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*Palatalisability via feature compatibility**

Kazutaka Kurisu
Kobe College

Productive palatalisation is a striking property of Japanese mimetic items. The docking site of the [−anterior] feature is contingent on consonantal place, and rhotics resist palatalisation. Cross-linguistically, consonantal places differ in palatalisability, and palatalised apical rhotics are not preferred. Bringing together the cross-linguistic insights offered by Rose (1997b) and Hall (2000), I offer a new account of Japanese mimetic palatalisation, which crucially appeals to the notion of feature compatibility. The proposed analysis is attractive for two reasons. First, feature compatibility is firmly grounded in robust cross-linguistic tendencies. Second, the analysis covers a much wider range of data than that proposed by Zoll (1996, 1997), which is based on constituent-initial licensing of complex segments. The analysis defended in the present work is thus desirable both cross-linguistically and empirically.

1 Introduction

Palatalisation is one of the most extensively studied phenomena in segmental phonology. Japanese exhibits a morphologically conditioned palatalisation phenomenon in the mimetic vocabulary which denotes 'uncontrolledness'. More specifically, palatalisation is associated with a wide range of meanings, such as childishness, immaturity, inelegance, instability, diversity, excessive energy, noisiness and uncoordinated movement, as discussed by Mester & Itô (1989) and Hamano (1998). On

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the phonological side, earlier analyses focused on a principled understanding of the systematic distribution of palatalisation in disyllabic roots (Mester & Itô 1989, Zoll 1996, 1997).

Mester & Itô (1989) develop the first comprehensive analysis of mimetic palatalisation in derivational terms. Their theoretical emphasis is on arguing for contrastive underspecification (Steriade 1987b, Clements 1988, Cohn 1992). But their algorithmic procedure for determining the locus of palatalisation is not very satisfactory, as it is little more than a restatement of a descriptive generalisation. Zoll (1996, 1997) develops a more principled exposition within the framework of Optimality Theory (Prince & Smolensky 2004). Her analysis appeals crucially to place complexity and the notion of phonological licensing.

The location of palatalisation is largely dependent on the consonantal composition of a mimetic root, especially the place of articulation of the two consonants in CVCV roots. Coronals other than /r/ host palatalisation in preference to non-coronals, and non-coronal consonants (i.e. labials, dorsals and /h/) undergo palatalisation only in root-initial position. When both consonants are coronal, the rightmost one attracts palatalisation. Palatalisation never targets /r/. When palatalisation applies, coronal obstruents are realised as simplex alveopalatals. Palatalised labials and dorsals surface as complex segments, with palatalisation realised as a secondary articulation. Building upon the strong cross-linguistic tendency for marked phonological structure to prefer constituent-initial positions, Zoll (1996, 1997) argues that complex consonants are licensed only word-initially. Her OT analysis is quite parsimonious, since the fact that the liquid /r/ does not exhibit the same pattern as other coronals is accounted for without invoking any additional mechanism, such as the underspecification employed by Mester & Itô (1989), given that palatalised /r/ is a complex consonant.

In this paper, I propose a different take on expounding the locus of palatalisation, developing an analysis which appeals to feature compatibility. Apart from palatalisation, cross-linguistic evidence indicates that certain phonological features are more compatible with particular features than with others (see e.g. Stevens *et al*. 1986, Stevens & Keyser 1989, Archangeli & Pulleyblank 1994, MacEachern 1997, Walker 1998, Yip 2005). Cross-linguistic surveys in earlier literature suggest that the notion of feature compatibility can be generalised to palatalisation. I propose an analysis that builds on those of Rose (1997b) and Hall (2000). Exploring morphologically governed palatalisation in Ethio-Semitic languages, Rose (1997b) advocates a palatalisability hierarchy in which coronals are more susceptible to palatalisation than non-coronals. This hierarchy is designed to capture the compatibility of major consonantal places with palatalisation, and adequately explains why coronal consonants take precedence over non-coronal ones in Japanese mimetic palatalisation.

From a theoretical point of view, I argue that the crucial issue is the compatibility of palatalisation with underlying, rather than surface, consonantal places. Given the standard assumption that markedness

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constraints are sensitive to the surface representation alone, it may appear that the relevant feature-compatibility account ought to be couched in terms of faithfulness constraints. However, a faithfulness-oriented approach encounters various empirical and conceptual problems that would be insurmountable to a non-stipulative account. For example, such a faithfulness approach cannot unify lexical and derived palatalisation. Instead, I argue that markedness plays an essential role in formulating the compatibility of consonantal places and palatalisation. I propose a mechanism that enables the markedness-based palatalisation hierarchy to be sensitive to underlying consonantal places. A desirable consequence is that lexical and derived palatalisation can be unified without recourse to faithfulness constraints.

The compatibility of palatalisation and consonantal places is not sufficient for elucidating the whole data of Japanese mimetic palatalisation. /r/ consistently resists palatalisation, even though it is coronal. Hall (2000), citing a rich repertoire of cross-linguistic evidence, argues that apical rhotics are far less likely to be palatalised than non-rhotic consonants. Adopting this insight, we can capture the behaviour of /r/ with a markedness constraint that directly militates against palatalised apical rhotics. This obviates the need for underspecification, as utilised by Mester & Itô (1989). Hence the analysis offered here confirms Zoll's (1996, 1997) position that Japanese mimetic palatalisation does not provide cogent evidence for contrastive underspecification.

The proposed feature-compatibility account is superior to the analysis put forward by Zoll. First, the former is capable of accounting for why /r/-initial monosyllabic roots are robustly immune to palatalisation, while the latter predicts that palatalisation would occur on root-initial /r/, which is not the case. Second, the feature-compatibility analysis is able to explain aspects of the behaviour of palatal consonants which have been previously overlooked, and which are not accounted for by Zoll's analysis. These empirical findings strongly favour the feature-compatibility approach to be developed below.

The remainder of this paper is organised as follows. In §2, I lay out the basic data and descriptive generalisations of Japanese mimetic palatalisation. §3 discusses the compatibility of consonantal places with palatalisation. I propose that this compatibility should be formalised in terms of markedness constraints, and discuss how markedness-oriented feature-compatibility constraints can make reference to the lexical place features of consonants. Equipped with the central idea established in §3, §4 is devoted to my OT analysis. I demonstrate that both derived and lexical mimetic palatalisation are efficiently handled with the notion of feature compatibility, as well as with other independently motivated constraints. In §5, capitalising upon the insight of Hall (2000) that apical rhotics are highly resistant to palatalisation across languages, I analyse the absence of palatalised rhotics without invoking underspecification. The proposed analysis not only accounts for the peculiar behaviour of /r/ in Japanese, but also allows us to understand its patterning in terms of feature

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compatibility. §6 compares my analysis with Zoll's, and concludes that it is empirically favoured because it is able to account for examples which have not received serious attention in earlier literature. In addition, Zoll's analysis makes an incorrect prediction concerning the behaviour of /r/. Finally, the main results of this paper and remaining issues are summarised in §7.

2 Japanese mimetic palatalisation

Many of the examples of mimetic palatalisation presented in this section are taken from Mester & Itô (1989) and Hamano (1998). Every mimetic root is either monosyllabic or disyllabic, as shown in (1). They seldom appear independently. Instead, they must usually be followed by a suffix (e.g. an adverbial suffix *-to* or *-ri*) or reduplicated.[1]

(1) a.	piN	'lively'	b.	saba	'refreshed'
	gaN	'ding-dong'		tobo	'tottering'
	soQ	'silently'		moʒi	'restless'
	muQ	'offended'		bosa	'messed up (hair)'

Both monosyllabic and disyllabic roots participate in mimetic palatalisation. Of principal empirical interest in this morphophonological process are disyllabic CVCV roots (see §5 for some discussion of palatalisation in monosyllabic roots). In this paper, palatalised forms are represented in reduplicated forms, which are morphological constructions typical of the Japanese mimetic stratum.

The forms in (2) demonstrate that coronals take precedence over non-coronals for palatalisation. If the two root consonants are a combination of coronal and non-coronal, the coronal attracts palatalisation, regardless of the syntagmatic relation between the two root consonants.

(2)	*base forms*		*palatalised forms*	
	zabu-zabu	'splashing'	ʒabu-ʒabu	'splashing indiscriminately'
	toko-toko	'walking slowly'	ʧoko-ʧoko	'moving around restlessly'
	kata-kata	'clattering'	kaʧa-kaʧa	'clattering aperiodically'
	kasa-kasa	'dry'	kaʃa-kaʃa	'dry rustling sound'
	gasa-gasa	'rustling'	gaʃa-gaʃa	'noisy rustling sound'

[1] Palatalisation is the primary concern in this paper, so palatalised consonants are represented phonetically. Otherwise, the transcription of Japanese data in this paper is largely phonemic, following the *kunreisiki* system of Romanisation. The following notational conventions are adopted in this paper: [tu] = [tsu], [hu] = [ɸu] and [r] = [ɾ]. /N/ represents a placeless moraic coda nasal, and /Q/ represents the first half of a geminate. /Q/-final roots are usually followed by an adverbial suffix, so /Q/ does not appear word-finally. The Japanese high back vowel is said to be unrounded [ɯ] (Tsujimura 2007: 17; see Vance 1987 and Shibatani 1990 for discussion). This phonetic precision is not important. For the sake of perspicuity, I use [u] throughout.

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When the root consonants are both coronals, the rightmost one hosts palatalisation, as exemplified in (3).

(3) *base forms*		*palatalised forms*	
dosa-dosa	'flowing'	doʃa-doʃa	'flowing in large amounts'
nuta-nuta	'clammy'	nutʃa-nutʃa	'very clammy'
nuto-nuto	'sticky'	nutʃo-nutʃo	'very sticky'
neta-neta	'viscous'	netʃa-netʃa	'very viscous'
neto-neto	'greasy'	netʃo-netʃo	'very greasy'

By contrast, when both root consonants are non-coronal, the root-initial consonant undergoes palatalisation, as illustrated in (4). Coronals and non-coronals thus display a marked contrast, the effect referred to as conflicting directionality by Zoll (1996, 1997).

(4) *base forms*		*palatalised forms*	
poko-poko	'up and down'	pʲoko-pʲoko	'jumping around'
gobo-gobo	'gurgling'	gʲobo-gʲobo	'gurgling messily'
goho-goho	'coughing'	gʲoho-gʲoho	'coughing with nausea'
gaha-gaha	'laughing'	gʲaha-gʲaha	'laughing loudly'

Interestingly, /r/ exhibits peculiar behaviour. Unlike other coronals, it consistently resists palatalisation. As the examples in (5) show, medial rhotics escape palatalisation. As a result, the initial consonant is targeted by palatalisation, irrespective of its place of articulation. As there are no disyllabic mimetic roots which begin with a rhotic (Hamano 1998), /r/ is never palatalised in disyllabic roots. As discussed in §5, monosyllabic roots with initial /r/ are never palatalised either, so that /r/ consistently resists palatalisation in the mimetic vocabulary.

(5) *base forms*		*palatalised forms*	
horo-horo	'weak'	çoro-çoro	'staggering'
hura-hura	'wavy'	çura-çura	'swaying'
noro-noro	'slow'	ɲoro-ɲoro	'wriggling around'
nuru-nuru	'slimy'	ɲuru-ɲuru	'wriggly'
toro-toro	'slow'	ʧoro-ʧoro	'flowing little by little'
turu-turu	'slurping'	ʧuru-ʧuru	'sipping'
zara-zara	'coarse (texture)'	ʒara-ʒara	'jingling'
koro-koro	'rolling'	kʲoro-kʲoro	'looking around'
goro-goro	'rumbling'	gʲoro-gʲoro	'goggle-eyed'

Another crucial fact to be addressed below is that not all surface palatalisations are derived (Mester & Itô 1989, Hamano 1998: 186; see Schourup & Tamori 1992 for the view that mimetic palatalisation is not synchronically derived). Consider the examples in (6). Either the palatalised form is not paired with a non-palatalised form (e.g. *[musa-musa]) or the corresponding non-palatalised form is not taken as a base, due to semantic irrelevance (e.g. [zuta-zuta] 'into shreds' exists, but has nothing to do with rhythm). Interestingly, these lexically palatalised CVCV

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mimetic roots obey the same distributional restrictions as derived palatalisation (see §4 for discussion of a slight difference between the two types of palatalisation). The examples in (6a) contain both a coronal and a non-coronal consonant, and the coronal consonant consistently hosts palatalisation, irrespective of its root-internal position, in the same way as in (2). Those in (6b) have two coronal consonants, with the rightmost attracting palatalisation, parallel to (3). In (6c), neither consonant is a coronal, and the root-initial consonant is palatalised. This is consistent with derived palatalisation in (4). In addition, consistent with the data in (5), grammatical forms avoid a palatalised rhotic, as exemplified in (6d). The examples in (6) are not derived, but are nevertheless generally associated with uncontrolledness, although the relation is often opaque.

(6) *palatalised forms*

a.	muʃa-muʃa	'munching'
	puɲo-puɲo	'bouncing softly'
	ʧupa-ʧupa	'sucking'
	ʃaka-ʃaka	'lightly shaken rhythmically'
	ʃobo-ʃobo	'strained (eyes)'
b.	zuʧa-zuʧa	'drummed in heavy rhythm'
	suʧa-suʧa	'drummed in light rhythm'
c.	kʲupo-kʲupo	'pumping'
	kʲaha-kʲaha	'laughing cutely'
d.	çuru-çuru	'shrewd'
	ʃari-ʃari	'rice-washing sound'
	ʒari-ʒari	'crunchy'

In summary, the distributional pattern of palatalisation is uniform, whether derived or lexical, except for the somewhat marginal case that I will discuss in §4. Rhotic /r/ is never palatalised in the mimetic vocabulary.

Alderete & Kochetov (2009) cast doubt on the validity of the conflicting directionality effect. In particular, they reject the generalisation illustrated in (3) and (4): the right-edge orientation in roots with two coronal consonants and root-initial palatalisation in examples with two non-coronal consonants. First, they maintain that the basic descriptive generalisation suffers from a paucity of supporting data. It is true that there is not a large number of examples like (3) and (4). Given that mimetic roots are restricted in size (either monosyllabic or disyllabic), and that not all non-palatalised forms are paired with palatalised counterparts, it is not surprising that the number of palatalised mimetic items is not overwhelmingly large. In addition, there are some phonotactic restrictions (e.g. the prohibition of certain palatal(ised) segments before a front vowel and a ban on initial /r/ in disyllabic roots), which further diminish the number of potential palatalised items.

Second, Alderete & Kochetov claim that there are counterexamples. They assembled their data from published studies and consultation with

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six Japanese native speakers. As counterexamples to the right orientation in roots with two coronals, they provide [ʃana-ʃana], [ʃuta-ʃuta], [ʤota-ʤota] and [ɲoso-ɲoso]. These forms are certainly not well established, and consultation with native speakers revealed that these forms had neither been heard nor used by over 95% of 120 informants. Among others, the following seven items are provided by Alderete & Kochetov as counterexamples to initial palatalisation in roots with two non-coronal consonants: [mugʲu-mugʲu], [gokʲu-gokʲu], [hugʲa-hugʲa], [gogʲu-gogʲu], [haçu-haçu], [bakʲu-bakʲu] and [guço-guço]. Some informants said that the meaning of [hugʲa-hugʲa] was imaginable, associating it with babies' crying. But the seven forms were rejected by virtually all informants. Several informants observed that the seven items sounded like mimetic ones because of their disyllabic reduplicated shapes, but, like others, they did not recognise the seven purported palatalisation forms.

This shows that the alleged counterexamples are likely to be idiosyncratic, and to conclude that the conflicting directionality effect is vacuous would be hasty. The counterexamples given by Alderete & Kochetov (2009) do not provide compelling evidence for native speaker knowledge about mimetic palatalisation. In the discussion below, I follow Mester & Itô (1989) and Hamano (1998) in assuming that Japanese mimetic palatalisation does in fact exhibit the directionality bias. However, it is possible that such idiosyncratic items may become established in the future, and that the directionality bias may consequently disappear. In any case, the presence or absence of the directionality effect does not jeopardise the principal claim in this paper, that palatalisation should be analysed in terms of feature compatibility.

3 Palatalisability of consonantal places

This section is aimed at establishing a markedness hierarchy for palatalisation. In §3.1, I review Rose's (1997b) discussion of morphophonological palatalisation in Gurage languages and the palatalisability hierarchy which she proposes. In this hierarchy, coronal consonants are most prone to undergo palatalisation. This palatalisability hierarchy is reinforced by additional cross-linguistic evidence drawn from synchronic and diachronic phenomena. §3.2 fleshes out the palatalisability hierarchy. I argue that the palatalisability scale must be markedness-based and that we can and should dispense with apparently similar faithfulness-oriented formalisations of the compatibility of palatalisation with major consonantal place features.

3.1 A cross-linguistic palatalisability scale

In this section, I establish a palatalisability scale for the major consonantal places. Along with Mester & Itô (1989) and Zoll (1996, 1997), I assume that [−anterior] is the feature responsible for palatalisation (see also

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Clements 1976, Pulleyblank 1989, Hume 1990, 1992, 1996, Lahiri & Evers 1991 and Clements & Hume 1995).[2]

Investigating Ethio-Semitic languages, Rose (1997b) observes that consonantal places differ with respect to their compatibility with palatalisation. In Harari, the 2nd person singular feminine subject suffix /-i/ triggers palatalisation, a process which affects only stem consonants (Leslau 1958). As shown in (7a) and (b), stem-final coronal obstruents and sonorants undergo palatalisation. When the final coronal is a sonorant, as in (b), the medial coronal is also palatalised. Finally, (7c) demonstrates that palatalisation migrates to a medial or even to an initial coronal if the final consonant is either labial or dorsal. The liquid /r/ is never targeted by palatalisation, exactly as in Japanese. These examples suggest that coronals are better hosts for palatalisation than labials and dorsals.

(7)	*2sg masc*	*2sg fem*	
a.	kifæt	kifætʃ-i	'open!'
	zimæd	zimædʒ-i	'drag!'
	libæs	libæʃ-i	'dress!'
b.	xidæn	xidʒæɲ-i	'cover!'
	gidæl	gidʒæj-i	'kill!'
c.	kitæb	kitʃæb-i	'write!'
	sidæb	sidʒæb-i	'insult!'
	diræq	dʒiræq-i	'be dry!'
	sibær	ʃibær-i	'break!'

According to Rose (1997b), Amharic and Soddo are similar to Harari, in that only coronals can host palatalisation in the 2nd person singular feminine subject construction. In these languages, however, palatalisation is confined to stem-final coronals. In Soddo, the host must be an obstruent, and coronal sonorants are not palatalised. Despite these interlanguage

[2] This is not an uncontroversial assumption. Among others, Sagey (1986), Schein & Steriade (1986), Rubach (1993), Ní Chiosáin (1994) and Hall (1997) argue that palatalisation is defined by [−back]. For instance, Ní Chiosáin (1994) observes that debuccalisation in Irish mutation does not deprive consonants of the palatalisation feature. Crucially, palatalisation survives even after the coronal feature disappears through debuccalisation. If palatalisation is defined by [−anterior] dependent on the coronal feature, palatalisation should be lost when the coronal feature is debuccalised. It logically follows that palatalisation cannot be defined by [−anterior] dominated by the coronal node. Rubach (1993) states that palatalisation in Slovak is triggered by /æ/ (e.g. /vnuk-æ/ → [vnúʧ-a] 'grandson (DIM)') as well as by non-low front vowels. Note that the vowel change /æ/ → [a] is an independent phonological process called /æ/-backing, which takes place after a non-labial consonant (Rubach 1993: 102). Hall (1997: 82) points out that /æ/ is unlikely to be a [−anterior] segment. Consequently, palatalisation triggered by the low front vowel is conditioned by a phonological feature other than [−anterior]. Lahiri & Evers (1991), however, argue that either [−anterior] or [+high] is responsible for palatalisation. They propose an analysis of Japanese mimetic palatalisation built upon this idea, in which [−anterior] first looks for the rightmost coronal consonant. If this scan fails, due to the absence of a coronal, [+high] docks onto the initial consonant. The identity of the feature responsible for palatalisation does not impinge on the following discussion.

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differences, Harari, Amharic and Soddo all favour coronals over non-coronals for palatalisation.

Next, consider the data in (8) from Chaha. The 2nd person singular feminine subject is again expressed with palatalisation (Polotsky 1951, Johnson 1975, Hetzron 1977, McCarthy 1983, Scobbie 1991, Archangeli & Pulleyblank 1994, Odden 1994, Rose 1994, 1997a, b, Banksira 2000, Kurisu 2001). Unlike in Harari, the *-i* suffix is no longer extant, but has been absorbed synchronically. As indicated in (8a), stem-final coronals and dorsals undergo palatalisation. Otherwise, the rightmost dorsal undergoes palatalisation, as exemplified in (8b). Dorsal palatalisation is flexible in this sense, whereas coronal palatalisation is restricted to the right periphery of the stem. Palatalisation never targets labial consonants.

(8)

	2sg masc	*2sg fem*	
a.	nɨkɨs	nɨkɨʃ	'bite!'
	kɨft	kɨftʃ	'open!'
	zɨmd	zɨmdʒ	'pull!'
	dɨrg	dɨrgʲ	'hit!'
	fɨræx	fɨrægʲ	'be patient!'
b.	nɨxæβ	nɨxʲæβ	'find!'
	nɨgɨf	nɨgʲɨf	'prune!'
	gɨmɨm	gʲɨmɨm	'chip the rim of the utensil!'

We can see that Harari, Amharic, Soddo and Chaha have various things in common. All these languages palatalise coronal consonants. In addition, dorsal consonants are palatalised in Chaha. This suggests an implicational relationship such that the palatalisation of dorsals implies that of coronals, but not *vice versa*. Labials are never subject to palatalisation, not just in these four languages, but in Gurage languages in general. This finding leads to the palatalisability hierarchy proposed by Rose (1997b: 48), in which coronal consonants are better hosts for palatalisation than dorsals, and dorsals are better hosts than labials (Maddieson 1984). This is expressed in the form of OT constraints in (9). For the purpose of explaining Japanese mimetic palatalisation, the crucial dichotomy is between coronals and non-coronals.

(9) $*\textsc{Lab}^{j} \gg *\textsc{Dors}^{j} \gg *\textsc{Cor}^{j}$

Besides the morphophonological facts discussed above, the place-compatibility hierarchy in (9) also accords with a number of distributional and historical facts. Kochetov (2001) conducts a detailed study of palatalised coronals and labials. He observes that palatalised coronals are more resistant to loss of the palatalisation feature in many phonological positions than palatalised labials. In many languages, the palatalisation contrast in labials is neutralised word-finally (i.e. Labial^{j} → Labial), although that in coronals is retained in the same position (e.g. Russian dialects, Krinichnoe Bulgarian, Polish, Belarusian and Scots Gaelic). However, languages with the reverse neutralisation pattern are not attested.

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Similarly, in Krinichnoe Bulgarian coda labials cannot be palatalised before a non-palatalised plain consonant, but coronals can. These cross-linguistic facts are in complete harmony with the observation that there is no Slavic language in which the phonological contrast between plain and palatalised labials is preserved without a parallel contrast in coronals (Padgett 2001: 209). These findings are fully in harmony with the palatalisability scale provided in (9).

Early Latin had no palatal or palatalised consonant, including the glide /j/, which was introduced in the transitional period from Early Latin to Late Latin. Coronal and dorsal consonants began to undergo palatalisation when followed by /j/ (Lloyd 1987: 132–134). Essentially, palatalised velars were absent before /j/ entered the language: the palatal consonant came first and palatalised dorsals later. This temporal order suggests that palatals or palatalised coronals are less marked than palatalised dorsals. Equally significant is the fact that labial palatalisation is not reported to have occurred during the same transitional period. The lack of palatalised labial consonants illustrates the superiority of palatalised dorsals over palatalised labials. These historical facts support (9) (see Hock 1991 for more discussion).

Before closing this section, it is worth noting that the palatalisability hierarchy in (9) may be either phonetically or functionally grounded. Padgett (2001: 209) argues that palatalised coronals are typically somewhat affricated, and that the frication provides an acoustic cue to palatalisation. In general, coronals can hold rich acoustic cues to palatalisation, and are therefore highly suitable for carrying a phonological contrast between plain and palatalised consonants (see Kochetov 2001 for relevant discussion). In line with the recent increasing recognition of the indispensable role played by perceptual elements in explaining phonological patterning (Flemming 1995, Jun 1995, Steriade 1999, Hume & Johnson 2001, Padgett 2003, Hayes *et al.* 2004, Fleischhacker 2005, Zuraw 2007), we can interpret the ability of coronals to carry rich acoustic cues to palatalisation as illustrating the great degree of compatibility between palatalisation and coronals. While bearing in mind that the palatalisability hierarchy in (9) is ultimately rooted in rudimentary phonetic factors, I will here continue to use the markedness constraints given there.

3.2 Evaluation metric

The markedness hierarchy in (9) may not appear to be adequate for a comprehensive analysis of the examples presented in §2. Markedness constraints are responsible for evaluating the well-formedness of output structure alone (i.e. one-argument constraints in the sense of Itô & Mester 1999: 91). /n/ and /h/ are underlyingly different in place, but both yield a palatal consonant under palatalisation in Japanese, so that they pattern in the same way as coronal obstruents and non-coronals respectively. This fact is problematic under the standard understanding of markedness constraints: if the markedness constraints for palatalisation were sensitive

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to the output segments resulting from restructuring, the fact that underlying coronals and non-coronals pattern differently would be inexplicable. This observation strongly suggests that relevant feature-compatibility constraints somehow need to make reference to consonantal place in the input, since this is the only level at which palatalised /n/ and /h/ are reliably distinguished in terms of consonantal place.

The necessity for a mechanism of feature compatibility which makes reference to the major places in the input representation is strongly supported by the cross-linguistic variability of consonantal changes involved in palatalisation. For example, palatalisation of /k g/ surfaces as a secondary articulation in Japanese, unlike the historical reflex of the first velar palatalisation in Slavonic languages. Palatalised /k g/ are realised as [ʧ ʤ] in numerous Slavonic languages, e.g. Bulgarian (Scatton 1993), Macedonian (Friedman 1993), Slovene (Priestly 1993), Czech (Short 1993a), Slovak (Short 1993b), Cassubian (Stone 1993a), Sorbian (Stone 1993b), Polabian (Polański 1993) and Russian (Timberlake 1993). Palatalised /h/ becomes [ç] in Japanese, but [ʃ] in Slovene (Priestly 1993). Furthermore, palatalised /t/ is phonetically realised as [ʧ] in Japanese, but as palatal [c] in Zoque (Clements 2001). There are many analogous examples, convincingly indicating that the same consonant can be manifests in a variety of ways as a result of palatalisation. This in turn shows that the cross-linguistic compatibility of palatalisation with major consonantal places cannot be defined at the level of surface representation produced by restructuring.

Different consonants can be realised as the same as a result of palatalisation. For example, [ʃ] is the result of the palatalisation of /h/ in Slovene, but of /x/ in Slavonic languages like Bulgarian (Scatton 1993), Macedonian (Friedman 1993), Russian (Timberlake 1993) and Ukrainian (Shevelov 1993). Palatalised /t/ results in [ʧ] in Japanese, Dakota (Shaw 1976) and Odawa (Piggott 1974). But it is /k/ which becomes [ʧ] in Slovak (Rubach 1993, Short 1993b) and, optionally, in Acadian French (Hume 1992). We can again draw the conclusion that what is important is the compatibility of the [−anterior] feature with lexical consonant place rather than the output place resulting from palatalisation. Different underlying places can be neutralised through restructuring, meaning that we cannot formalise feature compatibility at the output level.

Summarising, in palatalisation the same consonant can be realised differently, while different consonants can be realised in the same way. These facts compellingly show that a mechanism making reference to major places of consonants in input is required to evaluate the well-formedness of palatalisation in terms of feature compatibility.

One possibility is to postulate faithfulness constraints which militate against the insertion of [−anterior] in consonantal places (i.e. $\textsc{Dep}[-\text{ant}]_{\alpha}$, where α is a variable ranging over various major consonantal places), ranked as follows: $\textsc{Dep}[-\text{ant}]_{\textsc{Lab}} \gg \textsc{Dep}[-\text{ant}]_{\textsc{Dors}} \gg \textsc{Dep}[-\text{ant}]_{\textsc{Cor}}$. This approach is not tenable, for several reasons. First, it suffers from analytical duplication, as the role of the faithfulness constraints largely overlaps that

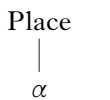
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of the markedness constraints in (9). Second, the faithfulness hierarchy should be ranked in parallel with (9) to maintain place compatibility with palatalisation. However, it remains mysterious why the two hierarchies are ranked in parallel, as there is no *a priori* theoretical reason for this parallel ranking. In principle, they might be ranked separately. But allowing such a possibility misses the robust cross-linguistic tendency for coronal consonants to be more susceptible to palatalisation than any other consonants. Finally, the postulation of the two palatalisability hierarchies misses the fact that derived palatalisation and lexical palatalisation basically pattern alike in Japanese mimetics.

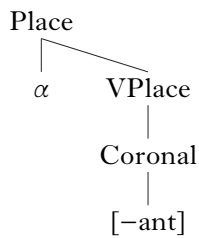
These considerations reveal that a satisfactory analysis should propose a single palatalisability hierarchy. Faithfulness constraints are not promising, for two reasons. First, palatalisation may be lexical, as mentioned above. Second, richness of the base prevents us from restricting the input in any way (Smolensky 1996, Kurisu 2000, Davidson *et al*. 2004, Prince & Smolensky 2004). Correct outputs should emerge on the basis of ranked constraints, meaning that the docking site of [−anterior] should be determined by output well-formedness alone. Faithfulness constraints cannot exclude the illegitimate palatalisation which would result from faithful parsing of input.

In fact, the markedness scale in (9) suffices if the following assumption is accepted. *Contra* Bhat (1978: 68) and Lahiri & Evers (1991: 85), I assume that initial palatalisation merely adds [−anterior] to the coronal node under VPlace, irrespective of the major place of the host. This is shown in (10), where α denotes a major place. But everything else is left intact. This entails that the major place of a palatalised consonant is identical to that of its plain counterpart. Restructuring may or may not happen at a subsequent stage.

(10) a. *Plain* C



b. *Palatalised* C



This assumption is corroborated by evidence from the historical development of palatalisation in certain languages. In Sanskrit, for instance, originally phonologically conditioned palatalisation was phonemicised. Pre-Sanskrit [penke] 'five' became [penkʲe], which in turn became [pankʲa] due to the merger of non-high vowels. At this point, the conditioning environment of palatalisation (the front vowel) was lost. [pankʲa] later underwent restructuring, resulting in [paɲʧa] (Hock 1991: 74). The same phonemicisation applied to Pre-Sanskrit [g] (i.e. [g] → [gʲ] → [ʤ]). The crucial observation is that this series of diachronic shifts involved an

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intermediate step in which palatalisation was realised as a secondary articulation without altering the major place specification of the velar consonants. This suggests that palatalisation and restructuring were two distinct operations, supporting the assumption above.

Rubach (2007) discusses synchronic evidence for the separation of palatalisation and the coronalisation involved in restructuring. In Polish, word-final consonants are palatalised if they are followed by a word-initial [i], e.g. [x] becomes [xʲ] (*strach* [x] 'fear' *vs. strach Iwony* [xʲ i] 'Yvonne's fear'). This postlexical palatalisation, in which there is no coronalisation, contrasts with /x/-palatalisation at the lexical level. As seen in examples like *strach vs. strasz-y-ć* [ʃ ɨ] 'to frighten', palatalised /x/ is realised as a coronal in the lexical component. Rubach (2007: 121–122) maintains that the markedness constraint for coronalisation is ranked differently at the two levels with respect to the relevant faithfulness constraint. For our purposes, it is important that coronalisation does not automatically apply when the velar consonant undergoes palatalisation. Otherwise, it would be coronalised at the postlexical as well as at the lexical level. This lends further support to my proposal in (10b) that palatalisation merely adds the [−anterior] feature to the original place of a consonant when palatalisation first takes place.

I propose that the constraint *PLACEʲ is sensitive to the major place to which [−anterior] is originally attached (i.e. α in (10b)). In other words, *PLACEʲ is insensitive to the segmental representation after restructuring, as illustrated in (11). As a result, the underlying major place of a palatalised consonant is visible to the *PLACEʲ constraints. DEP[−ant] can be dispensed with, though the palatalisability constraints are markedness-based and must be capable of referring to the input major places. This proposal is desirable in that lexical and derived palatalisation are integrated in a single palatalisability hierarchy, avoiding the problems that arise if both markedness and faithfulness constraints are used. Also, this formalisation of the *PLACEʲ constraints enables consistent evaluation of their violation, irrespective of the cross-linguistic variation in restructuring, and offers a straightforward measure for assessing the validity of the palatalisability hierarchy in (9).

(11)

Plain C (10a)	α
	↓
Palatalised C (10b)	α^{j} ← evaluated by *PLACEʲ
	↓
Restructuring	β

This interpretation of *PLACEʲ receives support from Japanese. Citing several phonetic studies, Vance (1987) remarks that palatalised /h/ is usually realised as a true palatal [ç], but sometimes as [hʲ]. It is not clear from his statement whether this optionality is observed within or across speakers. Crucially, however, neither intra-speaker nor inter-speaker variation is observed in respect of the docking site of [−anterior] in

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examples involving /h/. The only legitimate palatalised form for the base /goho-goho/ in (4) is [gʲoho-gʲoho]. Applying palatalisation to /h/ is not grammatical. Given the choice between coronal [ç] and non-coronal [hʲ] for palatalised /h/, ungrammatical *[goço-goço] would be incorrectly sanctioned if the restructured representation (i.e. β in (11)) were evaluated by *PLACE^{j}, since palatalisation prefers coronals to non-coronals.[3] This cogently shows that the *PLACE^{j} constraints are sensitive to the representation resulting from initial palatalisation (i.e. (10b) and α^{j} in (11)).

This proposal explicitly assumes that there are derivational steps involved in palatalisation. It is obvious that the initial stage of palatalisation in (10b) is lexical. The question is where further restructuring occurs. There are two possibilities: either at the lexical level or at the postlexical level. For two reasons, the lexical level is more likely. First, postlexical alternations are typically automatic and apply across the board (although this is not an absolute principle; Mohanan 1995: 63). Optional restructuring of /h/ in palatalisation does not accord with this property of postlexical phonology.

Second, restructuring is categorical. Lexical operations are categorical, while postlexical processes are normally gradient. This distinction between lexical and postlexical phonology is also necessary in palatalisation. Zsiga (1995) observes that lexical and postlexical palatalisation are fundamentally different in American English. The result of an electropalatographic experiment reveals that underlying [ʃ] (e.g. *fresh*) and lexically derived [ʃ] (e.g. *confession*) are articulated invariantly, and also share the same acoustic characteristics. Postlexical [ʃ] (e.g. *confess you*) differs acoustically from canonical [ʃ]. Furthermore, the production of postlexical [ʃ] is unstable, and exhibits larger tongue contact at the front and central palatal regions than lexically derived [ʃ]. Thus, postlexical [ʃ] is not alveopalatal from the perspective of articulation. Zsiga (1995: 292) maintains that the striking contrast between lexical and postlexical [ʃ] can be understood if the latter is interpreted as simultaneous articulation of [s] and [j] (i.e. coarticulatory gestural blending). Postlexical [ʃ] is then free from cognitive phonological principles, which causes uncontrolled and haphazard gestural overlap. So palatalisation is not a unitary phenomenon, but can be subdivided into categorical lexical palatalisation and noncategorical postlexical palatalisation. Similarly, Holst & Nolan (1995), Cho (2001) and many others also recognise two types of palatalisation.

As in other languages, restructuring is not a matter of gradualness in Japanese. It is categorical, whether it is optional, as in the palatalisation of /h/, or obligatory, as with the palatalisation of coronal consonants. Given that the categorical lexical level and the gradient postlexical level must be clearly differentiated for palatalisation and that restructuring is categorical, restructuring is most likely to take place in the lexical component. Also, the acoustic and articulatory parallels between underlying and

[3] As discussed in §4, I assume that palatal consonants are specified for both coronal and dorsal features, with the coronal node hosting the [−anterior] feature (see (27)).

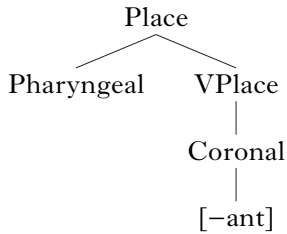
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lexically derived [ʃ] obtained in Zsiga's experiment is suggestive of the lexical nature of restructuring.

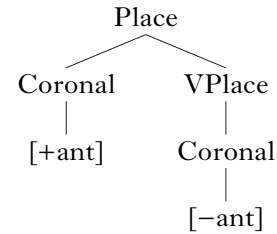
In summary, both mandatory and optional restructuring are lexical processes. This suggests that initial palatalisation and subsequent restructuring both occur at the lexical level. Of the two phonological representations within the lexical stratum (i.e. [α^{j}] and [β] in (11)), the *PLACE^{j} constraints are sensitive only to [α^{j}].

Given the evaluation metric proposed here, it is possible to distinguish between derived [ç] and [ɲ], since [ç] violates *[−COR]^{j} (a collection of markedness constraints punishing palatalised non-coronals), whereas [ɲ] violates *COR^{j}, as seen in (12). It follows that /h/ and /n/ pattern with non-coronal and coronal consonants respectively.

(12) a. *Palatalised* /h/



b. *Palatalised* /n/



Some remarks are in order concerning the representation in (12a). Laryngeal consonants are often considered to be placeless (Clements 1985, Sagey 1986, Steriade 1987a, Avery & Rice 1989, MacEachern 1997). However, the fact that the laryngeal consonant can be palatalised suggests that it has a place, possibly pharyngeal, as discussed by McCarthy (1988, 1991, 1994), Lombardi (1997) and de Lacy (2002). This idea is supported by the fact that simplex [h] is not tolerated in the coda in Japanese. Given the Japanese coda condition that militates against a coda with its own place specification (Itô 1986, 1989, Itô & Mester 1993), the exclusion of [h] from codas would remain a mystery if it were placeless. But this fact makes immediate sense if it bears some kind of place specification.

Evidence from other languages reinforces this assumption. In the Guddiri dialect of Hausa, velars have generally been debuccalised, as have palatalised velar ejectives. But this debuccalisation process has not deprived original velars of palatalisation (i.e. [kʲʼ] > [ʔʲ]) (Fallon 1999: 195). This is exactly the same pattern as discussed in note 2 for Irish. In Mono, consonants at all places are palatalised. Glottal stops also participate in palatalisation, as shown by [kaʔʲa] 'weaver bird' and [ʔʲara] 'flayed' (Olson 2005: 58). In Kashmiri, [hʲ] is phonemic, as confirmed by the following minimal pairs: [haav] 'you show' *vs.* [hʲaav] 'you cause to give' and [mahan] 'to kisses' *vs.* [mahʲan] 'to the mosquitoes' (Bhat 1987: 47). The [−anterior] feature must be accompanied by some major consonantal place, as in (10b). Thus laryngeal consonants must bear a place specification.

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I have shown in this section that the compatibility of the [−anterior] feature and consonantal places is expressed as in (9). This palatalisability hierarchy is based upon markedness constraints, so both derived and lexical palatalisation obey it. Palatalisation is frequently accompanied by restructuring, so the underlying major place feature of a palatalised consonant may eventually be obscured. The proposed assessment of *PLACE^{j} violation enables the *PLACE^{j} constraints to be sensitive to the original major place by hypothesising an initial stage where the [−anterior] feature is added as a secondary place. Restructuring may happen later. Given this metric, the proposed markedness-oriented palatalisability hierarchy is uniformly applicable regardless of (i) whether palatalisation is derived or lexical and (ii) whether restructuring occurs or not.

4 Analysis

In Japanese, labials and dorsals pattern together with respect to mimetic palatalisation. For perspicuity, *LAB^{j} and *DORS^{j} are subsumed under *[−COR]^{j} in the analysis developed below. Laryngeal consonants are considered to be [−COR] consonants.

The constraint ranking in (9) explains the data in (2). As shown in (13), palatalisation of the coronal consonant fares better than that of the labial. MAX[−ant] is ranked high, so the candidate which does not realise the [−anterior] feature is suboptimal. Anticipating the discussion below, the fact that labials and dorsals are occasionally palatalised in Japanese shows that MAX[−ant] outranks *[−COR]^{j}. Docking of the [−anterior] feature on a vowel is excluded by IDENT(VPlace).

(13)

/zabu-zabu, [−ant]/	MAX	*[−COR]^{j}	*COR^{j}
a. zabu-zabu	*!		
☞ b. ʒabu-ʒabu			*
c. zab^{j}u-zab^{j}u		*!	

To account for the directionality effect observed in (3), I assume the two alignment constraints in (14). They require docking of the [−anterior] feature on the left and right periphery of roots respectively. These alignment constraints are general, in the sense that they do not refer to the result of palatalisation. They simply dictate where [−anterior] must be placed. Zoll (1997) assumes alignment constraints referring to the prosodic word, but the constraints in (14) make reference to the root. This difference is trivial. Base–reduplicant faithfulness in the sense of McCarthy & Prince (1995) is undominated in Japanese, so the base and the reduplicant share the same palatalisation pattern. An entire reduplicated form constitutes one prosodic word. Assuming that the base and the reduplicant have root status, we can abstract away from trivial violation marks in tableaux by making alignment constraints refer to roots.

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(14) a. ALIGN-L([−ant], Rt)
[−ant] is left-aligned to a root.
b. ALIGN-R([−ant], Rt)
[−ant] is right-aligned to a root.

The examples in (3) are analysed in (15). MAX[−ant] is ranked high, so that underlyingly floating [−anterior] must receive phonological exponence. ALIGN-R is ranked over ALIGN-L, so the second coronal consonant is palatalised to minimise violation of the right-alignment constraint, all else being equal. Here and below, alignment violations are assessed in terms of segments.[4]

(15)

/dosa-dosa, [−ant]/	MAX	ALIGN-R	ALIGN-L
a. dosa-dosa	*!		
b. ʤosa-ʤosa		**!*	
☞ c. doʃa-doʃa		*	**

Returning briefly to the examples in (2), we see that they show that ALIGN-R must be dominated by *[−COR]^{j} in order to generate coronal preference. Otherwise, coronal dominance would not be captured. This is illustrated in (16).

(16)

/zabu-zabu, [−ant]/	*[−COR]^{j}	ALIGN-R	ALIGN-L
☞ a. ʒabu-ʒabu		***	
b. zab^{j}u-zab^{j}u	*!	*	**

How are the forms in (4) to be accounted for? As things stand, the analysis above wrongly predicts palatalisation of the second consonant. Neither consonant in the roots is coronal, so the constraints proposed so far cannot generate the optimal candidate. Given the ranking of the two alignment constraints, the root-internal consonant would be erroneously palatalised in order to eschew increment of ALIGN-R violations.

I propose that the left-alignment effect in (4) can be explained by taking advantage of constraint conjunction (Smolensky 1995, 1997, 2006). Constraint conjunction combines two elementary constraints to yield constraints with more specific requirements. Conjunction thus derives specialised constraints from primitive ones. Conjoined constraints are

[4] McCarthy (2003) puts forward the idea of counting all constraint violations categorically in OT. He claims that gradient assessment of constraint violations can and should be replaced by a categorical one, since the former makes typologically undesirable predictions, and sketches an analysis of mimetic palatalisation which does not make use of gradient alignment. He employs a categorical constraint, SUFFIX/σ[−ant], which requires suffixation of [−anterior] after a syllable. It is orthogonal to the present purposes whether violations of alignment constraints are gradient or categorical. I assume conservatively that alignment violations are computed gradiently.

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disobeyed only if both members of combined constraints are simultaneously violated individually in a designated domain.

The relevant conjoined constraint is defined in (17), where the domain is the segment. It restricts the distribution of palatalised non-coronal consonants to root-initial position, and therefore brings out the effect of positional markedness (Lombardi 1991, 1995, Zoll 1996, 2004, Crosswhite 1999, Steriade 1999, Smith 2002).

(17) ALIGN-L([−ant], Rt) & *[−COR]^{j}
Palatalised non-coronal consonants are left-aligned to a root.

Even though the notions are separable empirically, positional markedness is often compared with positional faithfulness (Alderete 1995, Jun 1995, Casali 1996, Beckman 1997, 1998, Lombardi 1999). In the current context, positional faithfulness does not succeed, since the source of palatalisation may be a floating feature contained in the underlying representation. There is no fixed lexical position to be faithful to. As a result, appeal to positional faithfulness is of no help here (see Zoll 2004 for a somewhat similar argument in Guugu Yimidhirr).

Smith (2002) differentiates two kinds of positional markedness constraints, involving (i) prominent positions universally quantified over marked structure and (ii) marked structure universally quantified over prominent positions. Prominent positions may be defined in terms of phonetic, psychological or phonological considerations (see Beckman 1997, 1998 for related discussion). In the first type of positional markedness, salient positions must be occupied by some marked structure or representation. Hence phonological augmentation or fortition is induced. In the latter type, on the other hand, marked phonological structure or representation must be placed in a prominent position. The conjoined constraint given in (17) clearly belongs to this second type of positional markedness constraints, since the root-initial position is not always occupied by a palatalised non-coronal consonant.

An analysis of (4) is presented in (18). ALIGN-L itself is ranked below ALIGN-R, but the conjoined constraint is ranked above the right-alignment constraint. (18b) satisfies the right-alignment constraint better than (18a). However, the former incurs a fatal violation of the conjoined constraint. In this analysis, the ranking ALIGN-R ≫ ALIGN-L and the high-ranked conjoined constraint generate the effect that Zoll (1996, 1997) calls conflicting directionality. The conjoined constraint must outrank *[−COR]^{j}. Palatalised labials are less preferable than palatalised dorsals (see (9)), so the optimal candidate actually incurs a worse violation of *[−COR]^{j} than suboptimal (18b). In order to allow initial palatalisation of /p/ in (18), the conjoined constraint must be ranked over *[–COR]^{j}.

(18)

/poko-poko, [−ant]/	ALIGN-L & *[−COR]^{j}	*[−COR]^{j}	ALIGN-R	ALIGN-L
☞ a. p^{j}oko-p^{j}oko		*	***	
b. pok^{j}o-pok^{j}o	*!	*	*	**

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The lexical palatalisation data in (6a–c), where there are no non-palatalised counterparts, can be explained in the same fashion. Assuming richness of the base, suppose that [−anterior] is misplaced in the underlying representation. As demonstrated below, the analysis here predicts that the [−anterior] feature is relocated. In (19), I hypothesise that the root-initial bilabial is lexically palatalised. Faithful realisation incurs a fatal violation of *[−Cor]^{j}. But migration of underlying [−anterior] is not cost-free. This relocation leads to a violation of the NoFlop constraint that inhibits shifting of underlying material (Alderete 1999, McCarthy 2003). The constraint operative here is NoFlop[−ant], which prohibits shifting of the [−anterior] feature.

(19)

/m^{j}usa-m^{j}usa/	Max	*[−Cor]^{j}	NoFlop
a. musa-musa	*!		
b. m^{j}usa-m^{j}usa		*!	
☞ c. muʃa-muʃa			*

In (20), both root consonants are coronals, and medial palatalisation applies. Given that Align-R is ranked above Align-L, the root-internal consonant attracts palatalisation even if the first one is lexically palatalised.

(20)

/ʒuta-ʒuta/	Max	Align-R	Align-L
a. zuta-zuta	*!		
b. ʒuta-ʒuta		**!*	
☞ c. zutʃa-zutʃa		*	**

The optimal form violates NoFlop, suggesting that it is dominated by Align-R, as in (21).

(21)

/ʒuta-ʒuta/	Align-R	NoFlop
a. ʒuta-ʒuta	**!*	
☞ b. zutʃa-zutʃa	*	*

In (22), the root consonants are non-coronal. Let us hypothesise that the root-internal one is palatalised underlyingly. In that case, the [−anterior] feature must migrate to the root-initial position to satisfy the undominated conjoined constraint. The strict dominance of Max[−ant] over the conjoined constraint will be justified shortly.

(22)

/kup^{j}o-kup^{j}o/	Max	Align-L & *[−Cor]^{j}	NoFlop
a. kupo-kupo	*!		
☞ b. k^{j}upo-k^{j}upo			*
c. kup^{j}o-kup^{j}o		*!	

Closely related to the discussion above, notice that medial palatalisation is also found in monoconsonantal roots. In the two examples in (23a),

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taken from Hamano (1998), the medial consonants are coronals and palatalisation is lexical. It is interesting to observe that root-medial palatalisation of a non-coronal consonant is found too, as exemplified in (23b), where the final vowel is typically lengthened.

(23) *palatalised forms*

a. itʃa-itʃa ‘flirting’
u3a-u3a ‘in swarm’

b. og^{j}a-og^{j}a ‘crying (baby)’

The example in (23b) may appear to be a contradiction to the behaviour of non-coronal consonants considered so far, since non-coronal consonants are palatalised root-initially in the examples discussed above. But (23b) is not a counterexample.

In the account developed above, root-medial palatalisation is analysed as in (24) and (25). The lexically encoded palatalisation in (23a) is appropriately licensed, because depalatalisation leads to a fatal violation of MAX[−ant], as shown in (24).

(24)

/itʃa-itʃa/	MAX	*COR^{j}	ALIGN-R	ALIGN-L
a. ita-ita	*!			
☞ b. itʃa-itʃa		*	*	*

When there is no root-initial consonant, root-internal palatalisation is permitted for non-coronal consonants as well. As demonstrated in (25), this is because MAX[−ant] is ranked higher than the conjoined constraint. Given this ranking, lexical [−anterior] is not removed from the dorsal consonant. Unlike in CVCV mimetic roots, where the conjoined constraint is never violated, the lexical place feature of the unique consonant does not affect its palatalisability in VCV mimetic roots.[5]

(25)

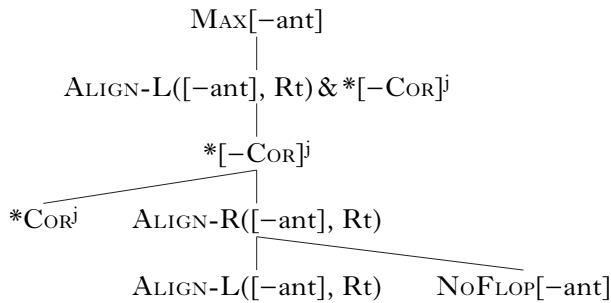
/og^{j}a-og^{j}a/	MAX	ALIGN-L & *[−COR]^{j}
a. oga-oga	*!	
☞ b. og^{j}a-og^{j}a		*

[5] Hamano (1998: 167–169) argues on semantic grounds that V-initial disyllabic mimetic roots are plausibly analysed as CVCV in the underlying representation. According to Hamano, each mimetic root segment is closely associated with a particular semantic concept, such as size or movement. The meaning of a complete mimetic root is by and large determined compositionally by combining these meanings. Given the observation that V-initial roots are semantically akin to [w]-initial roots, Hamano concludes that forms such as (23) begin with /w/. Hence the underlying representations of the forms in (23) should be /witʃa-witʃa/, /wu3a-wu3a/ and /wog^{j}a-wog^{j}a/. The initial glides are then deleted to resolve violation of a phonotactic constraint against any following vowel except [a] (Bloch 1950, McCawley 1968, Vance 1987). In output-driven systems like OT, it is tangential whether such an underlying glide is reconstructed or not.

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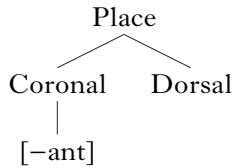
The constraint hierarchy developed so far is given in (26). This ranking integrates lexical and derived palatalisation and accounts for the effects of coronal dominance and conflicting directionality.

(26)



The feature-compatibility approach adopted here is sensitive to the input specification of consonantal places. A variety of interesting predictions arise from the fact that palatalisation may be either lexical or derived. Surface [ç] has two conceivable sources: (i) it is lexical, or (ii) it is derived from /h/ through palatalisation. Following Keating (1988), I assume that [ç] has both coronal and dorsal feature specifications (for discussion of the articulation of palatals, see also Recasens 1990, Keating 1991 and Recasens & Espinosa 2006). [−anterior] is most compatible with the coronal feature, so the most plausible subsegmental structure of palatals is that in (27).

(27)



This structure suggests that [−anterior] is a dependent of the coronal feature when [ç] is lexical. On the other hand, [−anterior] is attached to some other place when [ç] is derived from /h/ (see (12a)).

The feature-compatibility account developed so far predicts that lexical and derived [ç] behave differently. Lexical [ç] is treated as a coronal consonant, while [ç] derived from /h/ should pattern with non-coronal consonants. This is because feature compatibility refers to the level of underlying representation. Given that coronal consonants in Japanese are more susceptible to palatalisation than non-coronal ones, we expect lexical [ç] to display a broader range of distribution than derived [ç].

All the resulting predictions are given in (28), where the liquid [r] is not considered to be [COR], since it behaves differently from the other coronals. As Hamano (1998: 41) notes, [h] often appears in C_1 position (26 of the 366 disyllabic C_1VC_2V roots in her corpus), but in C_2 position it occurs less frequently than any other consonant (in just two of the

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366 roots: [goho-goho] 'coughing' and [uha-uha] 'exalted'). From a diachronic perspective, Hamano asserts that the low frequency of root-medial [h] is due to the intervocalic sound change of Proto-Japanese [p] into [w] in Old and Middle Japanese. Modern Japanese exhibits productive [p] ~ [h] alternations: [p] and [h] are closely related segments. The low frequency of root-medial [ç] is not surprising, since [ç] is an allophone of /h/ (i.e. /h/ → [ç]/ __ i), and the palatalised counterpart of /h/. Consequently, the prediction in (28d) cannot be tested.

(28) a. C_1 = [ç], C_2 = [COR]: Neither lexical nor derived [ç] is possible.
b. C_1 = [ç], C_2 = [−COR]: Both lexical and derived [ç] are possible.
c. C_1 = [COR], C_2 = [ç]: Only lexical [ç] is possible.
d. C_1 = [−COR], C_2 = [ç]: Only lexical [ç] is possible.

However, the predictions in (28a–c) are borne out empirically. First, (28a) is confirmed by the absence of mimetic roots containing [ç] as C_1 and a coronal consonant as C_2. In (28a), [ç] cannot be lexical, since lexical [−anterior] will shift to C_2 by sacrificing NOFLOP. In the same vein, derived palatalisation will assign [−anterior] to the coronal in C_2 position.

Second, (28b) is confirmed by actual data. Lexical [ç] is tolerated in C_1, because coronal is better suited for palatalisation than any other place. Consider for example [çoko-çoko] 'nimble', whose non-palatalised counterpart [hoko-hoko] does not exist. Derived [ç] can occupy C_1 as well, since the root-initial consonant is targeted by palatalisation if neither consonant is a non-rhotic coronal. This is illustrated by [çoro-çoro] 'staggering', derived from /horo-horo/ 'weak', and [çura-çura] 'swaying', derived from /hura-hura/ 'wavy' (see (5) above).

Finally, the most interesting prediction is provided in (28c), where lexical and derived [ç] behave differently. If a mimetic root has a [ç] which patterns with other coronal consonants, the root should not have a non-palatalised counterpart. On the other hand, if it has a [ç] which behaves like non-coronals, it ought to be paired with a non-palatalised counterpart. Only lexical [ç] should be permitted in (28c), as the initial coronal would otherwise attract palatalisation. A potential case is [doça], found in a Google search. This form is used in isolation as an exclamation to express surprise in a cold sweat. It is usually accompanied by final vowel lengthening, and [ç] is often geminated for emphasis. The non-palatalised counterpart [doha] does not exist, so [doça] is lexical. The prediction in (28c) is therefore confirmed empirically.

In summary, the positional effect of mimetic palatalisation can be accounted for by the palatalisability hierarchy in (9), as well as by other independently motivated constraints. As discussed in §2, lexical and derived palatalisation pattern by and large similarly. However, the distribution of [ç] differs in the two cases. Besides the data offered in §2, the feature-compatibility analysis accommodates the asymmetry of lexical [ç] and derived [ç].

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5 The immunity of rhotics to palatalisation

The behaviour of /r/, which consistently resists palatalisation in the mimetic vocabulary, remains unexplained. The following analysis is built on Hall's (2000) finding that apical rhotics are cross-linguistically more resistant to palatalisation than non-rhotic coronals. After briefly reviewing Hall's principal insights, I apply the idea to an account of the behaviour of /r/ in Japanese mimetic items, and defend the proposed account against an alternative employing underspecification. The latter is incapable of explaining cross-linguistic facts about rhotics that follow straightforwardly from the markedness constraint against palatalised apical rhotics.

Hall (2000) observes that apical rhotics (a cover term subsuming non-lateral approximants, trills and flaps, but excluding all other rhotics) are highly incompatible with palatalisation. The marked status of palatalised apical rhotics can be motivated by facts drawn from genetically unrelated languages. Probably the most important observation is that consonant inventories are asymmetrical. There is a substantial number of languages with at least one palatalised non-rhotic, but no palatalised apical rhotics. There are also languages with both palatalised apical rhotic and non-rhotic consonants. But there is no language that has at least one palatalised apical rhotic and no palatalised non-rhotics. This observation suggests that the presence of a palatalised apical rhotic implies that of a palatalised non-rhotic, but not *vice versa* (Hall 2000: 10). This accords with Hall's statistics, based on Maddieson (1984), which show that palatalised rhotics are much less common than palatalised nasals and palatalised obstruents. As additional justification for the marked status of rhotic palatalisation, Hall notes that phonemic /r^{j}/ was historically lost in Czech and Polish (Carlton 1991). In Serbo-Croatian, moreover, /r^{j}/ was depalatalised, whereas other palatalised coronal sonorants remained unaffected (Hock 1991: 134). In the same way, many Romance languages still have traces of palatalised /n/ and /l/, but palatalised /r/ has not survived (Hock 1991: 134). These diachronic facts convincingly illustrate the marked character of palatalised apical rhotics.

Hall (2000) contends that the phonetic property that is incompatible with palatalisation is apicality.[6] This is based on the fact that palatalised retroflexes and palatalised apical rhotics are both highly marked. As Japanese does not have any retroflex consonant, I focus upon apical rhotics below in order to abstract away from unnecessary complications.

In OT terms, this insight can be expressed as in (29). Because Japanese [r] is a flap (an apical consonant), the constraint ranking in (29) becomes an

[6] Walsh Dickey (1997) presents an opposing view, that rhotics disfavour palatalisation because they are inherently laminal. This proposal is tantamount to putting the blocking of rhotic palatalisation on a par with the absence of palatalised true palatal consonants (see Hall 1997 for discussion of the cross-linguistic absence of palatalised true palatal consonants). This view is refuted by Hall (2000: 16–19) and Wiese (2001: 344–346).

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important ingredient for analysing the persistent resistance of /r/ to palatalisation.

(29) *[r^{j}] ⩥ *Cor^{j}

Bringing together this constraint ranking and the place-compatibility hierarchy in (9), *[r^{j}] must outrank *[−Cor]^{j}, because palatalised labials and dorsals appear in the Japanese mimetic vocabulary. This yields the ranking in (30).

(30) *[r^{j}] ⩥ *[−Cor]^{j} ⩥ *Cor^{j}

This analysis accounts for the examples in (5), as shown in (31) for [çoro-çoro]. Another conceivable candidate, [horo-horo], fatally violates Max[−ant], which is ranked above *[−Cor]^{j}.

(31)

/horo-horo, [−ant]/	*[r^{j}]	*[−Cor]^{j}	*Cor^{j}	Align-R
☞ a. çoro-çoro		*		***
b. hor^{j}o-hor^{j}o	*!		*	*

Likewise, [çuru-çuru] in (6d), where palatalisation is lexical, is analysed as in (32). The input containing palatalised /r^{j}/ does not surface faithfully. Even if the rhotic is lexically palatalised, the [−anterior] feature moves to the appropriate consonant. The proposed exposition is compatible with richness of the base, so the absolute prohibition of [r^{j}] is properly expounded, regardless of whether it is lexical or derived.

(32)

/hur^{j}u-hur^{j}u/	*[r^{j}]	*[−Cor]^{j}	Align-R	NoFlop
☞ a. çuru-çuru		*	***	*
b. hur^{j}u-hur^{j}u	*!		*	

As I discussed above, vowel-initial monoconsonantal roots exist. In such roots, the consonant may be /r/, as exemplified in (33a). As is obvious from the lack of palatalised forms, the avoidance of palatalised rhotics is not a phonological restriction particular to biconsonantal roots. A number of mimetic roots are monosyllabic, and they can also be palatalised. Several representative examples are given in (33b). On the other hand, monosyllabic roots with an initial flap are never palatalised, as shown in (33c). The Japanese coda condition prevents a coda consonant from carrying its own place feature, so its place must be independently licensed by the following onset. A word-final coda is not followed by an onset, so [N] is placeless in (33b) and (c). Assuming an undominated *[−Place]^{j} constraint that penalises palatalisation of consonants which lack a major place, /r/ is the only potential target of palatalisation in (33c). However, it consistently resists palatalisation. This persistent resistance to palatalisation by the flap is in perfect harmony with the marked status of [r^{j}].

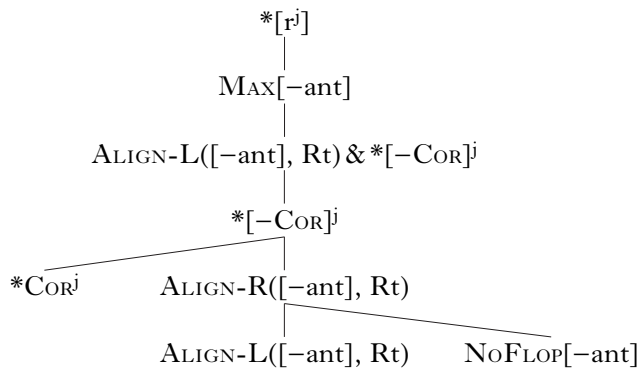
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(33)

	base forms		*palatalised forms*	
a.	uru-uru	'sweeping'	*ur^{j}u-ur^{j}u	
	uro-uro	'hanging around'	*ur^{j}o-ur^{j}o	
	ira-ira	'irritated'	*ir^{j}a-ir^{j}a	
	oro-oro	'flustered'	*or^{j}o-or^{j}o	
b.	tuN-tuN	'thrusting'	ʧuN-ʧuN	'chirping'
	toN-toN	'tap-tap'	ʧoN-ʧoN	'clapping'
	poN-poN	'in succession'	p^{j}oN-p^{j}oN	'jumping up and down'
	buN-buN	'buzzing'	b^{j}uN-b^{j}uN	'buzzing noisily'
	gaa-gaa	'quacking'	g^{j}aa-g^{j}aa	'crying loudly'
c.	raN-raN	'glaring'	*r^{j}aN-r^{j}aN	
	ruN-ruN	'pleasant'	*r^{j}uN-r^{j}uN	

The proposed analysis is summarised in (34). *[r^{j}] is ranked above MAX[−ant] in order to deal with the lack of palatalisation of /r/ in (33a) and (c). The prohibition of [r^{j}] is not a restriction which is imposed on Japanese phonology in general. It does appear in Sino-Japanese (e.g. [r^{j}o-koo] 'travel' and [koo-r^{j}aku] 'conquest') and loanwords (e.g. [r^{j}uumaʧi] 'rheumatism' and [r^{j}ukkusakku] 'rucksack'), although [r^{j}] is extremely rare in the latter (Moreton & Amano 1999). Abstracting away from the infrequency of [r^{j}] in loanwords, the asymmetry of these two lexical strata and the mimetic stratum can be handled within the core-periphery model of the phonological lexicon proposed by Itô & Mester (1995a, b, 1999). In this model, faithfulness constraints may be multiplied with respect to different lexical strata. MAX[−ant] must be relativised for the three lexical classes relevant here. MAX[−ant]$_{\text{Sino/Loan}}$ outranks *[r^{j}], so the palatalised rhotic is sanctioned in Sino-Japanese and loanwords. By contrast, *[r^{j}] is ranked above MAX[−ant]$_{\text{Mimetic}}$. Consequently, [r^{j}] is entirely absent from the mimetic vocabulary. (MAX[−ant]$_{\text{Sino/Loan}}$ is omitted from the ranking in (34).)

(34)



This completes my analysis of the palatalisation phenomenon in Japanese mimetics. A striking aspect of the proposed analysis is that the

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complete set of data is unified by the idea of feature compatibility. On the one hand, [−anterior] is less compatible with non-coronals than with coronals. On the other hand, among coronals, it favours non-rhotics over rhotics. The combination of these two palatalisability scales offers an integrated account of lexical and derived mimetic palatalisation in Japanese.

In their analysis of the resistance of /r/ to palatalisation, Mester & Itô (1989) invoke contrastive underspecification (Steriade 1987b, Clements 1988, Cohn 1992). /r/ is the only liquid in Japanese; its place is redundant and predictably coronal. Consonantal places are contrastive for all other manners of articulation. Using contrastive underspecification, Mester & Itô argue that the coronal feature of /r/ is underspecified in the lexical representation, and that due to its lack of a place specification, it is skipped when the best docking site for [−anterior] is scanned. The proposed feature-compatibility analysis is framed in a larger model of cross-linguistic markedness. However, the analysis in terms of contrastive underspecification rests on the particular architecture of the Japanese consonant inventory. Zoll (1996, 1997) provides similar discussion against the underspecification analysis of /r/.

Furthermore, input underspecification is not a viable analytical tool. Though the importance of coronal underspecification is extensively discussed in Paradis & Prunet (1991b), many arguments have been offered against the theory of underspecification (e.g. Stanley 1967, Mohanan 1991, Steriade 1995). McCarthy & Taub (1992) attack coronal underspecification in particular (see also Borowsky 1986, 1987, Yip 1988, Ní Chiosáin 1994 and Goad 1997). In addition, underlying underspecification is problematic in OT, as richness of the base removes all the restrictions imposed upon the input. It then follows that underspecification is not a reliable analytical tool in OT (see Kurisu 2000 for empirical argumentation in the context of Sino-Japanese root fusion). Note that the application of contrastive and radical underspecification is language-particular and usually even phenomenon-dependent (for some representative studies on radical underspecification, see in particular Kiparsky 1982, Archangeli 1984, Pulleyblank 1988a, b, Archangeli & Pulleyblank 1989 and Paradis & Prunet 1991a). There is no unified theory of underspecification that OT analyses can be built on.

Itô *et al*. (1995) make a proposal for retaining underspecification in OT, within a model of surface underspecification. In this proposal, only contrastive features can be licensed in the surface representation. Predictable features must be absent from the surface representation in order to respect the relevant licensing constraint. Within this proposal, a conceivable alternative analysis of /r/ appears to involve recourse to coronal underspecification of the rhotic in the surface representation. However, there is empirical evidence against this alternative.[7]

[7] I thank an anonymous reviewer for pointing this out to me. The discussion in the rest of this section largely owes much to this reviewer.

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Consider the 2nd person singular feminine subject formation in Harari. As shown in (7b), /l/ undergoes palatalisation (/gidæl-i/ → [gidʒæj-i]). But the last example in (7c) (/sibær-i/ → [ʃibær-i]) illustrates the fact that /r/ is not susceptible to palatalisation. The additional examples in (35) confirm that the resistance of /r/ to palatalisation holds across the board.

(35)

2sg masc	*2sg fem*	
sɨxær	ʃɨxær-i	'be drunk!'
diræq	dʒiræq-i	'be dry!'
t'iræg	tʃ'iræg-i	'sweep!'
birær	birær-i	'fly!'

Both liquids in Harari are coronal, so the coronal feature should be underspecified for both consonants. This leaves the palatalisability of /l/ unexplained. The phonological feature responsible for distinguishing /l/ and /r/ is [lateral]. This feature is usually seen as a dependent of coronal (Blevins 1994; see Rice & Avery 1991 and Yip 2005 for cases where [lateral] is considered as a dependent of some other feature). The coronal feature must then be specified for the liquids in order to host [lateral]. In this analysis, however, it remains a mystery why /r/ does not undergo palatalisation: we would expect that /l/ and /r/ should pattern alike, whether or not the coronal feature is specified. In contrast, *[rʲ] prohibits palatalised apical rhotics regardless of the consonant inventory, so the prohibition of palatalised rhotics in Japanese and Harari can be characterised in a unified fashion.

Many similar examples can be found. Serbo-Croatian has both plain and palatalised laterals, but has only one plain rhotic (Browne 1993). In the same vein, both alveolar and palatal(ised) laterals exist in Enga (Luzbetak 1956), Permian (Riese 1998), Komi (Hausenberg 1998), Slovak (Short 1993b), Saamic (Sammallahti 1998), Udmurt (Csúcs 1998) and Kalmuck (Svantesson *et al.* 2005), but the only rhotic is alveolar in all of these languages. Belarusian (Mayo 1993), Estonian (Viitso 1998), ObUgrian (Honti 1998), Kamassian (Simoncsics 1998), Khanty (Abondolo 1998a), Selkup (Helimski 1998) and Mari (Kangasmaa-Minn 1998) have both plain and palatalised laterals and nasals, but none of these languages has a palatalised rhotic. These cross-linguistic similarities follow straightforwardly from *[rʲ], but a theory of surface underspecification has no explanation.

The discussion above has shown that an account utilising *[rʲ] is more firmly grounded cross-linguistically than one employing language-dependent underspecification of a redundant feature. This is an important strength of the proposed feature-compatibility analysis, since all constraints are universal in OT.

6 Comparison with Zoll's place-complexity account

The goal of this section is to compare the feature-compatibility analysis with the OT account articulated by Zoll (1996, 1997). The analysis in Zoll

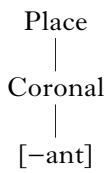
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(1997) is slightly different from that in Zoll (1996), but is essentially identical in all crucial respects. Here I consider only Zoll (1997).

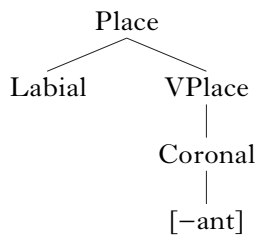
Zoll's most important proposal is that licensing of complex segments plays a central role in accounting for Japanese mimetic palatalisation. In disyllabic mimetic roots, there are two consonants which are potentially available for palatalisation. The locus of palatalisation is not fixed to the initial or medial position. They are both eligible docking sites for the palatalisation feature. Zoll proposes that this conflicting directionality effect stems from the interaction of two alignment constraints.

Her crucial observation is that palatalised coronal obstruents are realised as alveopalatal consonants, as shown in (36a). However, labial and dorsal consonants retain their original major place, and palatalisation is realised phonetically as a secondary articulation, as shown in (b) and (c). The crucial difference between (36a) and (b, c) is whether the output of palatalisation has a simplex or complex place of articulation.

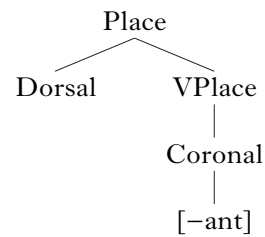
(36) a. /s z/ → [ʃ ʒ] /t d/ → [ʧ ʤ]



b. /p b/ → [pʲ bʲ]



c. /k g/ → [kʲ gʲ]



Zoll assumes the two alignment constraints in (37). (37a) requires complex segments to be in PWd-initial position, whereas (37b) is best satisfied when the [−anterior] feature is associated with the rightmost segment of a PWd. The left-alignment constraint in (37a) is based on the cross-linguistic observation that marked phonological representation or structure tends to be licensed only in the initial position of some constituent, as seen in Efik (Hyman 1990), Shona (Beckman 1997), Ancient Greek (Steriade 1995), Tamil (Christdas 1988, Beckman 1997) and Kukuya (Paulian 1975, Hyman 1990).

(37) a. ALIGN-L(Complex Segment, PWd)
A complex segment is PWd-initial.

b. ALIGN-R([−ant], PWd)
The feature [−anterior] is a suffix.

Zoll's analysis is implemented below. (38) shows how it accounts for the forms in (2). (38b) incurs a fatal violation of ALIGN-L(Complex, PWd), because [bʲ] has a complex place specification and it is not aligned to the left edge of a PWd. As a result, the root-initial consonant is targeted by palatalisation. On the assumption that the [−anterior] feature cannot be

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associated with a vowel, ALIGN-R([−ant], PWd) is necessarily violated at least once.[8]

(38)

/zabu-zabu, [−ant]/	ALIGN-L	ALIGN-R
☞ a. ʒabu-ʒabu		***
b. zabʲu-zabʲu	*!	*

(39) provides an analysis of cases where both root consonants are coronal, as in (3). ALIGN-L(Complex, Wd) is irrelevant here, since no complex segment is generated, regardless of the consonant to be palatalised. As a result, lower-ranked ALIGN-R([−ant], PWd) plays a decisive role. Medial palatalisation minimises the distance of palatalised segments from the right edge of the PWd, so (39b) is chosen as the winning candidate.

(39)

/dosa-dosa, [−ant]/	ALIGN-L	ALIGN-R
a. ʤosa-ʤosa		**!*
☞ b. doʃa-doʃa		*

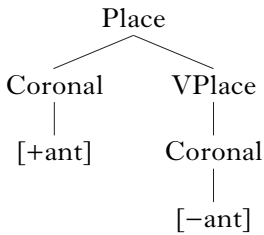
If both consonants are non-coronals, as in (4), ALIGN-L(Complex, PWd) comes into play, as palatalisation of either consonant creates a complex segment. Hence, the first consonant is palatalised in order to fulfil ALIGN-L(Complex, PWd), as shown in (40).

(40)

/poko-poko, [−ant]/	ALIGN-L	ALIGN-R
☞ a. pʲoko-pʲoko		***
b. pokʲo-pokʲo	*!	*

To explain the resistance of /r/ to palatalisation, Zoll (1997) observes that the rhotic bears two places of articulation when it is palatalised, as in (41).

(41) /r/ → [rʲ]



[8] Zoll (1997: 267) remarks that violations of ALIGN-L(Complex, PWd) are assessed for each segment that intervenes between the complex segment and the left edge of the PWd, but ALIGN-L violation marks are actually assigned categorically in her tableaux.

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As far as the resulting subsegmental structure is concerned, palatalised /r/ patterns in the same way as palatalised labial and dorsal consonants, in the sense that the place of the segment resulting from palatalisation is place complex. Given this representation, it is not surprising that palatalisation does not affect a root-internal rhotic. As illustrated in (42), the PWd-initial consonant is palatalised to avoid complex [r^{j}] in the root-medial position.

(42)

/horo-horo, [−ant]/	ALIGN-L	ALIGN-R
☞ a. çoro-çoro		***
b. hor^{j}o-hor^{j}o	*!	*

The feature-compatibility analysis proposed here and Zoll's (1997) place-complexity account are partially similar, in that the root-initial position is privileged. This is achieved by constraint conjunction in the former, but by a single alignment constraint in the latter. However, there are substantial differences, both conceptual and empirical.

Conceptually, palatalised non-coronals and palatalised rhotics are viewed as marked elements in the feature-compatibility analysis. In the place-complexity analysis, however, complex consonants are considered to be marked elements. This difference is quite important in the OT enterprise, which lays special emphasis on the role of markedness constraints.

Empirically, the feature-compatibility analysis is capable of accounting for data that are problematic for the place-complexity account. As shown in (33b), monosyllabic roots also participate in palatalisation. However, rhotic-initial roots never undergo palatalisation (33c). The rhotic resists palatalisation, irrespective of its position within a root. The account given in §5 appeals to the absolute markedness of palatalised apical rhotics. The position of [r^{j}] within the root is of no relevance – *[r^{j}] is violated everywhere. By contrast, the place-complexity analysis permits root-initial complex consonants when there is no other coronal consonant in the same root, and incorrectly predicts that a root-initial rhotic may be palatalised in monosyllabic roots.

A second advantage of the feature-compatibility analysis has to do with output [ç]. As noted above, a key corollary of my analysis is that it differentiates lexical [ç] from [ç] derived from palatalisation of /h/. The former is treated as an underlying coronal consonant, but the latter is not. This prediction in (28) is borne out, as discussed in §4. This is enabled in the feature-compatibility analysis by making *PLACE^{j} sensitive to the input representation. By contrast, in the place-complexity account, the docking site of palatalisation is determined by interactions of markedness constraints that are insensitive to the major places of palatalised consonants in the underlying representation. In other words, place differences in the lexical representation are ignored, and it is only the resulting output structure that matters for the locus of the [−anterior] feature. No theoretical account that disregards the input place of

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consonants would be able to explain the different distributional behaviour of lexical and derived [ç].

Third, the feature-compatibility analysis successfully accounts for the different distributions of derived [ç] and [ɲ] in the Japanese mimetic class. Again, this has to do with its ability to look at the input place specification of root consonants. [ç] and [ɲ] are palatals. Derived [ç] patterns with labials and dorsals. However, [ɲ] derived from /n/ exhibits the same distributional pattern as other non-rhotic coronal consonants. /n/ undergoes palatalisation unless the other consonant is a coronal (e.g. /noko-noko, [−ant]/ → [ɲoko-ɲoko] 'nonchalantly' and /hena-hena, [−ant]/ → [heɲa-heɲa] 'shilly-shally'). However, /n/ is not palatalised in root-initial position if the other consonant is also a coronal (see the examples in (3)). Root-initial palatalisation of /n/ could be independently eliminated in /neta-neta/ and /neto-neto/ (i.e. by a ban on certain sequences of a palatalised consonant and a front vowel). But this reasoning is invalidated by examples like [nuʧa-nuʧa] and [nuʧo-nuʧo] in (3). The different behaviour of derived [ç] and [ɲ] is successfully accounted for by the feature-compatibility account, since their underlying place features are different. In contrast, in the place-complexity account, which ignores the lexical place features of root consonants, we would expect the identical distributional pattern for derived [ç] and [ɲ], whether palatals are complex or simplex. This prediction is not upheld empirically.

Palatals provide an additional argument for the feature-compatibility analysis. As discussed and exemplified above, /n/ and other non-rhotic coronal consonants exhibit precisely the same pattern in palatalisation. This is not problematic for the feature-compatibility analysis, because it takes into account the underlying place specification of root consonants. Vance (1987, 2008) explicitly identifies Japanese [ɲ] as a dorso-palatal consonant, which is fully consistent with the structure in (27). [ɲ] thus involves place complexity in the sense of Zoll (1997). But palatalised coronal obstruents are realised as unambiguously simplex alveopalatals (e.g. /s/ → [ʃ] and /t/ → [ʧ]). Given these inconsistent results among coronals, the parallel behaviour of /n/ and coronal obstruents contradicts the place-complexity analysis.

These empirical considerations show that the feature-compatibility analysis is superior to the place-complexity account. Kingston (1993: 89–90) casts doubt on the view which attributes the rarity of palatalised dorsals (as compared with palatalised coronals) to their place complexity. Labialisation most frequently occurs on dorsal consonants, and the outcomes of labialisation are complex labio-dorsals, rather than dorsal consonants articulated with a simplex place specification. Given the fact that doubly articulated stops are not uncommon across languages, place complexity is not an essential factor in explaining the rarity of palatalised dorsals. Kingston claims that a combination of articulations with mutually enhancing acoustic effects is preferred and frequent. This does not accord with the place-complexity account given by Zoll, but is consistent with my feature-compatibility analysis.

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7 Conclusion

In this study, I have proposed that palatalisation must be captured in terms of feature compatibility. On the one hand, palatalisation prefers coronals and disfavours labials, with dorsals being positioned in between. On the other hand, palatalised apical rhotics are not favoured. These two findings have been obtained independently by Rose (1997b) and Hall (2000). The main goal of this study was to combine the two findings in order to give a better analysis of Japanese mimetic palatalisation.

I demonstrated that the combination of the two palatalisability hierarchies in (9) and (29) offers a straightforward account of mimetic palatalisation. As noted, the palatalisability hierarchy in (9) needs to be able to make reference to the underlying place specification of a root consonant. This is achieved by hypothesising an initial stage of palatalisation at which [−anterior] can be added as a secondary articulation to the major place of a consonant. Nothing else, in particular restructuring, occurs at this stage. I argued that the *PLACE^{j} constraints are sensitive to this initial representation rather than to the representation of the surface consonant produced by restructuring. This proposal succeeds in unifying lexical and derived palatalisation, and allows a formalisation of the cross-linguistic compatibility hierarchy of [−anterior] and the major consonantal places. The persistent resistance of /r/ to palatalisation is also accounted for in terms of feature compatibility. Contrastive underspecification does not need to be invoked, once the marked status of palatalised rhotics is recognised. The analysis is supported with facts not highlighted in the earlier literature (the absence of palatalisation in /r/-initial monosyllabic roots and numerous issues surrounding palatal consonants). The ability to account for such examples empirically means that the feature-compatibility approach should be preferred to the analysis given by Zoll (1996, 1997), which relies on the phonological licensing of complex segments.

The analysis given here is not intended to be specific to Japanese. Palatalisation in the Japanese mimetic vocabulary was taken here as a test case. But analyses exploiting the idea of feature compatibility may well be applicable to palatalisation phenomena in other languages too. An obvious direction for future research is testing the plausibility of the feature-compatibility account against data from a more extensive range of languages. The analysis developed in this study makes strong predictions regarding possible and impossible consonant inventories under palatalisation. There are restrictions on the ways in which the two palatalisability hierarchies can be combined; furthermore, MAX[−ant] can be incorporated in the hierarchies in only limited ways. Consequently, it is predicted that the permissible patterns of palatalisation are restricted. A comprehensive description of cross-linguistic patterns of palatalisation and a thorough typological examination of the resulting predictions will be a fruitful area for future exploration, which can confirm or disconfirm the proposed analysis of Japanese mimetic palatalisation from a typological point of view.

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Another important question is how the markedness constraint against palatalised laryngeal consonants is to be ranked with respect to other *PLACE^{j} constraints. Presumably, palatalised laryngeals are more marked than palatalised non-rhotic coronals. However, the relative markedness of palatalised laryngeals and palatalised labials or dorsals is not obvious, at least from the research carried out in this study. Future investigation of this question may make the palatalisability hierarchy in (9) more complete.

Furthermore, languages exhibit other secondary articulations, such as labialisation, velarisation, pharyngealisation and glottalisation. Walker (1998) claims that the entire typological variation of nasal harmony can be systematically accounted for by appealing to a universally fixed ranking of feature-compatibility constraints, where nasality and the manner of consonants participate as relevant features. It is of great empirical and theoretical interest to establish whether feature compatibility in relevant dimensions is responsible for an adequate explanation of other secondary articulation phenomena.

Finally, it is an interesting empirical question whether mimetic items are more susceptible to palatalisation than other items. As I discussed briefly, different Japanese lexical strata pattern differently with regard to palatalisation of /r/. Were this the case in other languages too, it might have interesting theoretical repercussions for the phonological organisation of the lexicon.

These issues go beyond the scope of this study, and I postpone inspection of them to future research.

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