coronal fricatives.

As for the issue of British *vs.* American varieties of English, lip rounding is observed in descriptions of both dialects (British English: Soames

<sup>10</sup> This may be due to the fact that affricates are simply described as a combination of a stop and a posterior coronal fricative, thereby implicitly suggesting lip rounding is present for affricates as well. Alternatively, this could be a real reflection of a lack of lip rounding in the affricates.

1891, Sweet 1908, Jones 1914, 1950, Kurath 1964, Gimson 1980, Rogers 2000; American English: Grandgent 1892, Hubbell 1950, Bronstein 1960, Rogers 2000, Keyser & Stevens 2006). Kurath (1964) and Rogers (2000) observe dialectal differences, but their observations are contradictory. Kurath (1964) notes that rounding is found in British English, but is absent in American English. Rogers (2000: 49), on the other hand, observes that ‘*commonly* in RP, and *usually* in GA, the postalveolars /tʃ dʒ ʃ ʒ/ ... have inherent rounding which is independent of the context’ (emphasis added). In short, there is no evidence that the lip rounding is more systematic in British English than it is in American English.

To summarise, there is no evidence that the lip rounding in posterior coronal obstruents of English became any less systematic or overt in the variety of English that PDK came in contact with, and thus we cannot account for the diachronic shift in the adaptation pattern based on changes in characteristics of the input. With these various alternatives ruled out as plausible explanations, I now present a model for how variable phonetic details reflected in earlier loans may become lost in later stages of the language contact situation.

#### 4 The emergence of phonemic uniformity

The adaptation of English posterior coronal obstruents presents an interesting testing ground for hypotheses about the nature of the input to loanword adaptation, because these English consonants not only have a posterior coronal constriction as their primary place of articulation, but they also have a lip-rounding gesture phonetically. The lip-rounding gesture in the posterior fricatives of English has received a lot of attention as an enhancement of the primary ‘feature-defining’ gesture in coronal fricatives (Keyser & Stevens 2006) – namely, lip rounding has the effect of lowering the frequency of the frication noise, further enhancing the low-frequency noise cue of the posterior coronal fricatives. As we have just seen, lip rounding is also found in English posterior coronal affricates, as well as fricatives.

In descriptions of these consonants, however, the lip-rounding gesture is mostly mentioned only in passing, if at all, and is never proposed as a distinctive feature of the consonants. As noted above, Keyser & Stevens (2006: 40) specifically mention that the lip rounding for /ʃ/ is ‘more variable than that in a featurally initiated rounding such as that in /u/’. We would thus expect most theories of phonology which make a distinction between abstract phonological features and surface phonetic details to treat the lip rounding in these consonants as being external to the phonological representation proper. Thus, if only phonological representations devoid of redundant surface-level details are visible to the loanword-adaptation process, we would not expect the lip rounding to be reflected in the Korean loans. However, as we have seen, <w> occurs quite frequently in the adaptation of English posterior coronal consonants, especially in the earlier periods of Contemporary Korean.

The entire situation is much more complex than a simple choice of phonetic *vs.* phonological adaptations, however. Occurrences of <w> have decreased drastically in PDK, when compared to earlier periods. In the case of /j/, <j> occurs categorically in back vowel contexts, pre-empting the use of <w>, and <w> occurs in front vowel contexts, which is the only context where <j> is strongly dispreferred. More strikingly, in the case of affricates, <w> is never found in the PDK data. There is no obvious native phonotactic restriction that can account for this change. As mentioned above, given that Korean phonology is predisposed to disfavour the palatal glide in this position due to phonotactic constraints against sibilant + /j/ sequences, if anything, <j> would be expected to disappear, but not <w>. Why, then, did <w> disappear in affricate adaptations in PDK?

In the initial stages of adaptation, where there are no established norms, each adapter is left to their own devices to carry out an online adaptation. These initial borrowings are unaffected by tendencies in pre-existing loans, since there are few or no pre-existing loans at this stage. As a result, the adaptation is more variable, and if a phonetic attribute is present inconsistently in the input, as in the case of lip rounding in English posterior coronal obstruents, we expect more variation to occur. At this initial stage, if, for example, an input posterior coronal obstruent has lip rounding that is robust enough to trigger adaptations with /w/ about 30% of the time, and if there are no other factors militating against the occurrence of /w/, we would expect /w/ to occur at a rate of 30%. Put in OT terms, a constraint promoting the matching of the input with the output, which has been variously referred to as MATCH (Davidson & Noyer 1997), MIMIC (Yip 2006) or BESIMILAR (Y. Kang 2003) in the literature, dominates the adaptation. At this stage, variation in characteristics of the input produces corresponding variation in the outcomes of adaptation.

This initial variation is not stable, however. Languages are generally intolerant of true synonyms (cf. the blocking effect described by Aronoff 1976), and as initial borrowings gain currency and become established loans, variation is likely to be reduced or eliminated, unless variants take on different functions (cf. Zuraw 2000: 119, Y. Kang 2003: 254). All else being equal, the more frequent variant (i.e. in the current discussion, the form without <w>) is more likely to be adopted as the norm. The process of standardisation can occur not only at the level of individual lexical items, but also at a more general level. Subsequent adaptations of new words continue to be conditioned by similarity to the input signal, but also by analogy to existing loan forms, which further strengthens the majority pattern. Crucially, such analogy to existing forms can be mediated by the adapters' knowledge of the phonological categories of the native language. In other words, when adapting a new word containing /tʃ/, for example, adapters may examine examples of English /tʃ/ adaptations in their lexicon and prefer to follow the dominant pattern in the current existing lexicon (i.e. the form without <w>). In OT terms, this regularising tendency can be modelled as another constraint, which we can refer to as UNIFORMITY, promoting the existing majority adaptation pattern for a given input

language phoneme, and eventually promoting the uniform exponents of that phoneme category. The addition of this normalising factor would further tip the scales toward the majority pattern, and all else being equal, each subsequent stage of adaptation would further increase the dominance of the majority form. Eventually, phonetic details which were reasonably well represented in earlier loans could essentially disappear, as we observed in the rounding of affricates, resulting in what would appear to be a phonological adaptation. In other words, this is a possible scenario of how what may appear to be a ‘phonological’ adaptation can arise from an essentially ‘phonetic’ adaptation through regularisation by analogy to the dominant pattern in pre-existing loans.

In the literature, we find the related observation of a diachronic shift in loanword adaptation patterns from more variable and more ‘phonetic’ ones to less variable and more ‘phonological’ ones. Haugen (1950: 216–217) observes that in the initial stage of loanword adaptation (his ‘pre-bilingual period’) words are adapted ‘with great irregularity in the phonetic results’; he refers to such a state as ‘ERRATIC SUBSTITUTION’. A subsequent stage (his ‘period of adult bilingualism’) exhibits ‘a more SYSTEMATIC SUBSTITUTION, in which the same [native language] phoneme is consistently employed for new [input language] loans’. In a diachronic study of English loanwords in Quebec French, Paradis & LaCharité (2008, 2009) found that the rate of non-phonological adaptations decreased from 17.5% (70 out of 401 cases) in Old Quebec French (late 19th–early 20th century Quebec City) to 9.5% in recent Quebec City French and to 7.1% in recent Montreal French. In particular, the rate of ‘phonetic approximation’ decreased from 5.5% in Old Quebec French to 1.1% and 0.4% in recent Quebec City French and recent Montreal French respectively. Here, we can observe a diachronic trend from ‘more variable’ to ‘less variable’, and from ‘less phonological’ to ‘more phonological’.<sup>11</sup>

Peperkamp *et al.* (2008), who are proponents of the ‘phonetic’ adaptation view, make a somewhat similar suggestion: the gap between the perception data in laboratory experiments, which is usually quite variable, and established adaptation patterns, which tend to be more systematic and regular, suggests that a process of ‘standardisation’ takes place as established loanwords develop.

However, it is also important to note that I am not proposing that the input-language phonology is irrelevant in loanword adaptations. On the contrary, the proposed process of regularisation essentially assumes that adapters utilise their knowledge of the phonemic, and possibly other more abstract, categories of the input language. For example, they should be able to identify English words containing /tʃ/. In this sense, I disagree with the purely phonetic view of adaptation, where the input to loanword

<sup>11</sup> Paradis & LaCharité (2008, 2009)’s main point is that even in Old Quebec French, where the level of bilingualism was relatively low, the adaptation was overwhelmingly ‘phonological’. Thus, regardless of the overall level of bilingualism in the community, loanword adaptation is fundamentally ‘phonological’.

adaptation consists of the unstructured acoustic signal (cf. Silverman 1992, Peperkamp *et al.* 2008, Boersma & Hamann 2009).

At the same time, I do not assume that adapters are fluent bilinguals who have native-like knowledge of English (cf. Paradis & LaCharité 1997). All that is required to make this regularisation process possible is minimal knowledge of English phoneme categories. In fact, there is ample evidence that the adaptation is often guided (or misled) by input-language orthography (Dohlus 2005, Smith 2006, Vendelin & Peperkamp 2006, Detey & Nespoulous 2008). An orthography effect seems to play a role when the adapters' knowledge of the input language is imperfect, leading them to resort to orthography to help them determine the correct English category in the input. For example, Y. Kang (2009) found that in 1930s Korean the adaptation of English /z/ varied between /ts/ and /s/ ~ /s'/. /ts/, which is voiced intervocally in Korean, occurred in contexts where English /z/ was more likely to remain voiced, whereas /s/ ~ /s'/ occurred in contexts where English /z/ was more likely to be devoiced. Overall, /ts/ was the majority pattern in the 1930s, and in PDK the pattern became phonemically more uniform, favouring /ts/, the majority pattern in earlier periods, in all phonological contexts. Interestingly, the 1930s adaptations reflect a strong influence from orthography. In other words, all else being equal, English /z/ was more likely to be adapted as /ts/ if it was written with a <z>, rather than with an <s>, regardless of the context. Thus, adapters of the 1930s appear to have been implicitly aware that the English phoneme /z/ should preferably be adapted as /ts/, but their knowledge of English appears to have been imperfect. As a result, they may not necessarily have been certain as to whether an alveolar fricative in any given word in English was /z/ or /s/. This problem was particularly acute in cases where English /z/ was devoiced or when it was written with an <s> and not <z>.

The proposed model also does not link the rise in 'phonological' adaptations to the level of bilingualism or the input language proficiency of the adapters necessarily. On the contrary, regularisation portrayed in this model is more likely to take place if the level of direct contact with English is held relatively low, which keeps the MATCH constraint ranked relatively low. In fact, in PDK there is marginal evidence that the rate of /w/ pronunciations for the English posterior coronal consonants, which is a symptom of 'phonetic', not 'phonological', adaptations, is higher for more educated speakers. Choi (2002) asked 210 Seoul Korean speakers to pronounce various English loanwords. Of interest to us is the pronunciation of three English loanwords where /ʃ/ occurred before a mid-front vowel /e/ or /ɛ/, which are adapted as /e.i/ and /e/ respectively: *Shakespeare*, *milkshake* and *shepherd*. The study found that the likelihood of English /ʃe/ or /ʃɛ/ being pronounced with /w/ was positively correlated with the level of education of the speakers (primary school: 0.00%, middle school: 2.57%, high school: 10.78%, university: 19.87%). In another survey involving 411 Seoul speakers (Choi 2001), the English affricates were rarely pronounced with /w/ overall, as discussed above, but news

broadcasters, who likely had a greater level of knowledge of English than the general population, had a slightly higher rate of /w/ pronunciations at 1.6% (9 out of 572 cases (44 speakers × 13 words)) than the general population at 0.1% (5 out of 4771 cases (367 speakers × 13 words)). In other words, it appears that, if anything, beyond a certain level, a higher level of input language knowledge works counter to phonemic levelling.

Another important aspect of the proposed model is that it does not predict that all non-feature-defining phonetic details will be completely lost as the contact situation matures in the same way that lip rounding for affricates disappeared in PDK or the contextual variation of /z/ adaptation disappeared in PDK. In fact, it is not the phonetic *vs.* phonological status of particular characteristics of the input but the consistency in the early stages of adaptation that is a key factor in determining whether characteristics will be eventually retained in the established norm. If an attribute is salient and consistent enough to show up in the adaptation in the majority of cases in the early stages, it is expected to survive. Minority patterns are expected to die out. In fact, however, if a given phonetic attribute occurs consistently and is salient, it is generally the case that that attribute can be analysed as a phonologically contrastive feature. Hence it is expected that most attributes that are consistently represented in established loans are also likely phonologically distinctive features in the input language.

This model also allows for the possibility that phonemic uniformity is not necessarily achieved. There is ample evidence that not all segmental adaptations become phonemically uniform (see Y. Kang, forthcoming, for a review). Even for /j/ adaptations in PDK (Google), /w/ occurs in over 50% of the cases before front vowels (Fig. 1), but in back vowel contexts /j/ pre-empts the occurrence of /w/, which is categorically absent. In the proposed model, the push toward phonemic uniformity (UNIFORMITY) and the drive to preserve input characteristics (MATCH/MIMIC/BESIMILAR) are formulated as constraints which are violable and in conflict with each other. The former does not necessarily override the latter. Depending on the ranking between these constraints, uniformity may or may not be achieved.<sup>12</sup>

It is not clear whether we can predict which ranking will prevail in any given situation, but it seems that phonetic saliency is a relevant factor, as well as the level of direct contact with the input language, as discussed above. In Korean, the lip rounding in affricates has almost completely been eliminated in PDK adaptations, but the lip rounding for /j/ has been retained in front vowel contexts, defying complete regularisation.

<sup>12</sup> As the associate editor points out, the variation in [w] realisation persists into the PDK for /j/, and the categorical re-ranking of constraints alone is ill equipped to handle the synchronic variation attested in the data. Rather, models of constraint ranking with a probabilistic component that can handle variation and gradient patterns in a systematic way seem more appropriate (cf. Boersma & Hayes 2001, Coetzee 2006, Hayes & Wilson 2008).

Assuming that the primary cue for rounding is found during the frication noise, the cue for the lip-rounding gesture is likely more salient in sounds with longer frication noise. As a result, we expect that lip rounding is more likely to be retained in the Korean adaptation for consonants with longer frication duration. The phonetic facts are certainly compatible with this interpretation. One of the key perceptual cues for the distinction between English voiceless affricates and fricatives is the longer frication duration of the fricative as compared to the affricate (Dorman *et al.* 1980, Hedrick 1997). The voiceless affricate also tends to have a longer constriction than the voiced affricate (Crystal & House 1982), which may explain the asymmetry in occurrences of <w> between the two affricates in EPK and 1930s Korean, i.e. <w> occurs at a substantial rate for the voiceless affricate /tʃ/ but not for the voiced affricate /dʒ/.

All in all, the pattern of <w> occurrences and their evolution in the adaptation of English posterior coronals shows that loanword adaptation is sensitive to phonetic details. However, phonetic details which do not constitute underlying phonological contrasts in the input language and are therefore less consistently present may be lost over time. Thus, in established loanwords, we can end up with a ‘cleaned-up’ version of the earlier adaptation, and the established pattern preferentially retains phonological information of the input language but not variable phonetic details. It is also worth pointing out that if one only examined the EPK data, one would be led to the conclusion that the input to loanword adaptation is phonetic and all phonetic details are reflected in the adaptation, regardless of their phonological status. If one only examined the PDK data, one would be led to the conclusion that only the phonologically contrastive aspects of the input language are reflected in the adaptation, which would also be incorrect.

## 5 Conclusion

The diachronic change in the distribution of <w> in the adaptation of English posterior coronal obstruents provides a good illustration of the complexity of the loanword-adaptation phenomenon. In earlier stages of contact, the distribution of <w> reflected phonetic details and the variability of the input fairly closely, but in PDK the norm of eliminating the <w> in affricate adaptations has been established. It is proposed that the development of the distribution of <w> is a case where what appears to be a phonological adaptation can arise from what is essentially a phonetic adaptation, as the loanwords undergo the process of standardisation and regularisation. But this process of regularisation crucially involves reference to the input language’s phonological categories, i.e. phonemes. If the two factors, (i) faithful representation of input phonetic details (MATCH) and (ii) uniform representation of input language categories (UNIFORMITY), are in conflict with each other, depending on how the conflict is resolved (i.e. their relative ranking in OT terms), the

end result may be what appears to be a phonological adaptation (UNIFORMITY $\gg$ MATCH) or the persistence of phonetic adaptations (MATCH $\gg$ UNIFORMITY). The current study contributes to the body of literature recognising the multi-faceted nature of loanword adaptation, and has examined how the diachronic shift in adaptation patterns can shed light on the interaction of phonological and phonetic factors in shaping the overall process.

Appendix: Google search list

/s/

English input	With <j>		With <w>		Neither		Total
champagne	샴페인	97·1	삼페인	0·0	삼페인	2·9	22,144
commercial	커머셜	100·0	커머쉴	0·0	커머쉴	0·0	19,108
condition	컨디션	100·0	컨디쉰	0·0	컨디션	0·0	11,302
cushion	쿠션	99·9	쿠쉰	0·0	쿠션	0·1	75,391
demonstration	데몬스트레이션	100·0	데몬스트레이쉰	0·0	데몬스트레이션	0·0	1,050
lotion	로션	99·4	로쉰	0·0	로션	0·6	59,953
motion	모션	99·8	모쉰	0·0	모션	0·2	1,415,672
pension	펜션	100·0	펜쉰	0·0	펜션	0·0	199,069
potential	포텐셜	99·0	포텐쉴	0·0	포텐셜	1·0	10,510
pressure	프레셔	87·1	프레쉬	0·0	프레셔	12·9	6,957
reception	리셉션	100·0	리셉쉰	0·0	리셉션	0·0	10,802
shade	셰이드	15·0	쉐이드	80·9	셰이드	4·0	12,848
shake	셰이크	7·1	쉐이크	92·6	셰이크	0·3	129,610
shampoo	샴푸	87·5	삼푸	0·0	샴푸	12·5	17,250
sharp	샤프	99·3	좌프	0·0	사프	0·7	139,030
shepherd	셰퍼드	60·6	쉐퍼드	26·0	세퍼드	13·4	13,090
sheriff	셰리프	50·7	쉐리프	23·0	세리프	26·3	905
sherry	셰리	50·2	쉐리	38·3	세리	11·5	7,627
shower	샤워	99·7	좌워	0·0	사워	0·3	133,405
special	스페셜	99·9	스페쉰	0·0	스페셜	0·1	440,264
brush			브러쉬	67·6	브러시	32·4	77,500
cash			캐쉬	64·5	캐시	35·5	63,400
chiffon			쉬폰	91·1	시폰	8·9	58,820
dash			대쉬	74·3	대시	25·7	33,240
dish			디쉬	72·4	디시	27·6	13,050
finish			피니쉬	76·8	피니시	23·2	16,530
fish			피쉬	58·0	피시	42·0	180,900
flash			플래쉬	3·8	플래시	96·2	4,139,000
fresh			프레쉬	79·3	프레시	20·7	110,700
machine			머신	1·5	머신	98·5	448,940
marsh-mallow			마쉬멜로우	28·5	마시멜로우	71·5	369
mushroom			머쉬룸	72·1	머시룸	27·9	1,347
rush			러쉬	88·2	러시	11·8	219,900
sheet			쉬트	6·1	시트	93·9	173,600
shilling			실링	1·1	실링	98·9	18,204
shingle			싱글	0·0	싱글	100·0	1,260,300
smash			스매쉬	77·5	스매시	22·5	24,760
trash			트래쉬	86·7	트래시	13·3	3,182

English input	With <j>	With <w>	Neither	Total
bishop	비숍 99.9		비숍 0.1	132,091
cashew	캐슈 99.9		캐수 0.1	907
chauvinism	쇼비니즘 99.9		소비니즘 0.1	689
parachute	패러슈트 100.0		패러수트 0.0	507
shock	쇼크 100.0		소크 0.0	215,099
shoes	슈즈 100.0		수즈 0.0	741,239
shoot	슈트 72.2		수트 27.8	4,570
short	쇼트 97.5		소트 2.5	71,560
shoulder	숄더 98.2		솔더 1.8	56,630

/tʃ/

English input	With <j>	With <w>	Neither	Total
catcher	캐처 30.3	캐취 0.3	캐처 69.4	2,968
cello	첼로 0.0	웰로 0.0	켈로 100.0	35,501
chain	체인 0.0	웨인 0.0	체인 100.0	119,027
chair	체어 0.0	웨어 0.3	체어 99.7	47,351
chamber	체임버 0.0	웨임버 0.0	체임버 99.9	11,406
champion	챔피온 0.0	웬피온 0.0	챔피온 100.0	56,701
chance	첸스 0.0	웬스 0.0	첸스 99.9	6,284
change	체인지 0.0	웨인지 0.2	체인지 99.7	55,040
channel	채널 0.0	웨널 0.0	채널 100.0	1,510,007
Chaplin	채플린 0.0	웨플린 0.0	채플린 100.0	20,200
chapter	챕터 0.0	웬터 0.0	챕터 100.0	36,702
charcoal	차콜 36.2	화콜 0.0	차콜 63.8	7,152
charge	차지 3.7	화지 0.1	차지 96.3	79,988
Charlie	찰리 4.6	왈리 0.5	찰리 94.9	73,952
charming	차밍 43.7	화밍 0.0	차밍 56.2	11,345
chart	차트 25.6	화트 0.0	차트 74.4	380,528
charter	차터 6.6	화터 0.0	차터 93.4	4,724
check	체크 0.0	웨크 0.1	체크 99.9	717,711
cherry	체리 0.0	웨리 0.1	체리 99.9	110,059
chess	체스 0.0	웨스 0.0	체스 100.0	25,410
China	차이나 0.5	화이나 0.0	차이나 99.5	479,323
chowder	차우더 7.4	화우더 0.0	차우더 92.6	1,491
Christian	크리스찬 44.1	크리스완 0.0	크리스찬 55.9	216,401
church 1	처치/취취 8.1	취치/취취 0.0	처치/취취 91.9	21,445
franchise	프랜차이즈 0.4	프랜화이즈 0.0	프랜차이즈 99.6	39,055
ketchup	케첩 2.9	케첩 0.0	케첩 97.0	4,865
Manchester	맨체스터 0.0	맨웨스터 0.0	맨체스터 100.0	68,104
picture	픽처 57.7	픽취 1.1	픽처 41.2	50,057
pitcher	피처 51.2	피취 0.0	피처 48.8	7,113
teacher	티처 60.5	티취 0.3	티처 39.2	20,976

English input	With <j>		With <w>		Neither	Total	
approach			어프로취	1·9	어프로치	98·1	7,287
arch			아취	4·0	아치	96·0	27,390
beach			비취	2·6	비치	97·4	319,260
bench			벤취	0·8	벤치	99·2	188,470
catch			캐취	4·2	캐치	95·8	36,240
cheese			취즈	0·0	치즈	100·0	276,038
chicken			취킨	0·2	치킨	99·8	77,745
Chile			칠레	0·0	칠레	100·0	52,800
chimney			침니	0·6	침니	99·4	1,278
chimpanzee			침팬지	0·0	침팬지	100·0	4,720
chinchilla 1			친칠라	0·0	친칠라	100·0	1,450
chinchilla 2			친칠라	0·0	친칠라	100·0	1,450
chips			칩스	0·9	칩스	99·1	6,426
church 2			처취	1·1	처치	98·9	19,927
coach			코취	0·0	코치	100·0	243,009
etching			에칭	0·0	에칭	100·0	13,100
inch			인취	0·0	인치	100·0	271,069
lunch			런취	0·3	런치	99·7	30,099
lynch			린취	7·6	린치	92·4	17,530
match			매취	0·4	매치	99·6	119,424
pitch			피취	0·1	피치	99·9	87,482
pitching			피칭	0·0	피칭	100·0	6,060
punch			펀취	0·2	펀치	99·8	34,764
research			리서취	0·0	리서치	100·0	227,095
sandwich			샌드위취	0·0	샌드위치	100·0	38,601
Scotch			스카취	0·8	스카치	99·2	10,279
scratch			스크래취	1·0	스크래치	99·0	15,760
sketch			스케취	0·1	스케치	99·9	87,350
speech			스피취	0·6	스피치	99·4	26,655
stitch			스티취	0·4	스티치	99·6	12,246
stretch			스트레취	1·1	스트레치	98·9	16,986
switch			스위취	0·1	스위치	99·9	211,168
touch			터취	0·1	터치	99·9	893,551
watch			워취	0·2	워치	99·8	124,203
wrench			웬취	0·0	웬치	100·0	14,404
amateur	아마쥬어	8·8			아마추어	91·2	21,720
chalk	쇼크	33·1			초크	66·9	9,870
chewing	쥬잉	85·9			추잉	14·1	1,257
chocolate	쇼콜렛	14·2			초콜렛	85·8	53,990
choice	쇼이스	13·8			초이스	86·2	346,700
Chomsky	흙스키	0·7			흙스키	99·3	41,977
situation	시츄에이션	50·3			시추에이션	49·7	3,460
spiritual	스피리츄얼	60·0			스피리추얼	40·0	1,027
virtue	버츄	92·8			버추	7·2	2,188

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English input	With <j>		With <w>		Neither	Total
gelatin	젤라틴	0·0	켈라틴	0·0	젤라틴 100·0	26,500
gentleman	젠틀맨	0·0	켈틀맨	0·1	젠틀맨 99·9	4,004
gesture	제스처	0·0	세스처	0·0	제스처 100·0	7,040
giant	자이언트	0·7	좌이언트	0·0	자이언트 99·3	41,694
gyro	자이로	0·4	좌이로	0·0	자이로 99·6	29,919
jack	잭크	0·2	쨌크	0·0	잭크 99·8	430
jamboree	잼보리	0·0	잼보리	0·0	잼보리 100·0	8,450
Jannie	재니	0·1	쨌니	0·1	재니 99·8	1,082
jazz	재즈	0·0	쨌즈	0·0	재즈 100·0	796,116
jelly	젤리	0·0	켈리	0·0	젤리 100·0	50,508
jersey	저지	39·1	쥐지	0·0	저지 60·9	60,900
jockey	자키	29·7	좌키	0·0	자키 70·3	17,070
journal	저널	0·0	쥐널	0·0	저널 100·0	630,255
judge	저지	15·6	쥐지	0·0	저지 84·4	7,420
jump	점프	0·2	쨌프	0·0	점프 99·8	108,190
junk	정크	0·3	쨌크	0·0	정크 99·7	58,473
major	메이저	18·1	메이쨌	0·0	메이저 81·9	92,907
manager	매니저	14·6	매니쨌	0·0	매니저 85·4	189,600
messenger	메신저	15·2	메신쨌	0·0	메신저 84·8	169,801
pajamas	파자마	0·1	파좌마	0·0	파자마 99·9	23,528
project	프로젝트	0·0	프로젝트	0·0	프로젝트 100·0	1,320,008
projector	프로젝터	0·0	프로젝터	0·0	프로젝터 100·0	280,000
advantage			어드밴티쨌	0·2	어드밴티지 99·8	3,328
average			에버리쨌	0·6	에버리지 99·4	1,318
badge			배쨌	0·0	배지 100·0	116,003
bridge			브리쨌	0·1	브리지 99·9	84,561
challenge			챌린쨌	0·0	챌린지 100·0	49,407
change			체인쨌	0·3	체인지 99·7	55,040
college			칼리쨌	0·2	칼리지 99·8	65,115
energy			에너쨌	0·0	에너지 100·0	274,059
engine			엔퀸	0·0	엔진 100·0	1,370,389
engineer			엔쨌니어	0·0	엔지니어 100·0	124,002
gauge			게이쨌	0·2	게이지 99·8	37,358
genius			쥐니어스	0·0	지니어스 100·0	27,507
gin			귄	1·6	진 98·4	30,294
ginger			귄저	0·0	진저 100·0	10,101
gypsy			겍시	0·0	집시 100·0	15,102
image			이미쨌	0·0	이미지 100·0	17,900,232
imagination			이매쨌네이션	0·6	이매지네이션 99·4	462
magic			매직	0·1	매직 99·9	146,103
message			메시쨌	0·0	메시지 100·0	422,019
mortgage			모기쨌	0·0	모기지 100·0	36,505
orange			오랜쨌	0·1	오렌지 99·9	307,267

English input	With <j>		With <w>		Neither	Total	
origin			오리귤	0·0	오리진	100·0	10,805
page			페이쥬	0·0	페이지	100·0	27,900,797
percentage			퍼센티쥬	0·0	퍼센티지	100·0	854
register			레쥬스터	0·0	레지스터	100·0	34,205
sausage			소시쥬	0·0	소시지	100·0	9,940
sponge			스폰쥬	0·0	스폰지	100·0	29,300
stage			스테이쥬	0·1	스테이지	99·9	91,759
syringe			시린쥬	0·1	시린지	99·9	1,991
technology			테크놀로쥬	0·0	테크놀로지	100·0	152,000
village			빌리쥬	0·2	빌리지	99·8	66,905
virginia			버쥬니아	0·0	버지니아	100·0	50,600
jaws	쥬스	87·9			조스	12·1	19,000
join	쥬인	0·4			조인	99·6	122,490
joint	쥬인트	36·9			조인트	63·1	50,200
joker	쥬커	9·9			조커	90·1	17,090
Jude	쥬드	47·9			주드	52·1	42,000
juice	쥬스	57·4			주스	42·6	65,300
junior	쥬니어	40·0			주니어	60·0	928,000
Jupiter	쥬피터	55·3			주피터	44·7	18,790

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