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Systemic Markedness and Faithfulness

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1 Introduction

Phonological patterns, whether viewed synchronically or as they change over time, can be explained only with reference to the larger system of oppositions that they are part of. This was the fundamental insight of modern phonology at the beginning of the last century, as it developed under the hands of de Saussure, Jakobson, Trubetzkoy, and others, in opposition to the atomistic practice of much Neogrammarian analysis. Evaluating a single item is not possible without at the same time evaluating all the other items that it stands in opposition to—"dans la langue il n'y a que des différences."

However, even though often invoked in the abstract, this systemic principle played a surprisingly inconspicuous role in later developments, which were dominated by post-Bloomfieldian structuralism and generative phonology. In the standard conception of a phonological derivation, an individual input item runs through a sequence of rules until no more rules can be applied. Each such input-output mapping proceeds in splendid isolation from all others. The picture is not substantially different in the input-output mappings that Optimality Theory (OT) is based on.[1] In theories of this kind, the overall system of contrasts is never directly appealed to, but plays at most an indirect role (in generative phonology, in the form of underspecification of redundant and predictable features and structures, see Mester and Ito 1989, Steriade 1995, and works cited there for overview and discussion). Crucially, there is no direct appeal, in phonological rules or constraints, to intrinsically systemic notions like opposition and distinctness, merger and neutralization, etc. The idea that there is something like systemic markedness that is intrinsically different from syntagmatic markedness is quite foreign to standard generative phonology (but see Kaye, Lowenstamm and Vergnaud 1985, where this important distinction is clearly made). Rather, such factors play a role only at a meta-level, in analyzing the rule system itself and in motivating, from the outside, the way Universal Grammar is organized and the way

[1] The analogical effects between related forms that any theory needs to come to terms with—classical generative phonology ascribes them to cyclic rule application, and current mainstream OT to Output-Output constraints—are orthogonal to this issue.

particular grammars change over time. Phonology itself (and, by extension, grammar), remains free of such notions.

Recent years have seen the reemergence, within OT phonology, of precisely these classical ideas relating to opposition and contrast as important operative elements within individual grammars. These developments were partially kindled by Adaptive Dispersion Theory (see Lindblom 1986 and work cited there), an attempt to model typology of phonological inventories as a set of elements evenly spaced (or "dispersed") in an acoustic-perceptual space.[2] This paper makes a small contribution to this line of inquiry by taking up a specific development in the historical phonology of Japanese concerning sibilants preceding front vowels. As we will show, the changes in question are difficult to make sense of syntagmatically, in terms of their local environment. They become understandable when approached paradigmatically, in relation to the phonological system as a whole.

In OT, the idea of dispersion is captured by constraints requiring that contrasts be maintained, and that they be perceptually distinct. Dispersion Theory (Flemming 1995, 2002, Padgett 1997, 2003) identifies two basic, and conflicting, markedness imperatives driving phonology: to *maximize* the perceptual distinctiveness between contrasting forms and to *minimize* effort (e.g., articulatory, processing). The resolution of these conflicts in individual grammars can be formally understood in terms of OT (Prince and Smolensky 1993), enriched by new constraints which work in tandem with the standard M/F constraints. Isolated inputs with their associated output candidates, as in standard OT, are not the only proper objects of evaluation. Inputs and candidate outputs consist of sets of forms that are in contrast.

The contrast-based version of OT (1) employed here, based on Padgett 2003, enriches both the M(arkedness) and the F(aithfulness) component OT by systemic constraints, which are defined in (2).

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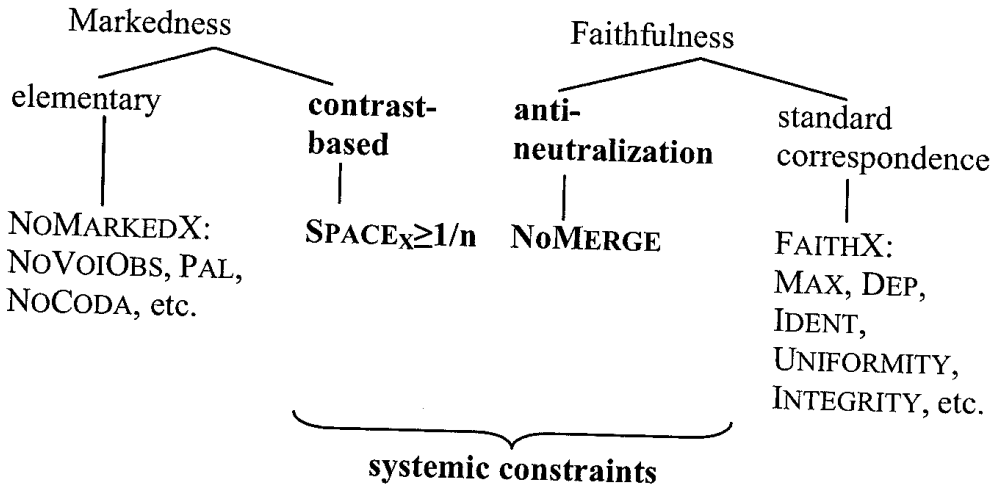
[2] Even though Adaptive Dispersion Theory was instrumental in resuscitating old systemic notions, the precise details of its quantitative spacing formulas have played little role in the OT-work, which works instead with categorical constraints.

(1)



(1) Systemic markedness and systemic faithfulness constraints:[3]

Systemic Markedness:	SPACE$_X$≥1/n	Potential minimal pairs differing in property X must differ in X by at least 1/nth of the available space
Systemic Faithfulness:	NOMERGE	No output word has multiple correspondents in the input (cf. UNIFORMITY)

Taking the color continuum of high vowels ranging from front unrounded [i] to back rounded [u] as an illustration, (3) shows this space packed with varying numbers of segments. The more segments, the smaller the perceptual space allotted to each.[4]

(3)

i i̟ i̠ u	Each segment occupies ¼ of the perceptual space
i i̞ u	Each segment occupies ⅓ of the perceptual space
i u	Each segment occupies ½ of the perceptual space
i̞	Each segment occupies all of the perceptual space

[3] Conceivably Padgett's NOMERGE needs to be split up into a family of more specific constraints, see Lubowicz 2003 for one interesting proposal in this direction, among many alternatives.

[4] Herrick 2003 presents an important evaluation and comparison, on the basis of a detailed acoustic study of the vowel systems of Catalan dialects, of different psychoacoustic units appropriate for measuring this kind of space.

Following Flemming and Padgett, let us postulate that the inventories in (3) are the result of a family of minimum space constraints (here, governing vowel color space), as in (4).

(4) Space constraints for vowel color

		$\text{SPACE}_{\text{VCol}} \geq 1/3$	$\text{SPACE}_{\text{VCol}} \geq 1/2$	$\text{SPACE}_{\text{VCol}} = 1$
a.	i ɨ ɨ u	*	*	*
b.	i ɨ u		*	*
c.	i u			*
d.	ɨ			

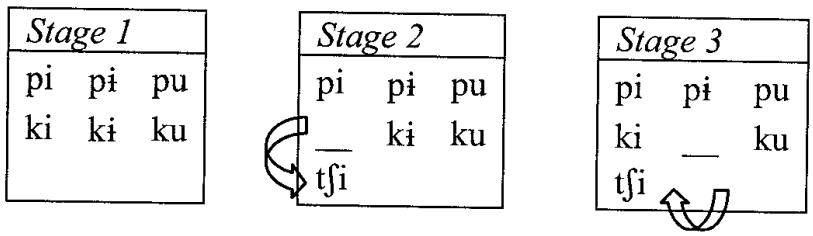
The fronting of [ɨ] to [i] following velars in the history of Russian ([kɨ]→[ki], etc.), as analyzed in Padgett 2003, provides an excellent illustration of the roles of the Space constraints and of the anti-neutralization constraint NoMERGE. (see also Sanders 2003 for a detailed study of issues in the historical phonology of Polish in these terms). Illustrative examples appear in (5).

(5)

kɨjev	>	kiev	'Kiev'
rukɨ	>	ruki	'hands (acc.pl.)'
drugɨ	>	drugi	'friends (acc.pl.)'
xɨtrɨj	>	xitrɨj	'clever'
pastuxɨ	>	pastuxi	'shepherds (acc.pl.)'

Such fronting of central vowels after back consonants seems baffling when viewed from the perspective of its syntagmatic context: It is obviously not assimilatory, and there are no indications that some kind of dissimilation is at work. Padgett demonstrates that an explanatory account of the fronting of [kɨ] to [ki] hinges on two factors: (i) systemic markedness, i.e., the improved spacing of the pair [ki, ku] over the pair [kɨ, ku], and (ii) systemic faithfulness, i.e., the fact that the change no longer incurs a violation of NOMERGE after original [ki] was palatalized to [tʃi]. Both of these factors are illustrated in (6).

(6)



The tableau in (7) summarizes the main points of Padgett's analysis.

(7)

	pi_1 $pi̵_2$ pu_3 $ki̵_5$ ku_6 $tʃi_4$	NoMerge	Space$_{VCol}$≥½	Ident[VCol]
a.	pi pi̵ pu ki̵ ku tʃi		***!	
b. ▶	pi pi̵ pu ki_5 ku tʃi		**	*
c.	pi pi̵ pu ki_5 $ki̵_6$ tʃi		***!	**
d.	$pi_{1,2}$ pu ki_5 ku tʃi	*!		**

The input consists not of a single isolated form, but of an array of contrasting items.[5] This is crucial since what is being evaluated is the spacing and the mergers within this array. These are properties not of elements, but of systems—and it is a category error to try to ascribe them, in some form or other, to elements.

2 Sibilant depalatalization in Japanese

Here we focus on a different kind of non-assimilatory change that, as we will try to show, needs to be understood in a paradigmatic contrast-based way, namely, the historical depalatalization of coronal obstruents in

[5] In Padgett's conception, an idealized set of CV-syllables, see the work cited for discussion and motivation.

Japanese before the front vowel [e] (paralleled by the loss of the front glide [j] in the same position).

The Modern Japanese inventory of consonant phones is characterized by a systematic distinction between plain and palatal(ized) segments, as shown in (8).

(8) Modern Japanese consonant phones

		C	C^j	C	C^j	C	C^j	C	C^j	C	C^j
obstruents	voiceless	p	p^j	t	tʃ	s	ʃ	k	k^j	h	ç
	voiced	b	b^j	d	dʒ	z	ʒ	g	g^j		
sonorants	nasal	m	m^j	n	ɲ						
	nonnasal	w		ɾ	$ɾ^j$		j				

Conventionally CV-moras are classified as either 'plain' or 'palatal' (直音 *tyoku-on* vs. 拗音 *yoo-on*), where the term 'palatal' refers to several different phonetic realities: true palatals (the glide [j]), primary prepalatals,[6] and segments with secondary palatalization, as shown in (9).

(9)

		'plain'	**'palatal'**	Gloss
palatal glide:	with/without onset	ane	jane	'sister/roof'
		umi	jumi	'sea/bow'
coronals:	distinct primary place of articulation	ta	tʃa	'field/tea'
		saku	ʃaku	'fence/wine-serving'

[6] For most speakers, [tʃ,ʃ,ʒ] are not palato-alveolar but rather prepalatal, i.e. [tɕ,ɕ,ʑ] (see Okada 1999). Our broad transcriptions follow the usual practice in retaining the more familiar symbols, since nothing here hinges on the difference. While the high front vowel triggers both palatalization and affrication (/t,d/→[tʃi,(d)ʒi]), the high back vowel (unrounded in most varieties) triggers only affrication (/tu,du/→[tsu,(d)zu]). Among the voiced sibilants the affricate/fricative contrasts [dz/z] and [dʒ/ʒ] are neutralized (the よつがな *yotugana* phenomenon, referring to the four kana symbols づずぢじ involved): The second (fricative) member of each pair is usually found intervocalically, the first (affricate) member elsewhere.

noncoronals:	secondary palatal articulation	boo	bʲoo	'stick/second'
		kuukoo	kʲuukoo	'airport/express'

Besides such static underlying contrasts between plain and palatal moras, there is active palatalization of coronals before [i], as illustrated in the examples from the verbal conjugation system in (10) and in the loanword adaptations in (11).

(10)

		-i	*-e*	*-a*	*-o*	*-u*
speak	/hanas/	hanaʃ-i	hanas-e	hanas-anai	hanas-oo	hanas-u
win	/kat/	katʃ-i	kat-e	kat-anai	kat-oo	kats-u
		inf.	*imp.*	*neg.*	*tent.*	*pres.*

(2) Nativizing replacements in assimilated loanwords:[7]

source: ti/di →	loan: tʃi/dʒi	source: si/zi →	loan: ʃi/ʒi
team	tʃiimu	cinema	ʃinema
ticket	tʃiketto	dressing	doreʃʃiŋgu
dilemma	dʒiremma	zigzag	ʒiguzagu

We take note of the wellknown markedness factor at work by means of the constraint PAL informally stated in (12).

(3) PAL: Coronals are palatalized before front vowels.

In a more systematic development (as in Ito and Mester 1995b, p.196), PAL (or rather, its articulatory component, see Flemming 1995 on the acoustic side) can be thought of as a constraint (13) requiring that CV sequences headed by front vowels be articulatorily linked.

(4) CVLinkage: $(\text{cor}\wedge\text{frontV})_{\text{frontV}'}$
"A consonant-vowel sequence with a front vowel V forms a linked articulatory domain headed by V."

[7] Recent loans often preserve unpalatalized plosives before [i] ([emputii] 'empty', [indio] 'Indio', etc.) while sibilants continue to be obligatorily palatalized ([ʃitiibaŋku], 'Citibank', [ʃiiɸuudo] 'seafood'), see Ito and Mester 1995a, b for further details and exemplification.

(13) is in turn a special instance of the more general linkage constraint (14).

(5) CVLinkage: $(C\hat{}V)_{V'}$
"A consonant-vowel sequence forms a linked articulatory domain headed by V."

In contrast to the high front vowel [i], the mid front vowel [e] is not a palatalizer in the modern standard language (cf. the imperatives *hanas-e*, *kat-e* cited in (10) above, not **hanaʃ-e*, **katʃ-e*). This is why we occasionally encounter, as an alternative to the nativization strategy in (11) imposing palatalization on consonants in loanwords, the avoidance strategy in (15). Here the consonant remains unchanged, at the cost of shifting the vowel to [e], removing the pressure to palatalize.

(15) Alternative nativization strategy: vowel change [i]→[e]

source: ti/di →	loan: te/de
digital	**de**ʒitaru
Dixie	**de**kiʃii
bran**dy**	buran**dee**

Not only is there no requirement to palatalize before [e]—in this respect, Japanese is paralleled by numerous other languages—there is in addition an active ban on any kind of palatal segment before [e]. Given the well-known palatalization hierarchy of front vocoids, ranging from [j] as the strongest palatalizing element to [æ] as the weakest, it is not particularly unexpected that [e] fails to trigger palatalization. What is surprising is that it acts as a depalatalizer.

This is quite unusual and calls for an explanation. Thus while combinations with central and back vowels are fully attested ([ja], [kʲa], [pʲa], etc.), the corresponding sequences with [e] (*[je], *[kʲe], *[pʲe], etc.) are systematically excluded in Modern Japanese. For example, verb roots ending in /j/, such as the last three examples in (16), delete the glide before desinences beginning with /e/.

(16) j~Ø alternations:

	transitive	*intransitive*	
/tob/	tob-asu	tob-eru	'fly'
/sam/	sam-asu	sam-eru	'cool down'
/hag/	hag-asu	hag-eru	'peel off/become bald'

/moj/	moj-asu	mo-eru	'burn'
/taj/	taj-asu	ta-eru	'extinguish/be extinct'
/koj/	koj-asu	ko-eru	'make/become fat'

Besides the absence of any of the various types of palatal(ized) segments in (8) before [e] in native Japanese words, depalatalization manifests itself in a significant number of loanwords, as in the examples in (17) (interestingly, [tʃe]→[te] is not attested).

(17) Depalatalization in loanwords:

source je/(d)ʒe/ʃe →	loan i.e~e/ze/se
Yemen	**i.**emen
Yale	eeru
Los Angeles	rosu anzerusu
Argentina	aruzentʃin
general strike	**z**ene suto
gelatine	zeratʃin
shepherd (dog)	sepaado

In recent times, the sequences [ʃe], [tʃe], and [(d)ʒe] have entered the language in foreign loans, especially in word-initial position ([ʃerii] 'sherry', ([tʃeen] 'chain', [kuriʃe] 'cliché', etc. (see Ito and Mester 1995a, b for detailed analysis), and nativizations like *sepaado* in (17) have an old-fashioned flavor. However, this does not diminish the reality and generality of depalatalization as an historical process. In addition, all of the palatal(ized) segments in (8) besides [ʃ,tʃ,(d)ʒe] remain rigorously excluded before [e].

3 [e] as a palatalizer: dialectal and historical evidence

What causes this kind of depalatalization, and the corresponding anti-assimilatory cooccurrence restriction? An understanding of the historical development is helpful here, and it will give us a clue as to the systemic factors that are at work. From a CV-linkage point of view (cf. (14)), one might have expected the front vowels to require neighboring palatal consonants, and the central and back vowels to require the plain versions.

It therefore comes as no surprise that there are varieties of Japanese elsewhere in Japanese where [e] acts as a palatalizer (in addition to [i]), in particular, of sibilants. Wenck 1954 (p.61) reports that [ʃe], [ʒe], and more rarely [tʃe], occur in Western and Eastern Kyushu and in Tohoku

(Hokurikudo). Thus the name of the city *Sasebo* in Kyushu is pronounced [saʃeho] by its inhabitants, and other examples appear in (18). Martin 1987 (p.18) gives examples from dialect descriptions with similar facts from a number of other places in Honshu and Shikoku.

(18)

dialect form	standard form		
[ʃenʃee]	sensee	先生	'teacher'
[ʒenʒen]	zenzen	全然	'absolutely'
[kaʒe]	kaze	風	'wind'

Historically, palatalization before [e] was clearly much more widespread. Compelling evidence stems from the way sibilants before front vowels were spelled in Portuguese missionary documents (late 16th–early 17th century). In *Esopono Fabvlas* (*Aesop's Fables*, as translated from Latin into Japanese in Rodriguez 1593), we consistently find the letters <x> and <j> wherever <s> and <z> would have been expected on the basis of the Modern Japanese forms, illustrated in (19).

(19)

	Spelling by Rodriguez	16th century pronunciation	,Modern Japanese	gloss
癖	<cuxe>	[kuʃe]	[kuse]	'habit'
...せば	<...xeba>	[...ʃeba]	[...seba]	CONDITIONAL
前後	<jengo>	[ʒeŋgo]	[zeŋgo]	'front&back'
風	<caje>	[kaʒe]	[kaze]	'wind'
死人	<xinin>	[ʃinin]	[ʃinin]	'dead person'
酒	<saqe>	[sake]	[sake]	'rice wine'
姿を	<sugatavo>	[sugatawo]	[sugatao]	'figure'-ACC

That the spellings <x> and <j> were indeed intended to denote the palatal fricatives [ʃ] and [ʒ] is confirmed by the explicit description in Rodriguez 1604 (p.229; our translation): "<x> is pronounced as in Portugese *xaque* 'checkmate', *peixe* 'fish', and not as *cs* [ks] in Latin, nor as the throat sound found in some areas of Holland." The relevant spelling conventions are summarized in (20).

(20) Spelling conventions in missionary documents:

Spelling:	<s>	<x>	<z>	<j>
16th century pronunciation:	[s]	[ʃ]	[z]	[ʒ]

In the phonology section of his *Arte da Lingoa de Iapam,* the first grammar of Japanese in any Western language, Rodriguez 1604 (p.222; our translation) is careful to stress the complementary fact that "in Japanese, there are no sound combinations <ti> <di> <se> <si> <ze> <zi>…" i.e., palatalization before [e] was obligatory, just like palatalization before [i]. As a result, only palatal spellings are found before front vowels (21), but both palatal and nonpalatal spellings are found before back vowels (22), where palatalization is contrastive.

(21) Only palatal spellings before <i> and <e>

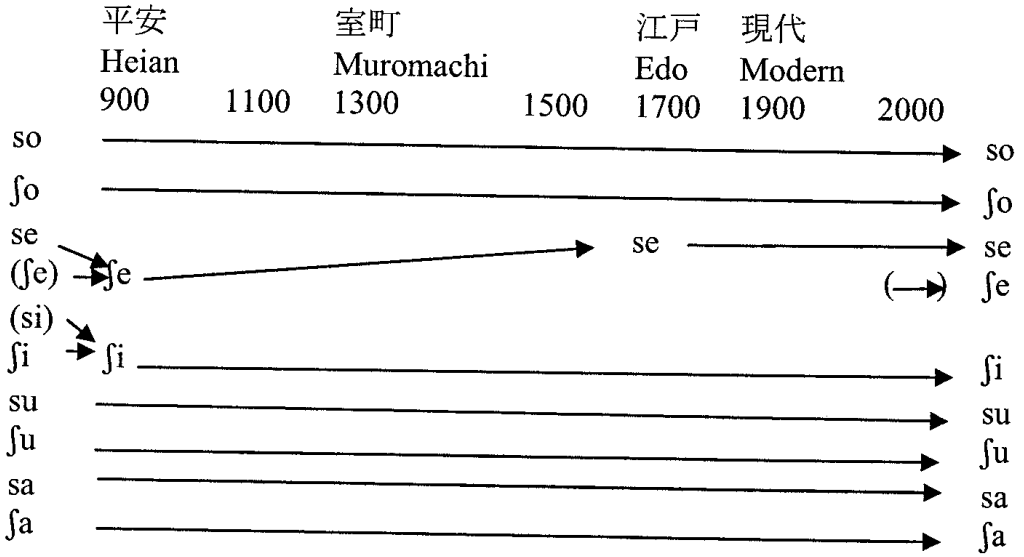
<xi>	[ʃita] / kanaʃi]	'low/sad'	下/悲し
*<si>	--		
<xe>	[ʃekai]/[kuʃe]	'world/habit'	世界/癖
*<se>	--		

(22) Both palatal and plain spellings before <a>, <o>, <u>.

<sa>	[satoo]/[ikusa]	'sugar/war'	砂糖/戦
<xa>	[ʃamen]/[gakuʃa]	'forgive/scholar'	赦免/学者
<so>	[soko]/[asobi]	'bottom/play'	底/遊び
<xo>	[ʃoogun]/[iʃʃo]	'Shogun/one place'	将軍/一所
<su>	[sugata]/[kusuri]	'figure/medicine'	姿/薬
<xu>	[ʃugo]/[goʃuin]	'protect/imperial seal'	守護/御朱印

Modern Japanese equivalents of these words are identical except for the cases with [e], where the plain fricative is found in [sekai]/[kuse] instead of the palatal version [ʃekai]/[kuʃe]. The historical development of sibilants from palatal to plain appears to have started in the early 17th century, as indicated in the approximate time table of mergers in (23).

(23) Historical development of sibilants: time table of mergers



With the shift of political and economic power from Kyoto in Western Japan to Edo (modern Tokyo) in Eastern Japan, the depalatalized variants won out in most dialects, including the modern standard. Rodriguez 1604 (pp.607-613; our translation) was aware of the dialectal split between the more conservative Western areas including the capital Kyoto (都 *Miyaco* 'capital') preserving palatalization before [e], and the innovating Eastern areas (関東 *Qvantŏ* 'Kanto', present-day Tokyo area) with depalatalization before [e], which was still considered vulgar at the time: "The syllable <xe> is pronounced as if whispered as <se> or <ce>. For example, <Xecai> (世界 'world') is uttered as <cekai>, and <saxeraruru> (させらるる 'made to do') as <saserarurū>. People from Qvantŏ are notorious for such pronunciations."

As noted above, in contemporary Japanese, due partly to the massive influx of foreign words (mostly from English) in the latter part of the twentieth century, palatal+/e/ was reintroduced in recent loans, and is also found in some peripheral forms such as the swearword [tʃe]. However, sibilants in the established vocabulary, i.e., words such as [sekai] or [kuse], in (21) show no tendency of reverting to their former pre-Edo period palatalized state.

4 Towards a contrast-based analysis

It is instructive to start with a brief look at a previous account of the situation found in the contemporary language offered in Ito and Mester

1995b. Abstracting away from details of formalization, this analysis translates the different behavior of [i] and [e] directly into a pair of opposing constraints, and accounts for the distribution of sibilant types in a front-vowel environment by coupling a palatalization constraint for [i] with a depalatalization constraint for [e], as in (24).

(24)

PAL(high, front):	palatal(ized) segment before /i/	*si, *ti, etc.
DEPAL(mid, front):	no palatal(ized) segment before /e/	*ʃe,*tʃe, etc.

The allophonic ranking scheme in (25) produces the desired output forms, as summarized in (26).

(25)

Context-sensitive Markedness: PAL(hi, front), DEPAL(mid, front)

|

Faithfulness Constraint: IDENT(anterior)

|

Context-free Markedness: *[–anterior]

(26)

Ranking	Result	
PAL(hi, front) » IDENT(ant):	/si, ʃi/	► [ʃi] (palatalization)
DEPAL(mid,front)»IDENT(ant):	/se, ʃe/	► [se] (depalatalization)
IDENT(ant) » *[–anterior]:	/sa,su,so,ʃa,ʃu,ʃo/	► [sa,su,so,ʃa,ʃu,ʃo] (remain faithful)

From the present perspective, it is clear where this theory goes wrong: It turns depalatalization—a language-particular constraint interaction effect which is driven, as we will see below, by systemic markedness—into a universal syntagmatic markedness constraint. The latter runs counter to the cross-linguistically well-attested palatalization in front-vowel environments, and is therefore typologically odd. Since palatalization before mid front vowels exists elsewhere (e.g., in Russian (see Padgett 2003) and even in pre-Edo and in dialectal Japanese) and is phonetically well-grounded, it is hard to see how depalatalization in the same

environment could also be grounded in syntagmatic markedness. Since all constraints are universal in OT, this would mean admitting constraints in the grammar that directly contradict each other. Constraint conflict is part of OT, but the existence of directly opposing constraints of the form HAVE-X and NO-X, or X and Anti-X, is doubtful at best. This problem persists in any analysis that postulates some depalatalization mechanism, triggered by the local pre-[e] syntagmatic environment.

The way out of the impasse, we submit, depends on one crucial idea: Depalatalization before [e] is an effect not of syntagmatic, but of systemic markedness. Comparing the straightforward distribution of sibilants of the pre-Edo period, with palatal variants before all front vowels, as in (27), to that of the modern period with a nonparallel distribution, let us again contemplate the question: Why depalatalization in Modern Japanese, resulting in different allophones of /s/ before front vowels? That is, why [se] instead of [ʃe], which would parallel [ʃi]?

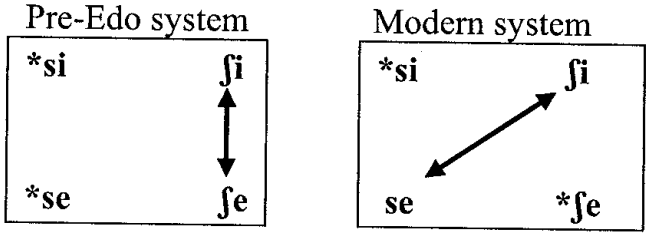
(27) Japanese sibilant system:

Pre-Edo			
*si	ʃi	su	ʃu
*se	ʃe	so	ʃo
		sa	ʃa

Modern			
*si	ʃi	su	ʃu
se	*ʃe	so	ʃo
		sa	ʃa

The crucial factor leading to depalatalization becomes tangible when we focus on the two systems of sibilants in the front-vowel environment, as in (28). Although the pre-Edo system is superior in terms of local (syntagmatic) markedness (palatal before front vowels), the modern system has a different point in its favor: The contrast between the CV-moras is greater than that in the pre-Edo system. The CV sequences "sibilant-front vowel" are differentiated both by the vowel ([i] vs. [e]) and by the consonant ([ʃ] vs [s]).

(28)



Depalatalization is a means of enhancing the contrast by polarizing the consonants: overall, [ʃi,se] is a better contrast than [ʃi,ʃe].

This is the central idea behind the analysis developed below. Instead of two opposing syntagmatic markedness constraints (PAL/i and DEPAL/e), there is only one syntagmatic markedness constraint (PAL). In addition, there is a paradigmatic markedness constraint: a spacing constraint—here dubbed "CONTRAST>i/e", in lieu of a full theory, yet to be developed, of spacing/contrast constraints governing sequences—declaring the contrast between two items contrasting only in [i] vs. [e] as insufficient. The respective ranking between PAL and CONTRAST>i/e crucially determines the outcome. In the pre-Edo system, the local palatalization constraint reigns supreme, hence the outcome [ʃi,ʃe] ((29)a).[8] But in the modern system the systemic constraint dominates the palatalization requirement, making [ʃi,se] the winner ((29)b).

(29) Pre-Edo vs. Modern ranking:

a. Pre-Edo:		PAL	CONTRAST >i/e PAL
	ʃi se	*!	
▶	ʃi ʃe		*

b. Modern:		CONTRAST >i/e	PAL
▶	ʃi se		*
	ʃi ʃe	*!	

We now turn to the details of the analysis. In the modern system, there are two other relevant candidates: Like (30)a [ʃi,ʃe] (30)c [si,se] simply loses by violating the high-ranking systemic constraint. However, [si,ʃe] (30)d also passes the systemic constraint and is in a tie with the desired winner [ʃi,se] (30)b.

[8] Tableaux (29)-(31) focus exclusively on markedness constraints and abstract away from faithfulness, hence also from the input.

(30)

		CONTRAST>i/e	PAL
a.	ʃi ʃe	*!	
b. ▶	ʃi se		*
c.	si se	*!	**
d. !!▶	si ʃe		*

In what respect is [ʃi,se] better than [si,ʃe]? The answer lies in the internal structure of PAL itself, which consists of subconstraints in a stringency relation (Prince 1998, de Lacy 2002): PAL(i) affects consonants before high front vowels, whereas PAL(i,e) affects a superset, namely, consonants before all front vowels. As shown in (31), [ʃi,se] violates both PAL constraints, [si,ʃe] only one.

(31)

		CONTRAST>i/e	PAL/i	PAL/i,e
a. ▶	ʃi se			*
b.	si ʃe		*!	*

The systemic faithfulness constraint NOMERGE (Padgett 2003) regulates Input-Output faithfulness (see the Russian example above in (5)–(7)). For the case at hand, the systemic markedness constraint CONTRAST>i/e ranks above the systemic faithfulness constraint NOMERGE, resulting in losing marks for the faithful candidate with no mergers (32)a. On the other hand, excessive neutralization, as in the last candidate (32)e, where everything has merged into [ʃi], is reined in by NOMERGE.

(32) CONTRAST>i/e » NOMERGE

	si ʃi se ʃe	CONTRAST > i/e	NOMERGE
a.	si ʃi se ʃe	*! (si/se) * (ʃi/ʃe)	
b.	ʃi se ʃe	*! (ʃi/ʃe)	* (si,ʃi→ʃi)
c.	ʃi ʃe	*! (ʃi/ʃe)	* (si,ʃi→ʃi) * (se,ʃe→ʃe)
d. ▶	ʃi se		* (si,ʃi→ʃi) * (se,ʃe→se)
e.	ʃi		* (si,ʃi→ʃi), *(si,se→ʃi) * (se,ʃi→ʃi), *(se,ʃe→ʃi) *!(ʃe,ʃi →ʃi), *(si,ʃe→ʃi)

The syntagmatic constraints do the same work as before, with the allophonic ranking illustrated in (33)a and (33)b.

(33) PAL/i, PAL/i,e » IDENT(anterior) » *[–anterior]

a. Palatalization is phonemic: IDENT(anterior) » *[–anterior]

Input:	ʃa	PAL/i, PAL/i,e	IDENT(ant)	*[–anterior]
▶	ʃa			*
	sa		*!	

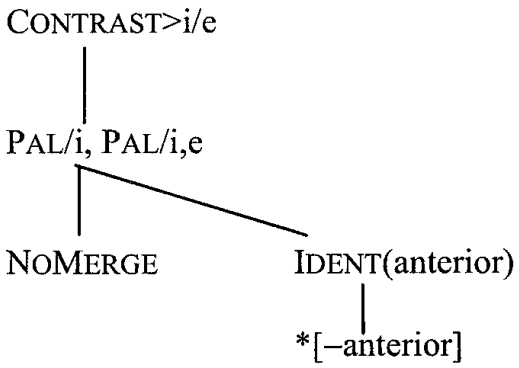
b. Palatalization is active: PAL » IDENT(anterior)

Input:	si	PAL/i, PAL/i,e	IDENT(ant)	*[–anterior]
	si	*!		
▶	ʃi		*	*

The overall ranking of the modern system is given in (34), followed by an overall ranking tableau (35).[9]

[9] We note, as a problem for future research, the redundancy of classical faithfulness with respect to NOMERGE: a violation of the latter always implies a violation of the former (though not vice versa). This suggests a theory with a faithfulness component significantly reduced in power—a welcome move for independent reasons, given the problems raised by the ever-increasing richness of the faithfulness mechanisms postulated by OT researchers (see Ito and Mester 2003, pp.155-183).

(34) Overall ranking (Modern system):



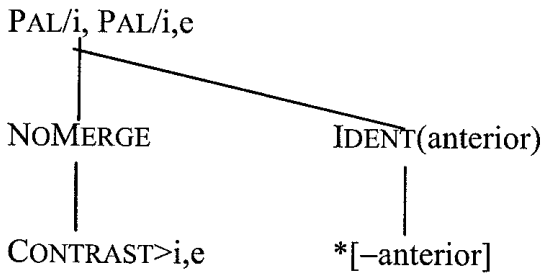
(35)

Input:	si ʃi se ʃe	CONTRAST >i/e	PAL/i	PAL/i,e	NO MERGE	IDENT (ant)	*[–ant]
	si ʃi se ʃe	*!*	*	**			**
	ʃi se ʃe	*!		*	*	*	**
	ʃi ʃe	*!			**	**	**
	si se	*!	*	**	**	**	
▶	ʃi se			*	**	**	*
	ʃi ʃe		*!	*	**	**	*
	ʃi	(see below)			******	**	*

The last candidate [ʃi], with multiple mergers, is excluded either (i) by high-ranking IDENT[VHeight] forestalling any vowel height mergers, or (ii) by another high-ranking self-conjoined NOMERGE constraint (see Padgett 2003), or (iii) by NOMERGE ranking above PAL/i,e.

As seen above in (29), the older pre-Edo system with [ʃi,ʃe] ranks CONTRAST>i,e below the palatalization constraint. The overall ranking is given in (36), followed by a tableau in (37).

(36) Pre-Edo ranking with *i/e*-palatalization:



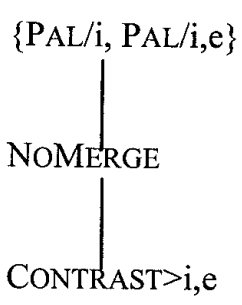
(37)

Input:	si ʃi se ʃe	PAL/i	PAL/i,e	NOMERGE	CONTRAST >i/e	IDENT (ant)	*[–ant]
	si ʃi se ʃe	*	*!*		**		**
	ʃi se ʃe		*!	*	*	*	**
▶	ʃi ʃe			**	*	**	**
	si se	*	*!*	**	*	**	
	ʃi se		*!	**		**	*
	si ʃe	*!	*	**		**	*
	ʃi			******!		**	*

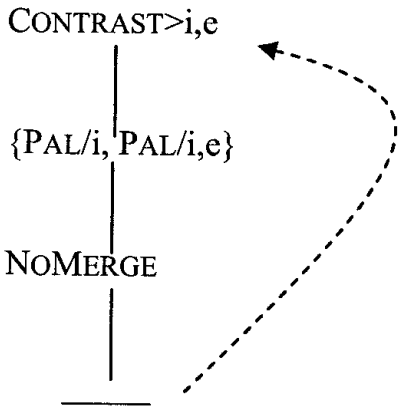
In (38), we illustrate graphically the ranking changes that took place between the pre-Edo and the Modern system.

(38) Historical reranking for the sibilant system:

a. Pre-Edo system:



b. Modern system:



This analysis carries over straightforwardly to other consonants, where palatalization before [i] makes the additional distinction: [kʲi] vs. [ke], etc. For the glide-vowel restriction discussed above in (17), historical evidence shows that syllable-initial /e/ was systematically pronounced [je], which in later development lost its onset.[10] The same strategy of reranking the systemic constraint above the markedness constraint, in this case ONSET, provides the basic account with some further details, which is beyond the scope of this paper.

5 Conclusion: comparison with alternatives

Before concluding, we here consider two alternative accounts of depalatalization that have been pursued in earlier work. First, there is the Neogrammarian (strictly phonetic, non-systemic) conditioning pursued in Wenck 1954, who hypothesizes that dialects where [e] is also a palatalizer have (or had) a higher, more tense, allophone of the mid front vowel. Even though there is little direct evidence for the conjecture, the idea is functionally plausible as a pull-chain scenario for Tohoku dialects, where the two high vowels [i] and [u] have collapsed into a single central vowel, and therefore the mid vowel [e] could raise without merging. On the other hand, while a lower tongue position of [e] could explain the lack/loss of palatalization before [e] in the mainstream dialects, this does not seem to help with depalatalization. As pointed out in section 2, the palatal segments, [tʃ], [ʃ], [dʒ] and [j] exist independently before the back vowels

[10] A simple illustration is the name of the Japanese unit of currency 円 *en* rendered as [jen] in western languages, obviously in imitation of the historical pronunciation.

[a, o, u], so it remains a mystery why they would cease to occur before [e], among all vowels, just because it has a lower (lax) realization. The upshot is that something else is needed to explain depalatalization, independent of the hypothesized higher/lower tongue position.

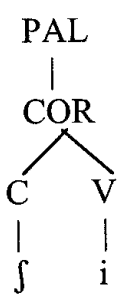
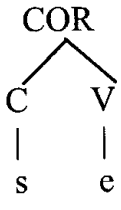
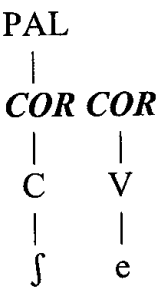
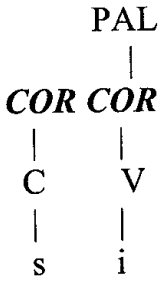
A very different kind of alternative is represented by the OCP-based account in Ito and Mester 1995a, b along feature-geometric lines (see also (24)–(26), above), where certain CV sequences violate a constraint on representations. By treating front vowels as COR (see Clements and Hume 1995 for an overview of this kind of approach to consonant-vowel interactions, and Flemming 1995 and Ní Chiosáin and Padgett 2001 for further discussion), and using PAL to distinguish mid and high vowels, palatal consonants (ʃ, tʃ, dʒ, j, etc.) and the high front vowel [i] have in relevant respects the same feature geometry, as do the nonpalatal coronal consonants (s, t, d, etc.) and the mid front vowel [e]. This is schematically illustrated in (39).

(39) Feature geometry of coronal/palatal consonants and front vowels:

PAL | [i] = COR | V	PAL | [ʃ] = COR | C	[e] = COR | V	[s] = COR | C

In CV combinations, the OCP requirement forces the fusion of the identically- structured COR and PAL nodes for [ʃi] (40)a and [se] (40)b. For *[ʃe] (40)c and *[si] (40)d, however, the nodes cannot fuse (since they are not identical), and an OCP violation ensues for both cases.

(40) OCP violations for *si and *ʃe

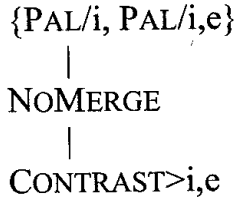
a. [ʃi]	b. [se]	c. *[ʃe]	d. *[si]
			
		*OCP (*COR COR*)	*OCP (*COR COR*)

The fundamental problem with this kind of approach, which we have already touched upon earlier in section 4, is that cross-linguistically, palatalization before mid front vowels is not at all uncommon, and is found even in Japanese dialects and was a standard feature of earlier stages of the language. In light of this, it seems ill-advised to depend on a theory where an assimilated sequence such as [ʃe] violates a putative universal representational constraint, as in (40)c.

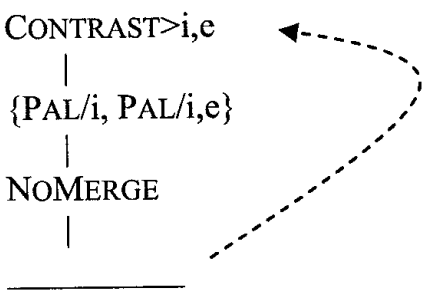
The problem disappears when we stop looking at [ʃe] in isolation—there is little wrong with it in isolation. Rather, the overall system of contrasts can be improved by avoiding [ʃe]. This explanation is still based on universal principles, but it requires systemic constraints. While many details remain to be settled, the contrast-based approach allows for a simple and unified explanation for the changes in the sibilant system in the history of Japanese.

(41)

Old system:



New system:



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