

## Stem and word in Sino-Japanese

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### 1. Introduction

During much of the recorded history of Japanese up to and including the modern language, a particular type of compound known as *kango* has made up a significant portion of the overall lexicon (see Shibatani 1990, 142-147 and work cited there). Kango are formed out of Sino-Japanese stems (or roots) and supply the vocabulary essential for all kinds of formal discourse (in recent times supplemented— but not replaced—by Western loans). They are the cumulative result of three distinct waves of intensive borrowing from Chinese,<sup>1</sup> each of which approximately reflects the contemporary pronunciation of the then-dominant dialect of Chinese.<sup>2</sup> Within modern Japanese, their role is comparable to that of the Latinate/Romance vocabulary borrowed into English since the Norman conquest. This paper develops an analysis of the segmental and prosodic characteristics of these SJ compounds and of the stems out of which they are built. In spite of their long history as part of the Japanese lexicon, SJ stems still constitute a stratum of their own, from the point of view of a synchronic linguistic analysis, unmistakably set apart from other lexical strata by several formal characteristics. In a general sense, this kind of stratal organization has been recognized in all serious work on the topic since Martin's and McCawley's classical studies (see Martin 1952 & McCawley 1968). In the constraint-based model of the lexicon developed in Itô and Mester 1995, lexical strata emerge as areas where the domains of a number of constraints intersect. The present paper is an attempt to flesh out the general model by means of a detailed case study of the Sino-Japanese stratum within the lexicon of Japanese.

Besides the combinatorial fact that many SJ stems only occur compounded with other elements of their class, and not in isolation or compounded with items from the rest of the lexicon, they have unique morpheme-structural and morphophonemic characteristics: They obey rigid templatic constraints unknown to the rest of the lexicon, and their compounding is associated with a special segmental phonology and prosodic morphology which give rise to very systematic alternations. The most salient of the latter is a process of contraction applying almost without exceptions within its lexical domain. We

will see that the attempt to develop a phonological understanding of contraction, leads immediately into several questions of current interest in segmental and prosodic phonology.

The specific properties that set SJ stems apart from the rest of the Japanese lexicon are: (i) a prosodic size limit on SJ stems (maximally two morae), (ii) the predictability of  $V_2$  in  $C_1V_1C_2V_2$  stems, and (iii) a radical neutralization of consonantal features in  $C_2$  position. From a historical perspective, all three properties are rooted in the canonically monosyllabic shape of the Chinese source words, and in the nativization strategies at work in Old Japanese and in the subsequent history of the language. Within the synchronic grammar, they have the status of constraints characterizing Sino-Japanese as a lexical class separate from the others (Yamato, Mimetic, and Foreign). We will show that with a proper understanding of the prosodic structure involved, and of the optimization principles governing them (Prince and Smolensky 1993, McCarthy and Prince 1993a,b), the characteristics of contraction require no direct reference to morphological (or syntactic) structure, but are the result of general alignment principles governing the mapping between morphosyntactic structure and phonological structure. The strictly segmental properties of SJ stems and SJ contraction are interesting in their own right, raising central questions regarding the interface between melodic and prosodic structures, in particular, the relative roles of root (segment) fusion vs. spreading, as well as issues in positional underspecification, neutralization, and privativity.

## 2. The facts of contraction

We begin with the segmental conditions governing the possibility of contraction in SJ compounds. The SJ stems undergoing contraction have the form  $/C_1VC_2(V)/$ , with an obstruent as their second consonant, as illustrated by *bet(u)* 'different, separate' in (1). In contemporary Japanese, there are only two obstruents that can appear in  $C_2$  position:  $/t/$  and  $/k/$ . We will call the corresponding classes of stems *t*-stems and *k*-stems. The final vowel, which alternates with zero, is given in parentheses. The question regarding its proper analysis will be taken up later, when we will argue, building on earlier work (Martin 1952, Itô 1986, Tateishi 1990) that this vowel is not an underlying segment.

The behavior of *t*-stems is illustrated in (1) and (2). (1) shows that contraction takes place with any following voiceless obstruent (1)a, but with no other segment type (1)b.<sup>3</sup>

(1) /bet(u)/ 'different'

a. Contraction with following voiceless obstruent:

[-son, -voi]	bek-kaku	'different style'
	bet-taku	'detached villa'
	bes-soo	'separate mail, separate shipment'
	bep-pai	'farewell cup, farewell dinner' (→ /hai/)

b. No contraction with other segments:

[-son, +voi]	betu-biN	'separate carrier'
	betu-daN	'particular(ly)'
	betu-goo	'separate issue'
	betu-ziN	'different person'
nasal	betu-noo	'separate payment'
	betu-meI	'another name'
liquid	betu-ri	'separation'
glide	betu-waku	'separate scale'
	betu-yaku	'different translation'
vowel	betu-eN	'farewell dinner'
	betu-i	'different opinion'

The *t*-stem /niti/ 'sun' in (2) shows parallel behavior. In order to illustrate the productivity of the process (within its lexical stratum), we are here listing compounds which denote relations between Japan (*ni-hoN* or *nip-poN*, with the first element /niti/ 'sun') and other countries. Thus *nit-tyuu* abbreviates *nip(-pon)-tyuu(-goku)*<sup>4</sup> and denotes the relations between Japan and the Peoples' Republic of China.

(2) /nit(i)/ 'sun'

a. Contraction with following voiceless obstruent:

[-son, -voi]	nip-pi	'Japan and the Philippines'
	nit-tyuu	'... and the People's Republic of China'
	nis-si	'... and China'
	nis-so	'... and the Soviet Union'
	nik-kaN	'... and Korea'

## b. No contraction with other segments:

[-son, +voi]	niti-bei	' ...	and America'
	niti-doku	' ...	and Germany'
	niti-goo	' ...	and Australia'
nasal	niti-maN	' ...	and Manchuria'
	niti-raN	' ...	and Holland'
liquid	niti-iN	' ...	and India'
vowel	niti-i	' ...	and Italy'
	niti-ei	' ...	and England'

The contraction possibilities for the remaining class of consonantal SJ stems are much more restricted. These stems have /k/ as their second consonant, and the basic generalization is that *k*-stems show contraction only if the following stem begins with /k/. This can be seen in (3) below for /gak(u)/ 'learning' and in (4) for /sek(i)/ 'stone'.

## (3) /gak(u)/ 'study, learning'

## a. Contraction with following /k/:

/k/	gak-kai	'learned society'
	gak-ku	'school district'
	gak-koo	'school'
	gak-kei	'my learned friend'
	gak-ki	'academic term, semester'

## b. No contraction with other segments:

[-son, -voi] (≠ /k/)	gaku-hi	'educational expenses'
	gaku-ha	'sect'
	gaku-sai	'scholastic ability'
[-son, +voi]	gaku-tyoo	'college president, rector'
	gaku-gai	'off-campus'
	gaku-doo	'school boy'
nasal	gaku-batu	'academic clique'
	gaku-neN	'school year'
	gaku-moN	'learning'
liquid glide	gaku-reki	'academic background'
	gaku-wari	'student rate'
vowel	gaku-yuu	'school friend'
	gaku-i	'academic degree'

- (4) /sek(i)/ 'stone'
- a. Contraction with following /k/:
- |     |         |                           |
|-----|---------|---------------------------|
| /k/ | sek-ka  | 'petrification'           |
|     | sek-kai | 'stone-ashes'; 'lime'     |
|     | sek-keN | 'stone-wash'; 'soap'      |
|     | sek-koo | 'stonemason, stonecutter' |
- b. No contraction with other segments:
- |              |           |                          |
|--------------|-----------|--------------------------|
| [-son, -voi] | seki-hitu | 'slate pencil'           |
| (≠ /k/)      | seki-tei  | 'rock garden'            |
|              | seki-syoo | 'stonemason'             |
| [-son, +voi] | seki-butu | 'stone Buddha'           |
|              | seki-zyuN | 'stalagmite'             |
| nasal        | seki-moN  | 'stone gate'             |
| liquid       | seki-roo  | 'paraffin'               |
| glide        | seki-yu   | 'stone-oil', 'petroleum' |
| vowel        | seki-eN   | 'rock salt'              |

These are the basic facts about the segmental characteristics of contraction. The first task is to develop an analysis of these phenomena that not only accounts for the facts, but also fits into the context of Japanese phonology as a whole. The second aspect of the contraction phenomenon, which will occupy us in the second part of the paper, is the existence of higher-order morphological and prosodic restrictions on the process. The relevance of such restrictions was already recognized in the earliest work on Sino-Japanese phonology in modern linguistics (Martin 1952 and McCawley 1968). The basic observation is the following: Even if the righthand context meets all the segmental requirements for contraction, i.e., even if the following segment is of the right type, this is not a sufficient condition for contraction to take place (even though it is a necessary condition). Whether or not contraction in fact takes place depends on the overall constituent of the word.

In terms of the analytical tasks to be dealt with, then, any treatment of Sino-Japanese phonology must confront the following issues: (i) the formal analysis of the vowel~zero alternation, (ii) the local segmental context of contraction, (iii) the different behavior of /k/ and /t/ as stem-final obstruents in Sino-Japanese stems, and (iv) the morphological/prosodic macro-context. The following sections will address each of these issues, developing the analysis along the way.

### 3. Segmental constraints on contraction

A superficial glance at the vowel-zero alternations exhibited by the SJ /CV<sub>1</sub>CV<sub>2</sub>/ stems in the previous section might have left the impression that what is involved here must be syncope, and not epenthesis. Both /i/ and /u/ alternate with zero, and how could an epenthesis rule know which vowel to insert in each case? However, previous research has collected a significant group of arguments all converging on the conclusion that the vowel-zero alternation must in fact be a case of epenthesis, and not of syncope.

First, even a syncope analysis must somehow take note of the curious distributional gap exhibited by /CV<sub>1</sub>CV<sub>2</sub>/ stems: The majority of vowels (namely, /a,e,o/) are excluded in V<sub>2</sub> position, only the high vowels /i,u/ are permitted. This restriction needs to find some expression in the grammar; and while a syncope analysis would be compatible with various accounts, it does not contribute towards an explanation.

A strong argument against syncope can be found in the behavior of SJ *k*-stems. As previous analysts (Itô 1986, Tateishi 1990) have noted, a syncope rule requires an unusual phonological context, applying exclusively to the sequence *kVk* (/gaku+koo/ → *gakkoo* 'school', etc.). This kind of behavior would be somewhat peculiar in light of the antigemination effect of the OCP discussed in McCarthy (1986), where it is shown that syncope rules are usually blocked, and in any case never favored, in contexts where their application would bring two identical consonants into adjacency, in violation of the OCP. The SJ rule in question, if it was a genuine case of syncope, would appear to obey exactly the opposite kind of conditioning — it would apply only to vowels flanked by identical consonants. It would thus not just be a violation of the OCP; rather, it would require an anti-OCP context, raising the suspicion that something fundamental has been missed in the analysis.<sup>5</sup>

Based on this kind of argumentation, Itô (1986) and Tateishi (1990) present a syllable-based analysis treating the alternations as cases of epenthesis. The hypothesis is that the underlying forms of these stems do not contain final vowels. Since there are TWO different vowels /i/ and /u/, the analysis must provide a means to indicate which one to choose. This is not an insurmountable problem: In the worst possible case, the melodic information would have to be underlyingly present. Since the vocalic melodeme is predictably [+high], this leaves backness as the only property requiring lexical specification. (Itô 1986 marks backness on the C<sub>2</sub> consonant). But a better analysis is at hand: As we will see below, it turns out (Tateishi 1990) that even the backness of the final vowel is almost entirely predictable. A simple analysis can therefore be

maintained in which the forms WITH final vowels in the above paradigms are considered to have undergone epenthesis.

### 3.1 Morpheme structure of stems.

There are two large-scale generalizations to be captured in this area: First, no SJ stem can be longer than two moras (monomoraic stems are not at all exceptional in this class). The historical reason for this restriction is quite obvious, given the fact that the sources of these loans were all Chinese monosyllables. We can formulate the constraint as a prosodic limit imposed on SJ stems (5), where the 'amount' notation  $|x|$  is used to refer to the prosodic size of an element  $x$ . The upper limit for SJ stems is two moras, which corresponds to the bimoraic foot that has been shown to play a central role in Japanese morphology and phonology (see Poser 1990, Itô 1990, Mester 1990, Haraguchi (this volume), and related work). For reasons that we will briefly return to later, this prosodic limit must in fact be stated in terms of "foot" and not directly in terms of moras.

(5) Prosodic stem limit:  $|Stem_{SJ}| \leq F (= 2\mu)$

In addition to this prosodic limitation, the segmental composition of these stems is highly restricted, as shown in (6) and (7).

(6) a. / <b>(C)V</b> /	b. / <b>(C)VV</b> / <sup>6</sup>	c. / <b>(C)VN</b> /
ka 'dept'	bee 'rice'	koN 'this'
i 'stomach'	kyoo 'capital'	keN 'prefecture'
gu 'material'	fuu 'wind'	kaN 'complete'
ke 'house'	dai 'big'	kiN 'money'
ko 'old'	sui 'water'	guN 'county'

#### (7) /**(C)VCV**/ stems

a. / <b>CVt(u)</b> /	b. / <b>CVt(i)</b> /	c. / <b>Cvk(u)</b> /	d. / <b>Cvk(i)</b> /
atu 'press'	hati 'eight'	tyaku 'arrival'	teki 'enemy'
betu 'different'	kiti 'good luck'	iku 'be raised'	riki 'power'
hitu 'writing'		huku 'luck'	
butu 'thing'		hoku 'north'	
sotu 'graduate'			

Focussing on the bisyllabic forms in (7), the object of our study, the empirical generalization in (8) is immediately apparent.

(8) **Segmental composition:**

$$/ C_1 V_1 C_2 V_2 /$$

$$\left. \begin{array}{c} | \\ \{ t \} \\ | \\ \{ k \} \end{array} \right\} \left. \begin{array}{c} | \\ \{ u \} \\ | \\ \{ i \} \end{array} \right\}$$

$C_2$  is always a voiceless stop (/t,k/) and  $V_2$  is always a high vowel (/i,u/).

It turns out, however, that the morpheme structural redundancies extend still further: Not only is  $V_2$  always high, its backness is also almost totally predictable from other properties of the form. The relevant generalizations are due to the study of Martin (1952), with recent refinements in Tateishi (1990). The situation is summarized in (9). For the *t*-stems, /u/ is overwhelmingly favored as  $V_2$ , occurring after all  $V_1$  vowels. *t*-stems with final /i/ are very rare. In terms of vowel patterns, the only case with the vowel pattern /a-i/ is the number word *hati* 'eight'; The vowel pattern /i-i/ is found in two number words (*iti* 'one', *siti* 'seven') and in two other examples (*niti* 'sun' and *kiti* 'good luck'). The *k*-stems show something resembling a harmony pattern, as Tateishi (1990) has recognized: After back vowels in  $V_1$ -position only /u/ is found (*tyaku*, *huku*, *hoku*); after front vowels in  $V_1$ -position, we find /i/—as the only option when  $V_1 = /e/$  (e.g. *seki* 'stone'), and as an option alongside /u/ when  $V_1 = /i/$ . The only environment where a contrast between /i/ and /u/ is found in  $V_2$ -position is with /i/ as  $V_1$ , e.g., *siki* 'ceremony' vs. *ziku* 'axle'; *tiku* 'accumulate' vs. *riki* 'power'. The upshot of these observations is, then, that (i)  $V_2$  in SJ stems is always a high vowel whose quality is highly predictable, a genuine exception occurs only in a single very restricted environment. (ii) The unmarked colour of the high  $V_2$  vowel is [+back], i.e., /u/, arguably the unmarked vowel of the Sino-Japanese and Foreign lexical stratum (markedly different from the native stratum, where /i/ is the prime candidate, see Poser 1984). The bulk of the /i/-cases arise through harmony, with [-back] harmony holding either uniformly or as a lexical option.



(9) Cooccurrence table for  $V_2$  (based on Martin 1952 and Tateishi 1990).

	$C_2 = /t/$	$C_2 = /k/$
$V_1 = a$	$V_2 = u$ (i)	$V_2 = u$
$V_1 = o$	$V_2 = u$	$V_2 = u$
$V_1 = u$	$V_2 = u$	$V_2 = u$
$V_1 = e$	$V_2 = u$	$V_2 = i$
$V_1 = i$	$V_2 = u$ (i)	$V_2 = u/i$

Examples:	
atu	gaku
sotu	hoku
butu	huku
betu	teki
hitu	iku/riki

"u (i)" = very few occurrences of *i* as  $V_2$ , exceptional formation

"u / i" = genuine contrast between *u* and *i* as  $V_2$

Turning to the analysis, the almost total predicability of  $v_2$  in SJ stems of the form CVCV implies, quite independent of the contraction phenomenon, that specifying this vowel in underlying representations is redundant and misses a major generalization. Following the works cited earlier, we hypothesize that  $v_2$  is underlyingly absent in most cases, and posit /bet/, /gak/, etc., as underlying representations. Vowel insertion is prosodic epenthesis triggered by an unlicensed obstruent codas (Itô 1986, Tateishi 1990); such lack of licensing will always trigger epenthesis word-finally. The default vowel in SJ is /u/. It is epenthesized whenever contraction cannot take place, to make forms like /bet/ syllabifiable, resulting in the output form [bet̃su]. *k*-stems show an additional spreading option to fill the epenthesized vocalic mora: The backness feature of front vowels /i, e/ as  $v_1$  can (for /i/) or must (for /e/) spread to  $v_2$ . This option is not available for *t*-stems. Exceptional cases (like *hati* 'eight') can be accommodated by assigning them a floating vocalic melodeme. It is a significant fact that a number of melodically exceptional forms are also exceptions to contraction: They always keep their final vowel. In such cases (mainly forms ending in ...*ki*, like *geki* 'drama', cf. *geki-ka* dramatization, \**gekka*), the straightforward analysis is to fully specify the final vowel. This is in fact tantamount to regarding such forms as not SJ (in their synchronic lexical classification), as far as contraction is concerned.

## 3.2 Contraction as root fusion

We now turn to the question of the local segmental context of contraction, and the phonological mechanism responsible for contraction. Here another phonological property of SJ stems enters the picture: Sino-Japanese stems are subject to syllabic closure, in the sense that there is never any resyllabification across stem boundaries. This could in part be viewed as an effect of cyclic syllabification, but such a view has various problems: For example, since they are properly to be regarded as ROOTS (i.e., minimal stems), Sino-Japanese morphemes do not constitute cyclic domains in standard Lexical Phonology (see Brame 1974, Kiparsky 1982, and Inkelas 1989 for discussion and argumentation). A superior conception of stem closure is to be found in alignment constraints of the kind explored in Optimality Theory by Prince and Smolensky (1993) and McCarthy and Prince (1993b).

Stem closure reveals itself in Sino-Japanese compounds in the fact that empty onsets remain unfilled even if the preceding stem ends in a nasal.<sup>7</sup> The resulting C.V transition persists in the output form, as the examples in (10) show (there is no systematic insertion of a default phonetic onset filler, laryngeal ([ʔ]) or other).

(10) Stem closure effects:

.siN.-aN.	*.si.n-aN.	*.sin.n-aN.	'new plan'
.kaN.-i.	*.ka.n-i.	*.kan.n-i.	'simplicity'
.hoN.-ei.	*.ho.n-ei.	*.hon.n-ei.	'headquarters'

Other forms of this kind from (1) are repeated in (11).

(11) .be.tu.-eN.	*.be.t-eN.	'farewell dinner'
.ga.ku.-i.	*.ga.k-i.	'academic degree'

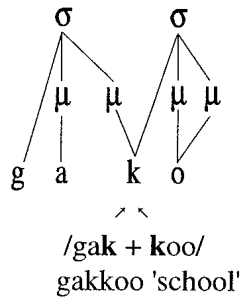
If we take syllabic closure seriously, it should hold in both directions: Not only from coda to onset (i.e.: "no resyllabification or spreading from coda to onset"), but also from onset to coda (i.e.: "no spreading or resyllabification from onset to coda"). Both are implied by the intuitive statement "Syllabification cannot cross Sino-Japanese morpheme boundaries"; within Optimality Theory, such effects are enforced through Alignment constraints, see McCarthy & Prince 1993b and Itô & Mester 1995 for discussion and theoretical development. Leaving the analysis at an intuitive level, we will here

simply appeal to a closure condition outlawing any direct spreading from the onset position to fill a coda mora (such spreading being nothing else but the establishment of a new syllabic relation).

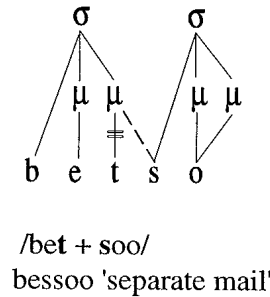
But this is exactly what the standard analysis of the contraction of *t*-stems amounts to, which takes this to be a case of segmental root spreading, as in (12)b, where the onset /s/ spreads to the coda of the preceding syllable. Thus in the analysis of Ito 1986, further developed in Tateishi 1990, Cho 1989, and Padgett 1991, SPREADING for *t*-stems contrasts with (OCP-related) FUSION (McCarthy 1986) for *k*-stems, as schematically indicated in (12)a.<sup>8</sup>

(12) The standard approach:

a. **Fusion** for *k*-stems:



b. **Spreading** for *t*-stems:



Ideally, the contraction behavior of *t*-stems (contraction with all voiceless obstruents) and of *k*-stems (contraction with *k*-initial stems only) should result from the same mechanism— all differences should follow from the fact that /k/ has a different representation from /t/ (in fact, has more specifications). But in the hybrid analysis sketched in (12), this representational difference is accompanied by an additional difference in operations: The contraction of *k*-stems is derived by FUSION of the final /k/ with an identical segment at the beginning of the second stem. On the other hand, for the *t*-final cases, the analysis appeals to a rule of melody spread (to an unspecified slot, if [t] is the default value.) This is of course in principle a tolerable situation, but duplication of differences raises the suspicion that the analysis contains redundancy.

Besides the problem of duplication, there is another argument against an analysis invoking root spreading for *t*-stems: Within the overall system of Japanese phonology, genuine cases of root node spreading have entirely different properties from what we find in the contraction with *t*-stems in Sino-Japanese compounds. And we take it that, *ceteris paribus*, the superior analysis is the one that does not multiply differences between lexical strata beyond

necessity, thus responding to the intuition that a language like Japanese is after all a single language with a single phonology, and not an assembly of essentially unconnected phonologies (see Itô & Mester 1995).

Particularly telling is the totally different behavior in Yamato (native) verbal root compounding illustrated in (13).<sup>9</sup> Here the first root (which adds a meaning element of 'intense action' to the compound) ends underlyingly with a consonant.

(13) Yamato (native) verbal root compounding (Martin 1952, Poser 1984)

a.			/but-/	'strike'
	toos-u	'pass'	but-toos-u	'continue non-stop'
	kir-u	'cut'	buk-kir-u	'hack'
	koros-u	'kill'	buk-koros-u	'kill violently'
	hanas-u	'let go'	bup-panas-u	'fire (a bullet)'
	nagur-u	'beat'	<b>bun-nagur-u</b>	'beat forcefully'
	tor-u	'take'	<b>bun-dor-u</b>	'rob'
b.			/tuk-/	'thrust'
	kakar-u	'start'	tuk-kakar-u	'plunge'
	har-u	'tighten'	<b>tup-par-u</b>	'stretch'
	hasir-u	'run'	<b>tup-pasir-u</b>	'run without break'
	nomer-u	'slant'	<b>tun-nomer-u</b>	'fall forward'
c.			/hik-/	'pull'
	kak-u	'scratch'	hik-kak-u	'scratch violently'
	har-u	'tighten'	<b>hip-par-u</b>	'pull, jerk'
	sak-u	'tear'	his-sak-u	'tear apart forcefully'
	muk-u	'peal'	<b>him-muk-u</b>	'peal off violently'
d.			/nor-/	'embark'
	tor-u	'take'	<b>not-toru</b>	'usurp'

The resolution of the cluster takes place in ways that are superficially quite similar to SJ contraction: For example, in the second form in (13)a, we get *buk-kiru* 'hack'. But upon closer inspection, fundamental differences show up. The following two are the most important: (i) In Yamato root compounding, sonorants spread onto obstruent positions, resulting in geminate sonorants (cf. (13)a) /but-naguru/ → *bun-nagur-u* 'beat forcefully'). This never happens in SJ

compounds (cf. (1) /bet-noo/ → *betu-noo* 'separate payment', never *\*ben-noo*). The last forms in (13)b and (13)c show gemination of sonorants in cases where the preceding verbal root ends in *k*: /tuk-nomeru/ → *tun-nomer-u* 'fall forward' and /hik-muku/ → *him-muk-u* 'peel off violently'. This leads to the second point (ii): Verb-root-final /k/ triggers gemination of any following [+cons] segment, not just of /k/. ( Cf. /hik-/ 'pull' in (13)c: /hik-haru/ → *hip-par-u* 'pull, jerk', /hik-saku/ → *his-sak-u* 'tear apart forcefully'.) Again this should be contrasted with the SJ forms in (3) above, where no contraction is observed in such cases (e.g., /gak-hi/ → *gaku-hi*, *\*gappi*, /gak-sai/ → *gaku-sai*, *\*gas-sai*, etc.).

A different way of looking at the differences between the gemination behavior manifested in Yamato verbal compounding and the contraction observed in Sino-Japanese consists in asking which properties of the first of the two consonants, if any, are preserved in the output. Here we observe that SJ stem-final obstruents (k,t) are always recoverable, as far as their root specifications are concerned: Their root (node) specifications never go away because we find contraction only with following obstruents, never with sonorants. For example, we never find contraction with nasals, which would lead to a [+sonorant] root. This kind of persistence of obstruent characteristics is quite different from the effects of gemination by spreading in (13), where all characteristics of the underlying segment are obliterated since any [+cons] root in the onset can spread to an obstruent position in the preceding syllable. These characteristic properties of SJ contraction, i.e., its restricted character and root-feature-preserving behavior, follow rather naturally if we conceive of SJ-contraction as FUSION of segments, and not as SPREADING. Recall that for *k*-stems, this is the only viable analysis in any case. The guiding idea, then, instead of multiplying operations, is to generalize FUSION beyond the special case of *k*-stems. Our general proposal is that fusion takes place not under feature IDENTITY but under feature COMPATIBILITY. At this point, the feature specifications of the stem-final obstruents become crucially important. We will see in the following section that the key ingredient of the analysis is underspecification of stem-final CORONAL, which directly implies the observed differences between /k/ and /t/.

### 3.3 Stem-final neutralization

Beyond the predictability of the final vowel, the choice of SJ stem-final obstruents is highly restricted: If it is not /k/, it must be /t/. This means that in SJ stem-final position, obstruent root nodes must be featurally specified so as

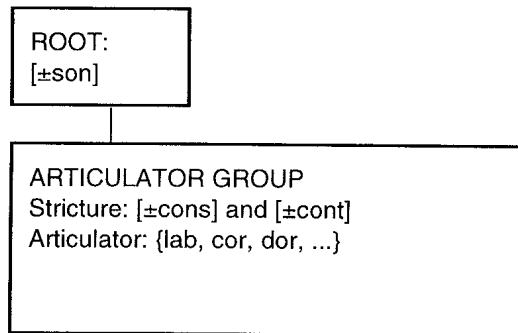
to distinguish them from stems ending with the nasal glide, or moraic nasal: The moraic nasal is indicated with a capital N (e.g. the two nasals in (10) *.siN.aN.*). In order to minimally distinguish the two obstruents /t/ and /k/, the analysis must capture the vast neutralization of contrasts in this position (unlike the stem-initial position). Stem-finally, there is good reason to assume that /k/ is specified as Dorsal, whereas /t/ is underspecified for place and acts as the default consonant:

- (i) There is considerable crosslinguistic evidence for the choice of Coronal as the default place (see Paradis and Prunet 1991, and references cited there).
- (ii) There is language-specific evidence in the fate of *p*-stems, which originally existed alongside *t*- and *k*-stems. In the course of the general weakening of this consonant in Japanese, such stems lost the labial consonant, and those that still show contraction behave partially like *t*-stems.<sup>10</sup> This makes sense under the assumption that /t/, and not /k/, is the default obstruent in stem-final position.
- (iii) /t/ triggers contraction with all voiceless obstruents, /k/ only with following /k/.

Given these assumptions, then, we end up with the following (slightly simplified) representations for SJ stem-final consonants (which make use of the Articulator Group Theory of Padgett 1991, 1994):

(14) Segmental representations and feature-geometric assumptions

a. Head portion:



b. Nonhead portion (root dependent):

Root	Root
[voi]	[nas]

c. Markedness implications:

[nas] ⊃ [+cns]      [nas] ⊃ [-cnt]      [-son] ⊃ [-cnt]      [-son] ⊃ [+cns]

d. SJ nonvocalic finals ("AG" = "Articulator Group", here without dependency structure).

/~t/	/~k/	/~N/
[-son] <sub>Rt</sub>	[-son] <sub>Rt</sub>	[+son] <sub>Rt</sub>
	[+cns	[nas]
	-cnt	
	DOR	
	] <sub>AG</sub>	

#### 4. Analysis and exemplification

The analysis of the segmental aspects of SJ-contraction, with all its pieces in place, is summarized in (15) and more fully illustrated in the subsequent sections.

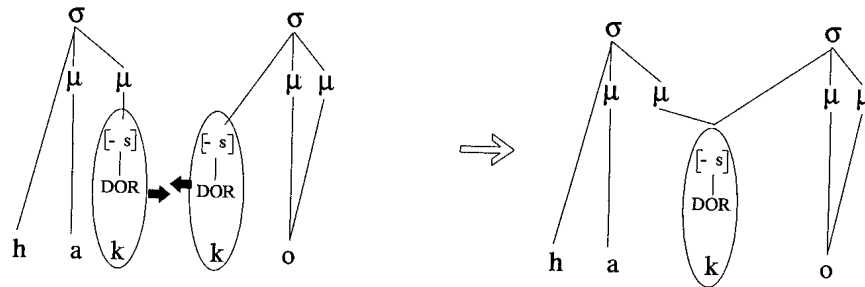
(15) SJ contraction: segmental phonology

- Contraction is **Root fusion**—unification of feature structures:
- fusion is **feature-preserving**: incompatible feature specifications block fusion
- fusion is **structure-preserving**: all previous syllable affiliations (between segment structure and prosodic structure) remain intact.
- **PLACE neutralization** in stem-final position, where a **privative** opposition emerges: velar vs. nonvelar (= coronal, the unmarked place).
- Underspecification analysis: coronals are underlyingly **unspecified** for PLACE in stem-final position.

### 4.1 Root fusion

We first show how fusion of compatible segments takes place, beginning with the familiar identity case with /k/, as in (16).

(16) /hak/ 'white' /koo/ light' → hakkoo

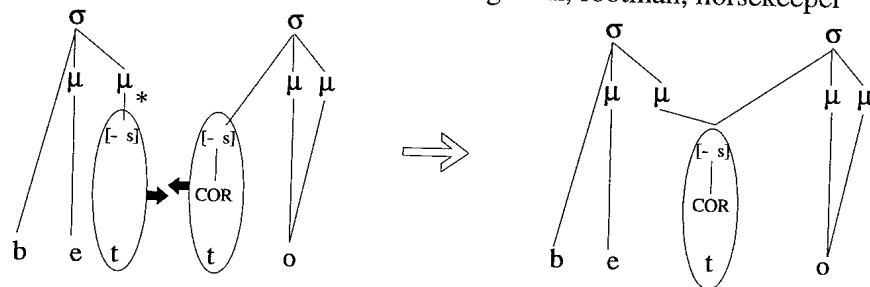


/hak-ki/	hakki	'white flag'
/hak-kiN/	hakkiN	'platinum'
/hak-keN/	hakkeN	'the white keys'
/hak-kot/	hakkotu	'skeleton'

In (16), the obstruent coda /k/ is unlicensed; the segment fuses with the following /k/ of /koo/ under feature compatibility, inheriting all associations. Coda licensing is not an issue in the resulting geminate structure (see Itô 1986, Goldsmith 1990, Itô and Mester 1993, and work cited there).

The case of /t-t/, as in (17), also shows fusion of compatible segments: stem-final /t/ is unspecified for place, whereas stem-initial /t/ is specified as CORONAL. The latter assumption will be seen to be crucial for other cases (see (21) below).

(17) /bet//too/ → bettoo

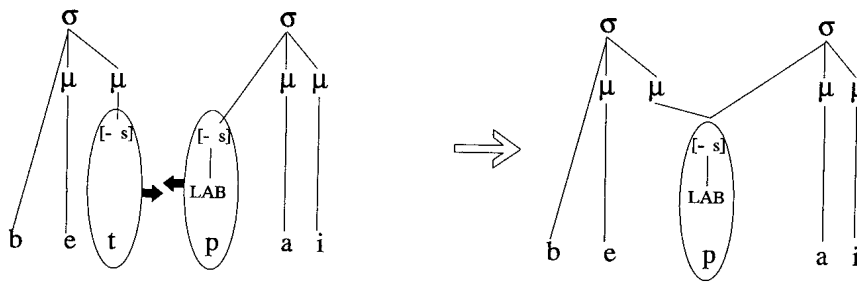




/bet-tak/	bettaku	'detached villa'
/bet-to/	betto	'special reserve (account)'
/bet-tei/	bettei	'villa, summer residence'

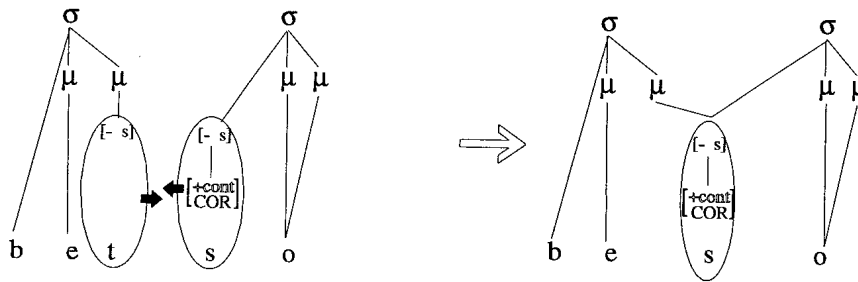
Other cases of fusion under compatibility are illustrated below: In (18), the following consonant is labial, and in (19) it is a coronal fricative.<sup>11</sup> Both are featurewise compatible with the preceding underspecified /t/, and fuse with it.

(18) /bet/ /pai/                    -beppai                    'farewell cup, farewell dinner'



/bet-pa/	beppa	'separate sect'	(ha)
/bet-piN/	beppiN	'a beauty, beautiful woman'	(hiN)
/bet-puu/	beppuu	'letter under separate cover'	(huu)
/bet-poo/	beppoo	'different method'	(hoo)
/bet-pyoo/	beppyoo	'annexed table, schedule'	(hyoo)

(19) /bet/ /soo/                    → bessoo                    'separate mail, separate shipment'



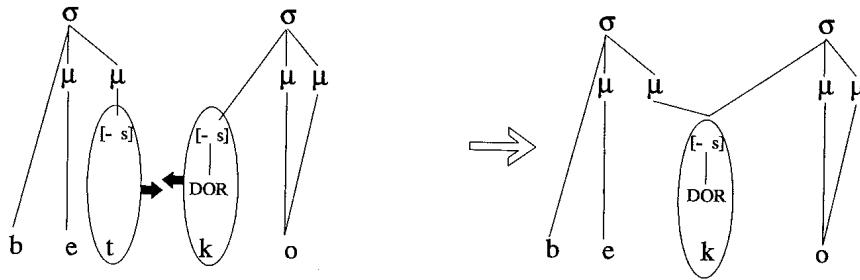
/bet-syoo/	bessyoo	'another name, alias'
/bet-sei/	bessei	'specially made'
/bet-sat/	bessatu	'separate volume'

/bet-sek(i)/	besseki	'special seat'
/bet-si/	bessi	'an attached paper'
/bet-syu/	bessyu	'another kind'

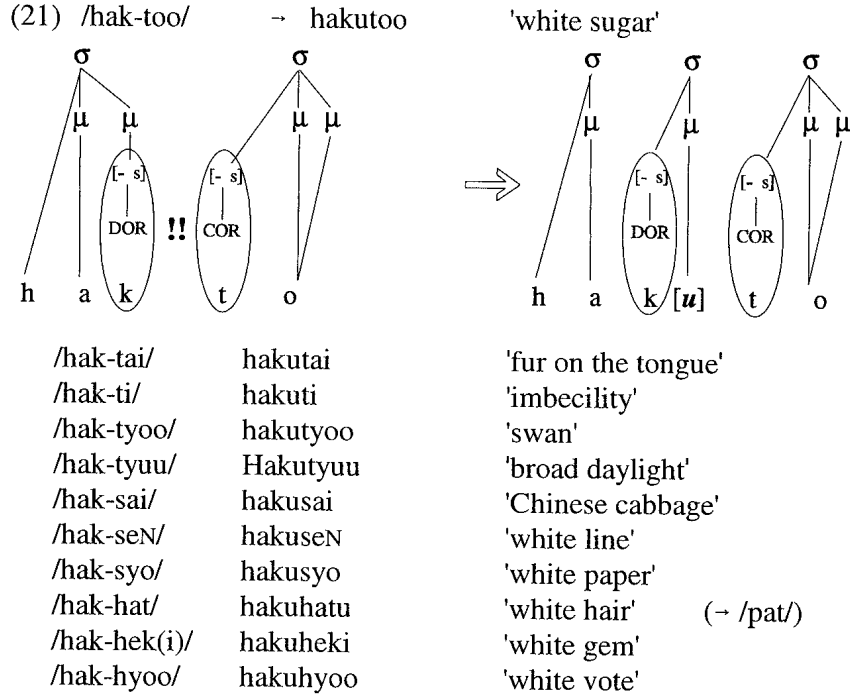
#### 4.2 Coronal asymmetry

The derivations in (20) and (21) show why it is crucial to assume a specificational asymmetry between stem-final and stem-initial position. The /t-k/ in (20) — underlying /bet-koo/ — turns into *bekkoo* 'separate clause'. But the /k-t/ case in (21) — underlying /hak-too/ — does not appear as *\*hakkoo*; fusion does not take place. Instead, we find *haku-too* 'white sugar', with epenthesis of the default vowel default /u/. This follows if final /t/ has no place specification, whereas initial /t/ is specified as CORONAL.

(20) /bet-koo/ → bek-koo 'separate clause'



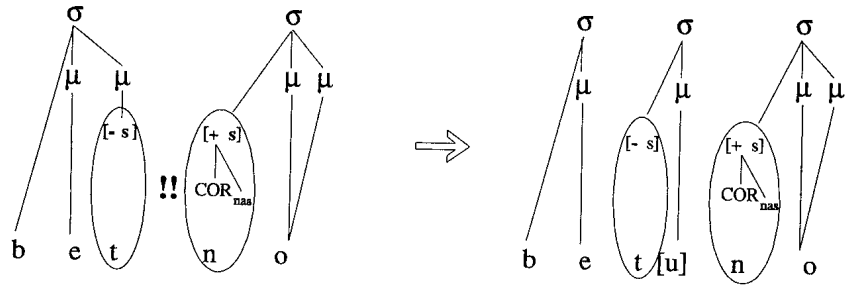
/bet-kak/	bekkaku	'different style'
/bet-ka/	bekka	'special course'
/bet-kaN/	bekkaN	'annex (to a building)'
/bet-ke/	bekke	'branch (cadet) family'
/bet-ki/	bekki	'separate paragraph'
/bet-ko/	bekko	'separate house'
/bet-kyo/	bekkyo	'separation, limited divorce'



To motivate the asymmetry, note that the stem-final position is a position of neutralization, whereas stem-initially, we find the full spectrum of contrasts in terms of place and manner. In particular, PLACE is fully contrastive in this position. We will assume that initial /t, d, s, z, n, r, š, č, j/ have the place specification CORONAL — they do not lack a place. But in stem-final position, the Place contrast is reduced to a binary opposition (CORONAL vs. DORSAL), here construed as a privative opposition, in terms of Contrastive Underspecification (as developed in Steriade 1987 and Mester and Itô 1989). In other words, underspecification is contextual, as in Kiparsky's (1982, 1985, etc.) conception. In stem-final position, where the contrast reduces to a privative one, PLACE has only one value (DORSAL). Absence of place specification gets spelled out as CORONAL, by universal default. Note that the resulting overall picture is not compatible with the tenets of Radical Underspecification, with systematic absence of CORONAL, since it is crucially important for stem-initial obstruents to be specified for this feature.

In (22), we have a case of feature incompatibility making fusion impossible: /bet-noo/ appears as *betu-noo* because the stem-final obstruent is distinct in its root-specifications from the following nasal—[-sonorant] vs. [+sonorant]. So no fusion is possible, and the epenthetic /u/ appears.

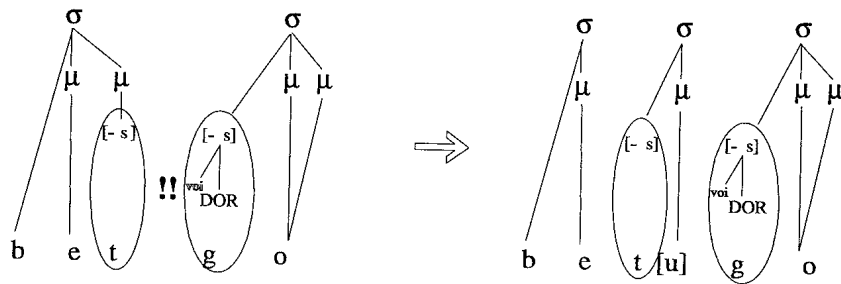
(22) /bet-noo/ → betunoo 'separate payment'



### 4.3 The voicing constraint

Finally, (23) is a case where compatibility holds, but fusion is still impossible. The fused result (*gg*, etc.) would violate a general constraint on Japanese syllable structure, which holds throughout the non-Foreign (i.e. Yamato, SJ, Mimetic) vocabulary: Voiced obstruent geminates like *bb*, *dd*, *gg* are prohibited.<sup>12</sup> We posit an absolute constraint ruling out any configuration in which (distinctive) voicing ends up connected to a coda position.<sup>13</sup> In (23), we see that the final segment of /bet/ is featurewise compatible with the initial voiced obstruent /g/ in /goo/, but the resulting syllabic affiliation of [voi] with coda is illformed, so we find epenthesis instead of fusion: *betu-goo* 'separate issue'.

(23) /bet-goo/ → betugoo 'separate issue'



/bet-biN/	betubiN	'separate carrier'
/bet-daN/	betudaN	'particular(ly)'
/bet-deN/	betudeN	'annex palace'

/bet-gi/	betugi	'other affair'
/bet-ziN/	betuziN	'different person'

#### 4.4 The segment head requirement

We have argued that SJ contraction is the result of fusion, not of spreading (in the sense of root node spreading to a prosodic position). In contrast to root spreading, melody-internal spreading of PLACE is well instantiated in SJ compounds, as examples like (24) make evident. PLACE spreading is called upon when the first stem ends in a nasal, deriving *sam-po* 'stroll', *san-dai* 'dilation', *san-koo* 'diffused light', etc.

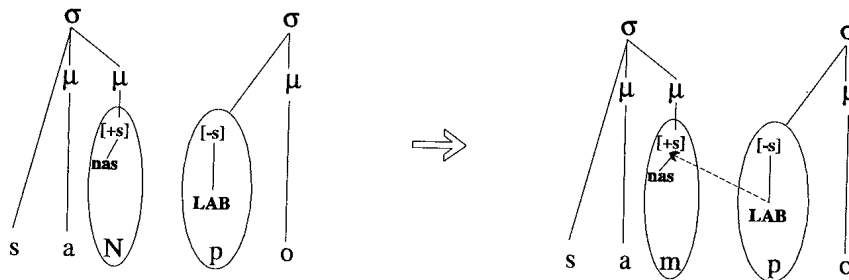
(24) PLACE Spread (≠ Root Spreading)

/saN/	'scatter'
<b>sam-po</b>	'stroll'
<b>sam-ma</b> N	'distracted'
<b>san-dai</b>	'dilation'
<b>san-koo</b>	'diffused light'

/saN-po/

→

sampo 'stroll'



Spreading is here forced by the requirement that segments must be headed, with PLACE being the head of a segment (cf. Itô and Mester 1993, for motivation and justification for this view).<sup>14</sup>

## 5. Prosodic constraints on contraction

### 5.1 Facts and generalizations

The perhaps most interesting restrictions on contraction depend not on the local segmental context, but rather on the overall constituent structure of the word (see Kubozono 1993a, for a comprehensive study of the relation between morphosyntactic constituent structure and prosodic form). The relevant situation arises in complex words—compounds containing further compounds and therefore consisting of three or more SJ stems. McCawley (1968) presents a very careful study of such cases. There are three different configurations to consider, distinguished in (25)a-c. There are two kinds of three-member compounds: the left-branching structure  $[A \ B] \ C$  in (25)a and the right-branching structure  $A \ [B \ C]$  in (25)b. In addition, there is the doubly-branching four-member compound structure  $[A \ B] \ [C \ D]$ , as in (25)c. Still more complex cases can be reduced to these elementary configurations. Contraction environments are indicated by "ˆ", noncontraction environments by "#".

#### (25) Structural constraints on SJ contraction

a. $[B \ C]$	$[A \ B] \ C$
<i>'different seat'</i>	<i>'special (assigned) seat'</i>
bes-seki	*[toku-bes]-seki
*betu-seki	[toku-betu]-seki
<i>'lead-pen'; 'pencil'</i>	<i>'10000-year pen'; 'fountain pen'</i>
em-pitu	*[man-nem]-pitu
*eN-hitu	[man-neN]-hitu
b. $[A \ B]$	$A \ [B \ C]$
<i>'annexed table, schedule'</i>	<i>'separate transcription'</i>
bep-pyoo	*bep-[pyoo-ki]
*betu-hyoo	betu-[hyoo-ki]
<i>'opposite+start'; 'rebel'</i>	<i>'new invention'</i>
ham-patu	*sim-[patu-me]
*haN-hatu	siN-[hatu-me]

c. [B̂ C]		[ÂB] # [ĈD]
'separate building'	bek-kaN	'special building superintendent'
*betu-kaN		*[toku-bek]-[kan-tyoo]
		[toku-betu]-[kan-tyoo]
'separate distribution'	bep-pai	'special delivery'
*betu-hai		*[toku-bep]-[pai-tatu]
		[toku-betu]-[hai-tatu]

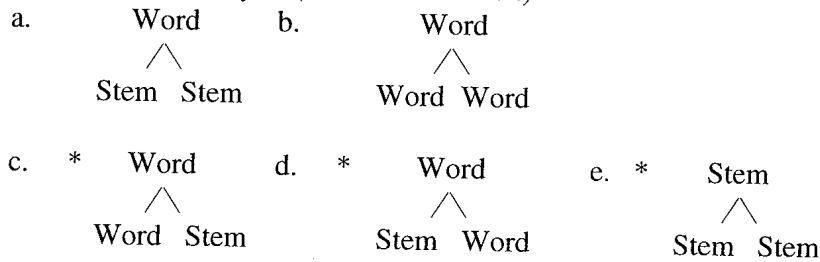
There are two intuitive generalizations here. First, each of the words contained within the whole word is 'frozen' and cannot undergo further contraction: [toku-betu]-seki 'special seat', not \*toku-bes-seki. The obstruent here acts as if it were in absolute word-final position, epenthesis is the only option. And secondly, a preceding/following stem then also acts like a word of its own and is unable to contract: betu-[hyoo-ki] 'separate transcription', not \*bep-pyoo-ki.

Recapturing McCawley's (1968) treatment (which made use of boundary symbols), we distinguish two kinds of word-internal constituents: stems and words. Assuming that A, B, and C are stems, the three-member compounds might be considered to have the structures in (26)a,b and the four-member compound the structure in (26)c.

- (26) a. [wd [wd Â B̂ wd] Ĉ wd] b. [wd Â [wd B̂ Ĉ wd] wd] c. [wd [wd Â B̂ wd] [wd Ĉ D̂ wd] wd]

Given structures like (26), the basic observation is that contraction affects obstruents at the end of a stem provided they are not at the end of a word. One way of rationalizing this is to appeal to an X-bar-theoretic treatment of word structure like that of Selkirk (1982). The idea is that for compounding only the structures in (27)a,b are available, not the structures in (27)c,d,e.

- (27) Morphological analysis (after Selkirk 1982)



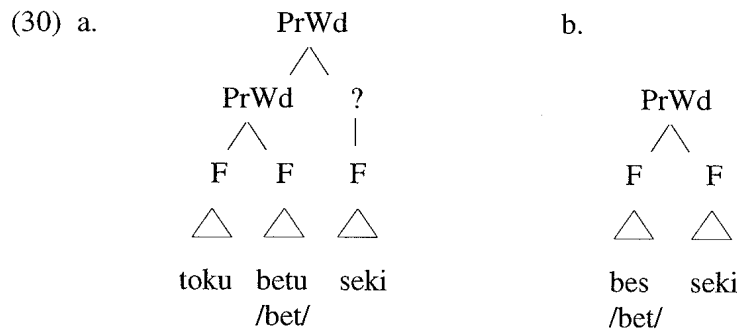
(27) encodes two kinds of combinatorial limitations, which are listed as two separate observations in (28).

- (28) i. Stem closure: "Two stems do not yield another stem" \*(27)e  
 ii. Parallelism: "Stems and words cannot be sisters" \*(27)c,d

## 5.2 Maximal size and homogeneity

Is there a **prosodic** rationale for the combinatorial limitations noted in (28)? First, there is the basic fact that contraction can only happen at the end of a STEM. Why not at the end of a WORD? We could state a specific domain-stipulation, but if we identify WORD with PROSODIC WORD (PrWd), we can get this as a consequence of Prosodic Licensing, which requires full syllabification. Suppose we require prosodic words to be fully licensed — then the basic syllable canon of Japanese will disallow the trigger of contraction, a voiceless obstruent, at the end of any PrWd, an alignment effect on PrWd, in terms of Generalized Alignment (McCarthy & Prince 1993b). This is in harmony with standard assumptions: Everything within a PrWd (and for complex structures, we will assume that this includes every constituent of type PrWd, down to the smallest and most embedded ones) must be prosodically licensed within that domain. This is stated in (29), and exemplified in (30).

(29) All PrWd-domains must be fully prosodically licensed.



For a form like [*toku-betu*]-*seki* 'special (assigned) seat' in (30)a, the first subpart [*toku-betu*] is itself a prosodic word, not merely a F-sized stem (see (5) and (31) below). The result is that already within the lower PrWd-domain the epenthetic vowel /u/ appears after the voiceless obstruent, to secure full



licensing. This obviates (i.e., removes the motivation and the context for) any contraction with the following obstruent /s/ of *seki* on the higher PrWd-domain. In the case of *bes-seki* in (31)b, on the other hand, there is no internal PrWd-domain, so the /t/ can contract with /s/. In this way, we can reduce the question of the "prosodic domain" of contraction to the much more general question regarding the domain on which full prosodic licensing is required: the prosodic word.

The next issue to address is the combinatorics of the stem- and word-categories that were given in (28). In particular, stem closure. Why is a structure like (27)e impossible? Why do two SJ stems immediately yield a SJ word, as in (27)a and not another SJ stem (27)e? We would like to suggest that the explanation for the fact that two SJ stem always immediately make a word—and never another stem—is already in our hands. It is nothing else but the prosodic size restriction on SJ stems that was stated as a distributional generalization at the beginning.

(31) Prosodic stem limit:  $| \text{Stem}_{\text{SJ}} | \leq F (= 2\mu)$  (= (5))

Once there is more than one SJ stem, there are more than 2 moras (or better, more than one foot), and the result can no longer constitute a single stem. That is why a combination of two stems cannot itself be a stem. It is essential to conceive of the prosodic stem limit (31) in terms of prosodic constituents (a single foot) and not in terms of direct mora counting. There are good reasons to assume that even monomoraic SJ stems (like *si* 'arrow' or *ku* 'phrase') always constitute a foot, even though a subminimal one.<sup>15</sup> The observation is that once compounding has combined two such monomoraic items into a word, contraction is blocked when further compounding takes place: Formally, we have  $[\mu]_{\text{F}} + [\mu]_{\text{F}}$ , which is two feet long and hence lies beyond the stem limit in terms of its size, even though the absolute mora count is only "2" (see also Kubozono 1993b, for a similar argument from accentuation). As usual in prosodic phonology, the constraints work in terms of the constituents and categories of the prosodic hierarchy, and not by means of a direct count in some unit of measurement for 'prosodic weight'.

For the structure in (30)a, the prosodic stem limit (31) forces the separate PrWd-node dominating the initial substring *toku-betu*, with the results already studied. The prosodic status of the second element *seki* in (30)a is still undetermined. Returning to (28), we have to face the question of parallelism. Why can words and stems never be sisters in compounds? Why are (27)c and (27)d impossible? We hypothesize the principle in (32) to account for this

parallelism effect.

- (32) **Prosodic Homogeneity:** Compound members must be of equal prosodic rank.

This should be a direct prosodic implication of the concept "compound", but that is a larger issue that we do not want to enter here (see Ladd 1992 for further discussion). Prosodic Homogeneity explains (25)b, where the morphological structure is A [B C]. One of the examples is repeated in (33). Contraction of the /t/ in the initial stem /bet/ is impossible because in the context of the compound, Prosodic Homogeneity type-lifts the F-sized stem /bet/ into a PrWd by itself. This is so because its sister, the complex unit *hyoo-ki*, is itself a PrWd.

- (33)
- |  |      |   |
|--|------|---|
| $  \begin{array}{c}  \text{PrWd} \\  \wedge \\  \text{PrWd} \quad \text{PrWd} \\  \wedge \quad   \\  \text{F} \quad \text{F} \quad \text{F} \\  \triangle \quad \triangle \quad \triangle \\  \text{betu} \quad \text{hyoo} \quad \text{ki} \\  /bet/ \quad /pyoo/  \end{array}  $ | cf.: | $  \begin{array}{c}  \text{PrWd} \\  \wedge \\  \text{F} \quad \text{F} \\  \triangle \quad \triangle \\  \text{bep} \quad \text{pyoo} \\  /bet/ \quad /pyoo/  \end{array}  $ |
|--|------|---|

### 5.3 Place assimilation

In general, place assimilation can (optionally) take place even between PrWds contained within a larger PrWd:

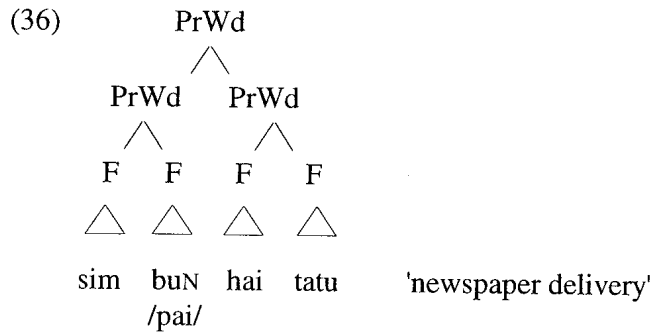
- (34) [sim-buŋ]-[koo-koku] 'newspaper advertisements'

But this does not happen when the second PrWd begins with /h/ (from /p/); in other words, we never find a labial in such contexts:

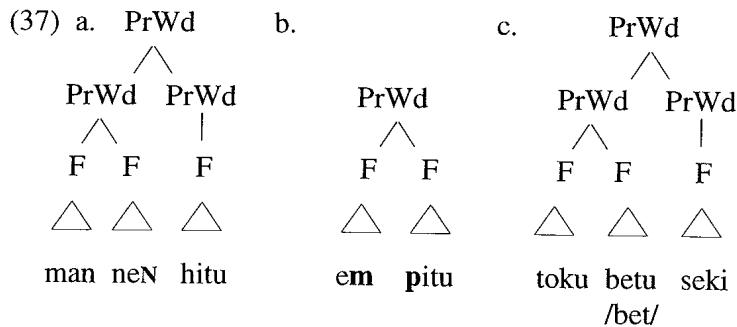
- (35) [sim-buN]-[hai-tatu] 'newspaper delivery'  
 \*[sim-buŋ]-[pai-tatu]

The reason is already given in the earlier discussion: Full licensing is enforced

on the material within the domain of every PrWd; among other things, the labial-constraint (see Itô and Mester 1995) is enforced on the PrWd-domain, turning the onset-/p/ into [h]. Later assimilation has lost its trigger, there is no LABIAL anymore.



The most wellknown contrast of this kind is the one in (37)a vs. (37)b. Here the second element *hitu* 'brush' is itself a PrWd.



(37)a is direct evidence for Prosodic Homogeneity as a principle lifting a foot-sized stem that is sister to a PrWd up to a PrWd. In the earlier case [*toku-betu*]-*seki* in (30)a, there was no direct evidence regarding the prosodic status of the second member (which consists only of single stem). The behavior of the /p/-cases shows that the correct structure here must be the one in (37)c, as dictated by Prosodic Homogeneity.<sup>16</sup>

## 6. Conclusion

We hope to have shown that, with a proper understanding of the prosodic structures involved and of the principles governing them, the characteristics of contraction in SJ compounds require no direct reference to morphological (or syntactic) structure, but are to a large extent the result of general alignment principles governing the mapping between morphosyntactic structure and phonological structure.

The specific properties that set SJ stems apart from the rest of the Japanese lexicon are few in number, but they have dramatic consequences:

- (i) Prosodically, there is a size limit on SJ stems, requiring them to be smaller or equal to a single foot.
- (ii) Final vowels in CVCV stems are largely predictable in quality and occurrence, hence epenthetic.
- (iii) In terms of their segmental features, final consonants in SJ stems are heavily underspecified.

All of these properties have a clear historical basis in the canonical shape of the (monosyllabic) items originally borrowed from Chinese, and in the way in which nativization took place. Within the synchronic grammar, which is not an historical manual, they have the status of constraints characterizing SJ stems as a class, setting them apart from other items (Yamato, Mimetic, and Foreign).

The overall surface effects visible in SJ compounds might create the impression that there is a totally separate phonological system at work in the Sino-Japanese stratum, essentially unconnected to the rest of the phonology, and sometimes contradicting what is otherwise found (see again the discussion of spreading vs. fusion in section 2.2). The main result of our study is that this is not so: There is rather a single and unitary phonological system, but it is operating on items partially segregated into lexical classes in terms of their feature specifications and their prosodic variety. Only future work can show whether it is indeed possible to capture most, and hopefully all, stratum-specific properties in a model of this kind.

### *Acknowledgements*

This paper constitutes part of a comprehensive analysis of Sino-Japanese Phonology and Prosodic Morphology within the framework of Optimality Theory which was presented by the authors in class lectures (Fall 1993) at UMass, Amherst, and at UC Santa Cruz. We would like to thank the audiences at these occasions, as well as the

participants of the Dokkyo Forum, for useful comments and suggestions. Special thanks are due to Haruo Kubozono for his extensive and helpful written commentary.

### Notes

1. Large-scale and systematic borrowing began in the pre-Nara period in connection with the introduction of Buddhism (6<sup>th</sup> century AD), followed by a second period in the 8<sup>th</sup> century and a third one in the 14<sup>th</sup> century (closely associated with Zen).
2. For the written language, this means, for example, that it is not unusual for a given Chinese character (*kanji*) to have more than one Sino-Japanese reading (*on-yomi*), besides its native-Japanese reading (*kun-yomi*).
3. Our transcriptions are approximately phonemic and follow the *kunreisiki* style of romanization in most respects. Note in particular /tu/ = [tsw], /ti/ = [tʃi], /si/ = [ʃi], /sy/ = [ʃ], /ty/ = [tʃ], /ky/ = [kʲ], etc. Underlying /p/ which is not part of a geminate or partial geminate cluster surfaces as /h/ (see McCawley 1968), resulting in numerous alternations like *bep-pai* vs. *hai*.
4. See Itô 1990 and Itô and Mester 1992 for studies of the prosodic characteristics of such word clippings in Japanese.
5. For a discussion of the separate question of how the current synchronic alternations arose through historical sound changes, see Beckman (this volume).
6. The basic generalization here is that V<sub>2</sub> must be [+high] (a 'glide'). Allowed underlying sequences are restricted to /ei/, /ou/, /ai/, /uu/, and /ui/. The first two are subject to the wellknown monophthongization laws: /ei/ → [ee], /ou/ → [oo]. Consequently, [\*ei, \*eu, \*oi, \*ou, \*aa, \*au, \*ii, \*iu].
7. This is clearly an alignment effect in Optimality Theory, with syllable-edge matching morpheme-edge. Cf. McCarthy and Prince 1993b.
8. While Tateishi (1990) posits a rule spreading the segmental root, similar to Itô (1986, 153), Cho (1989, 22) argues for a rule simultaneously spreading continuancy and Place. In Padgett's (1991) articulator group model, where [continuant] is a dependent of the articulator node, these separate components of feature structure can be transmitted in a unified process of Place Spread. We will here not enter into a detailed comparison of the various approaches, except for noting that the analysis presented below, in terms of unificational fusion (i.e., fusion of featurewise compatible segments), directly captures the intuitions about the necessary similarity of the segments to be fused.
9. Other similar cases are medial gemination as found in intensives, and the gemination triggered by *maC*-prefixation.
10. A case in point is /gool/ ~/gat/ 'suit, meet, combine, gather' (kun-reading *au*), appearing in compounds as *goo-doo* 'union, incorporation', *goo-i* 'mutual agreement', *gas-seN* 'battle', [*gaš-šuu*]-*koku* 'United States' (lit. '[meet crowd] nation'), etc. Overall, the /gool/ ~/gat/ alternation (going back to ancient \*/gaɸu/ (with a labial), see Vance 1987 and Tateishi 1990) are very irregular and suppletive. The general contraction scheme *au* → *oo* is widespread, cf. *haya-i*

'early', /o-haya-u/ → o-hayoo 'Good Morning' lit. 'it is early', and the Kansai variants of the past tense forms of ~w verbs like kaw~ 'buy': koota 'bought' instead of Standard katta, etc.

11. If [continuant] is a dependent of PLACE (Padgett 1991, 1994), the logic of dependency alone forces CORONAL specification, irrespective of all other considerations. See McCarthy and Taub 1992, and the discussion below.
12. The nondistinctively voiced sonorants do appear in gemination: *ammari*, etc.
13. See Itô and Mester 1993 for some discussion within a conception of licensing that distinguishes between (i) a failure of licensing due to a violation of an absolute domination prohibition, as in the case under discussion, and (ii) a failure of licensing due to the unavailability of any safe prosodic path.
14. Further restrictions of PLACE Spread, not investigated here, derive from stricture interactions between nasality and continuancy, see 14 and related discussion.
15. These subminimal feet are lexically prespecified, and in this way appear to escape the Foot Binary Constraint otherwise observed in prosodic parsing (see Mester 1994 and work cited there for general discussion). In terms of Optimality Theory, we conjecture that the Foot Binarity Constraint is in such cases outranked by another constraint which demands the presence of a foot.
16. There are some cases where apparently contraction applies beyond its usual domain, and we find "overapplication" of contraction: For /zit/ 'true' in A[BC] structures, we find *zis*-[se-kai] 'real world', *zis*-[se-keN] 'everyday world', *zis*-[sya-kai] 'real world, actual society', *zis*-[syuu-nyuu] 'real income', and *zis*-[sei-katu] 'real life' (from Nelson 1974 and Vance 1987). Apparently there is never overapplication with /p/: *zis*-[sei-ryoku] 'real [energy strength], actual power' vs. \**zip*-[pei-ryoku] 'real [soldier strength], effective strength' *zitu*-[hei-ryoku] but: *zip*-*pi* 'actual expenses', etc. It is implausible to try to deal with such cases as bracketing paradoxes (and this is not viable in any case in other situations, where contraction is found in two places). One obvious way of treating most of the recalcitrant cases in question is to regard the first element as prefixal. Under a prefixal analysis, Prosodic Homogeneity does not force the category "PrWd" onto the first element, and complete syllabification is not required, which in turn opens the door to fusion. Much less frequent, and often subject to variation, is the opposite kind of 'wrong' contraction, namely in [A B] C compounds: /[saN-kak]-kei/ '[three angle] shape', 'triangle' (*saŋkakukei* ~ *saŋkakkei* (variation)), cf. the general case: *saŋkakukiN*, \**saŋkakkiN* 'triangle bandage' *saŋkakuki*, \**saŋkakki* 'pennant'. According to Vance, 1987, some speakers have *saŋkakkei* 'triangle' just as an optional variant of *saŋkakukei*; others have the latter as the only variant. But there are also those who only accept the contracted version. A suffixal analysis for /-kei/ will not lead to the desired results. We could entertain the possibility of a "type lowering" analysis, but this has many drawbacks. Overall, the facts suggest that the A [B C] exceptions are quite real (and receive a prefixal analysis), whereas the [A B] C exceptions remain structurally marginal. Finally, Vance (1987) notes that there is not a single example of contraction in the middle of four-

stem combinations of the form [A B] [C D] (i.e., between B and C) [*saN-kak*]-[*kaN-kei*]/ 'triangular relationship, love triangle' *sanjakukakŋkei*, \**sanjakakŋkei*. This lends further support to the affixal analysis of the cases above: Such a structure is only possible if exactly one "loose" morpheme— not yet bound into a PrWd— is available.

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*Edited by*

Takashi Otake

Anne Cutler

Mouton de Gruyter  
Berlin · New York 1996