

JAPANESE LEXICAL PHONOLOGY AND MORPHOLOGY

By

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Department of Linguistics

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

September, 1985



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Abstract

Over the years, phonologists working in the generative framework have encountered a number of persistent problems in their descriptions of Japanese phonology. Several of these problems concern phonological rules that sometimes do and sometimes do not apply in seemingly identical phonological environments. Many of the proposed analyses achieve observational adequacy, but, nonetheless, are intuitively dissatisfying.

The first of two such problems involves the desiderative suffix -ta and the homophonous perfective inflection -ta, both of which attach to verb roots. When the verb root is vowel-final, the derivations are straightforward.

- (1) (a) $\text{tabe} + \text{ta} + \text{i} \rightarrow \text{tabe-ta-i}$ 'want to eat'
 $\text{mi} + \text{ta} + \text{i} \rightarrow \text{mi-ta-i}$ 'want to see'
- (b) $\text{tabe} + \text{ta} \rightarrow \text{tabe-ta}$ 'ate'
 $\text{mi} + \text{ta} \rightarrow \text{mi-ta}$ 'see (past)'

Derivations are not so straightforward when the verb root is consonant-final. In such cases an intervening i is inserted between the root and the desiderative suffix, but not between the root and the perfective inflection.

- (2) (a) $\text{tat} + \text{ta} + \text{i} \rightarrow \text{tat-i-ta-i}$ 'want to stand'
 $\text{kat} + \text{ta} + \text{i} \rightarrow \text{kat-i-ta-i}$ 'want to win'
- (b) $\text{tat} + \text{ta} \rightarrow \text{tat-ta}$ 'stood'
 $\text{kat} + \text{ta} \rightarrow \text{kat-ta}$ 'won'

McCawley (1968) is not specific in how he accounts for this differential insertion of i in these phonological identical environments, but

it appears that he favours the adoption of a morphological rule such as
(3) (from Koo, 1974).

(3) $\emptyset \rightarrow i / C]_{V_____} +tai$

Koo (1974) has attempted to reanalyze the desiderative suffix as -ita, but, since there is no evidence of VV cluster simplification in the language, he is left with the even more difficult problem of deleting the initial i of the suffix following vowel-final verb roots.

(4) tabe + ita + i \rightarrow tabe-ta-i 'want to eat'
 mi + ita + i \rightarrow mi-ta-i 'want to see'

Maeda (1979) has chosen a boundary solution, positing that t-initial inflections are joined to verb roots by morpheme boundaries (+), while other suffixes such as the desiderative suffix are joined by a stronger boundary (:). By making the i insertion rule sensitive to boundaries of level :, the correct outputs can be derived. This solution, though, is unsatisfactory since the assignment of boundaries is not independently motivated.

A second difficulty encountered by McCawley (1968) and others involves a high vowel syncopation rule that deletes the final i or u of Sino-Japanese monomorphemes when the initial consonant of a following Sino-Japanese monomorpheme is voiceless.

(5) iti + too \rightarrow it-too 'first class'
 roku + ka \rightarrow rok-ka 'sixth lesson'

However, a morpheme- or word-final high vowel at the boundary between a Sino-Japanese compound and a Sino-Japanese monomorpheme does not delete under those conditions.

- | | | | | |
|-----|--------------------------|-------|---------------|----------------------------|
| (6) | zi-ryoku | | | 'magnetism' (X-Y) |
| | zi-ryoku <u>u</u> + kei | ----> | zi-ryoku-kei | 'magnetometer' (X-Y-Z) |
| | hai-tatu | | | 'delivery' (Y-Z) |
| | betu <u>u</u> + hai-tatu | ----> | betu-hai-tatu | 'special delivery' (X-Y-Z) |

McCawley accounts for this pattern by invoking internal boundaries of different strengths: + and #.

- (7)
- | |
|-------------------|
| iti + too |
| roku + ka |
| zi + ryoku # kei |
| betu # hai + tatu |

He claims, then, that high vowel syncope is sensitive to boundaries of strength + and is, therefore, blocked from applying to the u of zi + ryokuu # kei. His analysis is correct, but his assignment of boundary strengths is rather arbitrary.

Analyses such as the two above which appeal to boundary strength hierarchies have often been intuitively dissatisfying because of a lack of independent motivation. The relatively recent theory of lexical morphology and phonology as formulated by Kiparsky (1982) is ideally suited for this type of problem. One of the theory's most compelling attributes is that phonological processes may be put into a much broader context that includes morphological processes as well. This more integrated approach is often able to fit formerly isolated facts into a network of related facts to provide compelling independent motivation for diverse processes. The purpose of this thesis, then, is to fit i insertion, high vowel syncope, and other Japanese phonological processes into the lexical phonology network to see exactly how they are related to each other and to the morphological phenomena of the language.

.30..September..1985

Patricia A. Shaw
Thesis Supervisor

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Despite the help I received from a variety of people, responsibility for any errors, omissions, or other weaknesses in this work rests solely on my own shoulders.

Chapter I

Introduction

I.1: Theoretical Outline

Over the years, phonologists working in the generative framework have encountered a number of persistent problems in their descriptions of Japanese phonology. Several of these problems concern phonological rules that sometimes do and sometimes do not apply in seemingly identical phonological environments. Many of the proposed analyses achieve observational adequacy, but, nonetheless, are intuitively dissatisfying.

The first of two such problems involves the desiderative suffix -ta and the homophonous perfective inflection -ta, both of which attach to verb roots. When the verb root is vowel-final, the derivations are straightforward.

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- (b) $\text{tabe} + \text{ta} \rightarrow \text{tabe-ta}$ 'ate'
 $\text{mi} + \text{ta} \rightarrow \text{mi-ta}$ 'see (past)'

In (1a), the final i is the indicative, adjectival inflection (see Chapter IX). Derivations are not so straightforward when the verb root is consonant-final. In such cases an intervening i is inserted between the root and the desiderative suffix, but not between the root and the perfective inflection.

- (2) (a) tat + ta + i ----> tat-i-ta-i 'want to stand'
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Maeda (1979) has chosen a boundary solution, positing that t-initial inflections are joined to verb roots by morpheme boundaries (+), while other suffixes such as the desiderative suffix are joined by a stronger boundary (:). By making the i insertion rule sensitive to boundaries of level :, the correct outputs can be derived. This solution, though, is unsatisfactory since its main motivation is merely that t-initial inflections behave differently from t-initial derivational suffixes with respect to i insertion. Hence, the proposed weaker boundary before t-initial inflections serves as little more than a diacritic exempting such suffixes from i insertion.

A second difficulty encountered by McCawley (1968) and others involves a high vowel syncope rule that deletes the final i or u of Sino-Japanese monomorphemes when the initial consonant of a following Sino-Japanese monomorpheme is voiceless.

- (5) iti + too ---> it-too 'first class'
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Like Maeda (1979), McCawley accounts for this pattern by invoking internal boundaries of different strengths: + and #.

- (7) iti + too
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He claims, then, that high vowel syncope is sensitive to boundaries of strength + and is, therefore, blocked from applying to the u of zi + ryoku # kei. His analysis is correct, but as will be shown later, his assignment of boundary strengths is rather arbitrary.

Analyses such as the two above which appeal to boundary strength hierarchies have often been intuitively dissatisfying because of a lack of independent motivation. The relatively recent theory of lexical morphology and phonology as formulated by Kiparsky (1982) is ideally

suitied for this type of problem. One of the theory's most compelling attributes is that phonological processes may be put into a much broader context that includes morphological processes as well. This more integrated approach to the grammar of a language is often able to fit formerly isolated facts into a network of related facts to create a convincing whole that can provide compelling independent motivation for any number of different processes. The purpose of this paper, then, is to fit i insertion, high vowel syncopation, and other Japanese phonological processes into the lexical phonology network to see exactly how they are related to each other and to the morphological phenomena of the language.

I.2: Source of Data

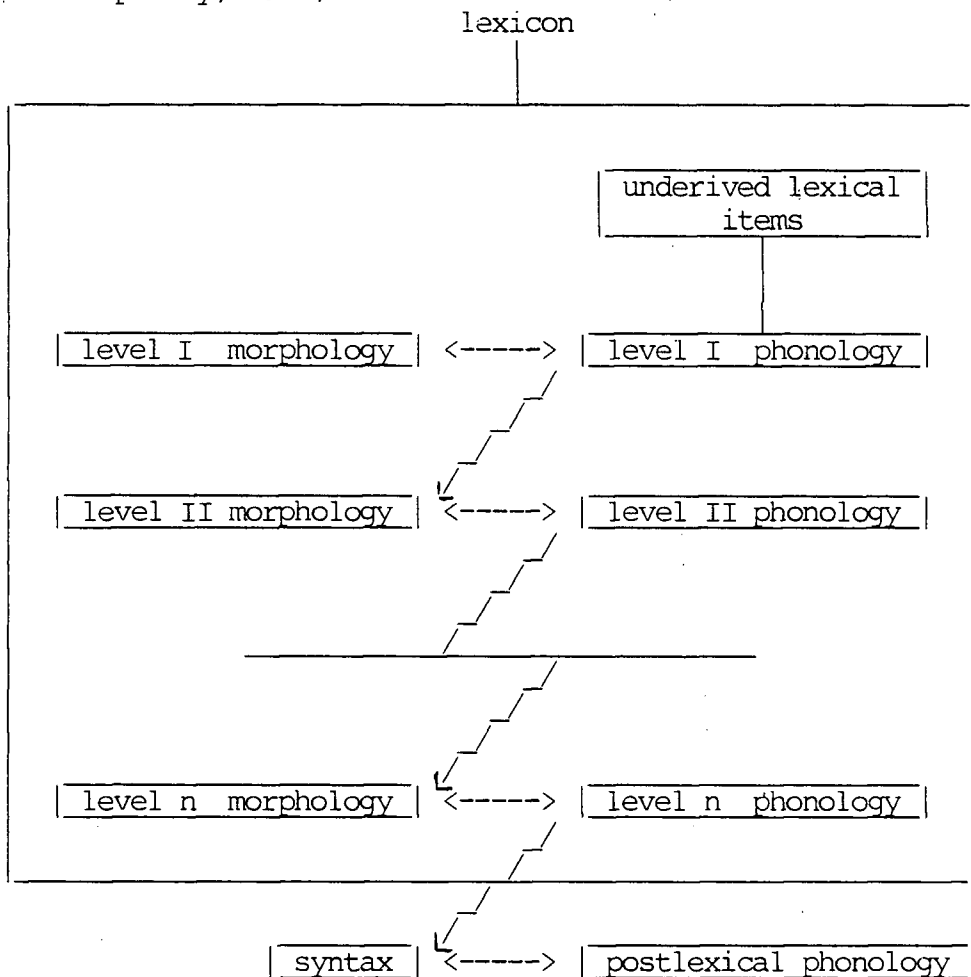
Data used throughout this paper were drawn from a variety of sources. By far the most useful sources were: (1) Takenobu, Y. 1940. Kenkyusha's New Japanese-English Dictionary, and (2) Martin, S.E. 1975. A Reference Grammar of Japanese. Lesser amounts of data were obtained from Block (1946), Kageyama (1982), McCawley (1968, 1977), and Parker (1939). In addition to these published sources, several examples were drawn from field notes based on utterances supplied by Mrs. Keiko Shibamura, a native speaker of the Tokyo (standard) dialect.

Chapter II

Lexical Morphology and Phonology

The basic insight of lexical morphology and phonology is that the lexicon is divided into a series of levels, each with its own component of morphological and phonological rules. The generalized diagram in (8) shows the routing that a basic, underived lexical item may take on its way to becoming a fully derived and phonologically well-formed word.

(8) (from Kiparsky, 1982)



According to (8), basic lexical items are fed directly into the phonological component of level I. Rules of syllabification and metri-

cal structure (structure-building rules) may apply immediately at this point, if such rules are in fact found at level I in the particular language under discussion. Structure-changing rules of level I are blocked by the Strict Cycle Condition from applying to these forms that are, as yet, nonderived. From level I phonology, the items proceed to level I morphology. If and when a morphological rule is applied to an item, that item is fed immediately back to level I phonology where the newly derived form is run through all the phonological rules of that level to see if any apply. At the end of the battery of phonological rules, that cycle of level I is said to be complete. Any internal brackets remaining at this stage are erased.¹ The item is then returned to level I morphology where the next cycle begins. Lexical items are cycled back and forth in this manner between the phonological and morphological components of level I until no more rules apply and the items exit level I.

Kiparsky (1982) claims that the outputs of each level must constitute well-formed lexical entries. In the case of Japanese nouns, it is true that only freely occurring nouns ever emerge from a level. However, Kiparsky's claim is untenable for Japanese verbs and adjectives, which are not well-formed until at least one inflection is attached to the stem. These indispensable inflections are not available until late in the grammar. This means that verbal and adjectival outputs from lower levels consist of a stem only and are not able to stand on their own as words. It will be assumed throughout this paper, then, that the verbal and adjectival outputs of each level need not be well-formed lexical entries, at least as far as the presence or absence of inflections is concerned.

There is some discussion in the literature about how the levels are linked -- whether the link goes from the phonology of one level to the phonology of the next level, or whether it goes from phonology to morphology (as shown in (8)). Kiparsky (1982) argues in favour of the former possibility. However, inconsistencies in his argumentation, a full discussion of which is beyond the scope of the present work, suggest that the latter alternative is the correct one. Indeed, subsequent work of Kiparsky's (1985) reverts to the earlier direction of flow modelled in (8), albeit without explicit discussion of the issue. Following Kiparsky (1985), therefore, I will assume in this paper a phonology to morphology link.

From level I, then, items advance directly to the morphological component of level II and are cycled back and forth through that level and, subsequently, through all the later levels in the lexicon. Upon emerging from the lexicon, the items are fed into the syntactic component of the grammar and, from there, into the post-lexical phonological component. In contrast to lexical rules, post-lexical rules are noncyclic and are sometimes called post-cyclic rules. They are characterized by exceptionless, across-the-board application. Also, they are exempt from the Strict Cycle Condition and, unlike cyclic rules, may apply in a structure-changing function in nonderived environments.

There are no published accounts of lexical morphology and phonology treatments of Japanese grammar. However, a level-ordered description of Japanese word formation has been worked out by Kageyama (1982) and is a useful reference. Recently, an unpublished Ph.D. thesis has been completed on the subject by Grignon (1985).² The theory has been

successfully applied with interesting results to Malayalam (Mohanam, 1981), Spanish (Harris, 1982), English (Rubach, 1984), and Dakota (Shaw, 1985).

Notes for Chapter II:

1. Kiparsky (1982) argues for a weaker Bracket Erasure Convention which applies only at the end of each level. There is no crucial evidence in this thesis for the weaker convention, so the stronger version, which applies at the end of each cycle, is adopted here.
2. Unfortunately, the Grignon thesis was not available at the time this thesis was being prepared.

Chapter III

Phonological Representation of the Syllable

The phonological component of Japanese grammar includes many syllable sensitive rules that are best characterized by a three dimensional representation of the syllable. Background information on that representation is provided in this section.

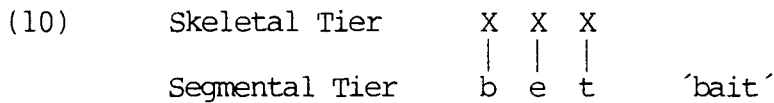
Three dimensional phonology represents an area of overlap between autosegmental phonology and metrical phonology. The contribution of autosegmental phonology is that, within that framework, the lexical representation of morphemes consists of a segmental tier with its individual members mapped onto an independent skeletal tier. One conception of the skeletal tier sees it composed of strings of C and V positions (9), a conception that works well in analyses of Arabic (McCarthy, 1981) and reduplication (Marantz, 1982; Yip, 1982).

(9)	Skeletal Tier	C	V	C	C	
	Segmental Tier	b	e	t	s	'baits'

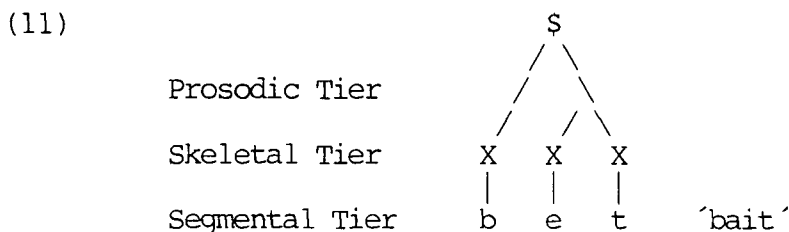
The purpose of the skeleton in such analyses is to act as a relatively stable "backbone" to ensure that correct temporal structure is maintained independently from whatever processes take place in the segmental tier.

An important objection to the autosegmental approach is that, despite the supposed independence of the two tiers, there remains an element of redundancy between the two. In particular, since it is explicitly required that [+syllabic] segments be matched with V positions ([+syllabic]) on the skeleton and [-syllabic] with C positions ([-sylla-

bic]) (Marantz, 1982), the feature [+syllabic] can be predicted, one tier from the other. Kaye and Lowenstamm (1982) argue that this redundancy can be eliminated by reducing the CV positions to bare skeletal points (x) unspecified for the feature [+syllabic].

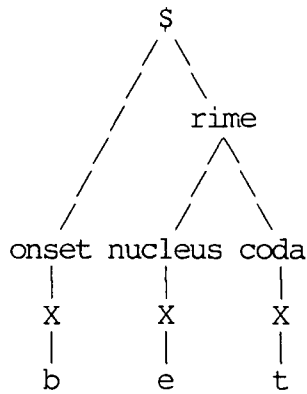


They further argue that [+syllabic] information which is unquestionably important in most analyses is recoverable from a third tier, the prosodic tier, which is a contribution from metrical phonology.



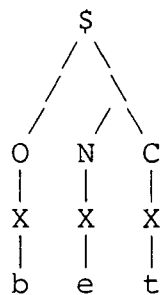
To best understand the workings of the prosodic tier, it is necessary to start with a lexical entry and trace in detail the establishment of syllable structure, the most relevant aspect of prosodic structure as far as this thesis is concerned. Starting with a lexical entry such as (10), rules of syllabification attempt to syllabify the string. A useful analogy in this regard is to imagine that the skeletal positions are portholes in the side of a ship. Rules of syllabification use these portholes to peer into the ship to see what segments lie within. Depending on what segments are discovered, a unique syllabification based on universal principles is erected. In this case, b, e, and t are discovered and a syllable is erected with the structure shown in (12).

(12)



Throughout this thesis, (12) will be simplified to (13).

(13)



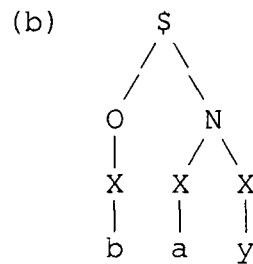
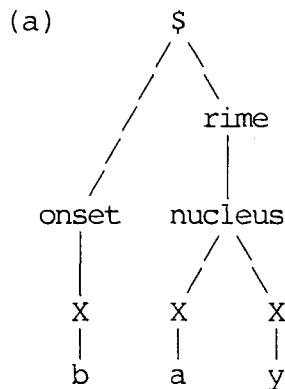
O = onset

N = nucleus

C = coda

If the segments b, a, and y had been discovered, the syllable structure erected would have been that shown in (14a) or, simplified, (14b).

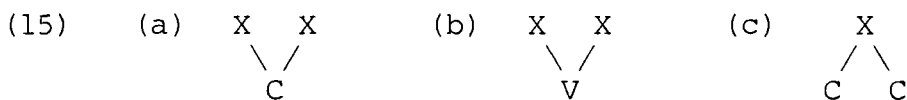
(14)



As a consequence of syllabification, the onset, nucleus, or coda status of each skeletal position is established. Since only consonants can occupy onset or coda positions and only vowels can occupy nucleus

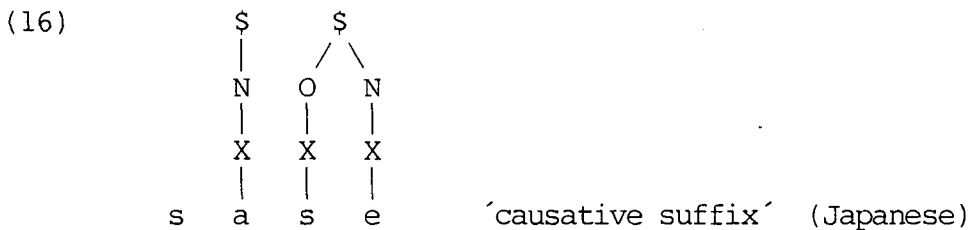
positions, it is indirectly determined which skeletal positions are "C" and which are "V". In this manner, then, [+syllabic] information about skeletal positions is recoverable, even though the positions themselves are unspecified for that feature.

In a three dimensional (or three tiered) representation, the terminal nodes of the syllabic hierarchy correspond to positions on the skeletal tier rather than to segments, as has more traditionally been supposed. The advantage of the three dimensional version is that segments are freed from their one to one correspondence with terminal nodes. This new independence permits configurations such as those in (15) to occur, which characterize geminate consonants (15a), long vowels (15b), and complex segments (15c).



Notice that the phonetic length of a segment is determined by the number of skeletal positions or points associated with it.

The independence between the segmental and skeletal tiers permits unassociated or floating segments to exist (16).



Floating segments are not associated with "portholes" and hence are invisible, at least initially, to rules of syllabification. However, if

"wrinkles" in the syllable contour persist after initial syllabification, the floating segment may be provided with a skeletal point and may participate in syllabification if its presence is required. Several examples of floating segments will be encountered in later chapters.

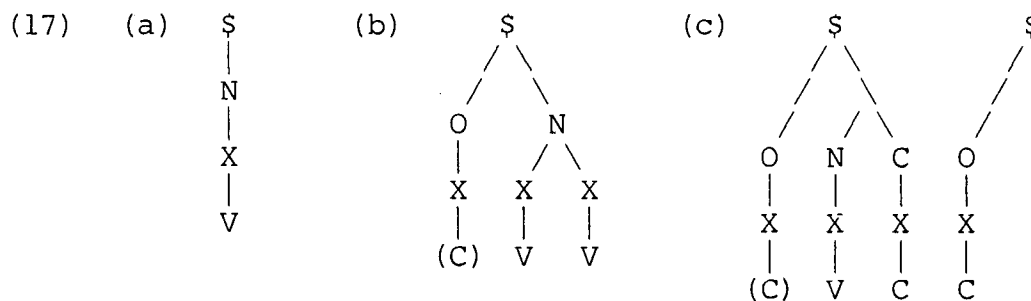
The segmental and skeletal tiers are also independent in the sense that changes introduced by rules to one tier do not necessarily effect changes in the other. By the same token, though, rules can exist that do introduce change simultaneously to both tiers.

Chapter IV

Japanese Syllable Structure

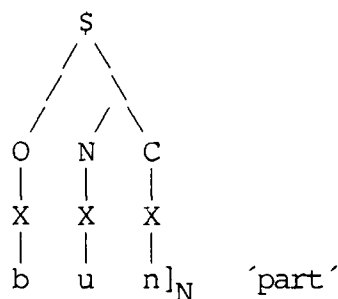
The unmarked syllable shape of Japanese is the universally un-

marked $C \hat{V}$ (skeletal tier not shown). Other possible syllable shapes are:



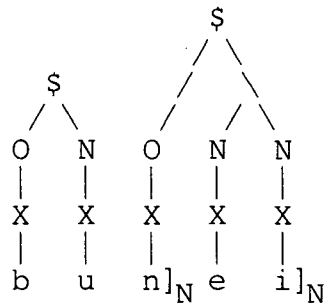
Of particular relevance to this thesis is the nature of the coda in Japanese syllables (see 17c). First of all, there are severe restrictions governing which consonants can occupy the coda position. Dealing first with word-final position, the only consonant that can apparently stand as a coda is n.

(18) preliminary version



Even this n has a tenuous existence as a coda. Whenever alternate syllabification is possible, the n is whisked out of the apparent coda position and into an onset position.

(19) bun + ei ----> bun-ei 'separate camp'

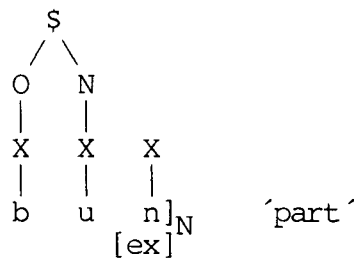


Normally a full-fledged coda persists as a coda throughout subsequent resyllabifications. In other words, previously established syllable structure tends to be respected. The half-hearted nature of the word-final coda n suggests that it may not be a coda at all. It is proposed here and substantiated further in Chapter VIII that word-final consonants are actually extrametrical and are largely invisible to rules of syllabification. The correct version of (18), then, is found in (21).

(20) extrametricality



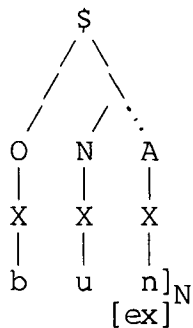
(21)



Despite the syllable structure established in (21), if bun is used independently as a word, the n must be pronounced and, hence, must be incorporated in some way into the syllable structure of the language. Following earlier proposals, then, it is theorized that the potential coda n becomes loosely attached to the syllable as an appendix (A) and

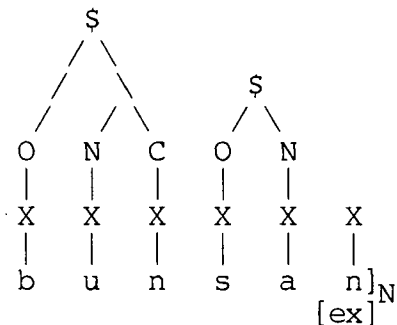
retains its extrametricality.

(22)



In contrast to word-final position, genuine codas are found in medial position wherever an onset directly follows.

(23) bun + san ----> bun-san 'break-up'



Throughout the language it can be seen that there is a close relationship between coda and following onset. In fact, almost the entire set of features of the coda is copied directly from the onset. The only independent feature possessed by the coda is nasality. This means that a nasal consonant in coda position will retain its nasality regardless of the nasality of the following onset. However, all the features of place will be copied from the onset, a process which creates a homorganic nasal coda.

(24) bun + betu ----> bun-betu 'separation'
 bun + kai ----> bun-kai 'dissociation'

Where the coda is non-nasal, its set of features is entirely copied from the onset (total assimilation) and a geminate cluster is produced.

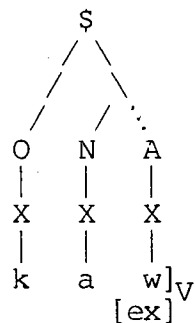
- (25) (a) kaw + ta ---> kat-ta 'buy (past)'
 (b) wakar + tari ---> wakat-tari 'understand (alternative)'

The dependency of the coda on the following onset suggests that the onset in some sense governs (Kaye, Lowenstamm, and Vergnaud (1985)) the coda. Furthermore, since no genuine codas exist in the language without governing onsets, it is reasoned that a coda government principle exists.

- (26) **Coda Government Principle:** Only those consonants that are governed directly by following onsets may be syllabified as codas. With the exception of nasality, the features of the coda consonant are copied directly from the governing onset.

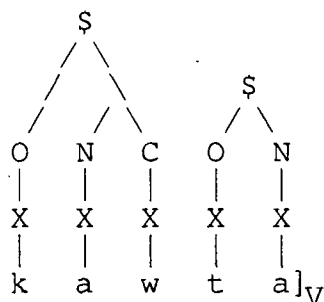
To illustrate the action of the Coda Government Principle, a complete derivation of (25a) is presented.

- (27) kaw + ta ---> kat-ta (from (25a)) (preliminary version)
 (a) extrametricality, syllabification



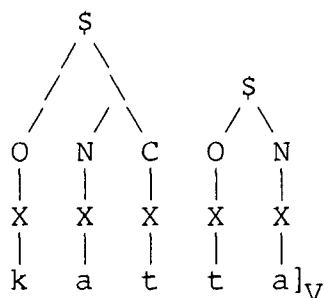
The appendix (A) cannot be analyzed as a coda since there is no following onset present to govern the coda position.

(27) (b) inflection, loss of extrametricality, resyllabification



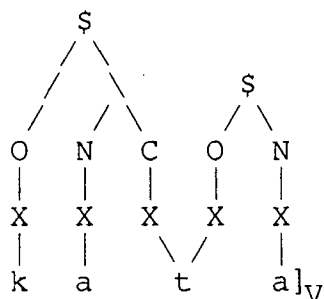
In (27b) the appendix of (27a) is reanalyzed as a coda following the introduction of the onset (t) which can govern the coda position. By the coda government principle (26) the features of the coda consonant are copied directly from the governing onset (t) to produce a geminate cluster (tt).

(27) (c) coda government principle



By the obligatory contour principle, (27c) automatically reduces to (27d).

(27) (d) obligatory contour principle



Chapter V

High Vowel Syncopation: Evidence for Levels I and II

V.1: High Vowel Syncopation

Over the centuries, Japanese has borrowed a large number of morphemes from Chinese. The shape of these Sino-Japanese morphemes is governed by strict morpheme structure constraints. Specifically, the morphemes must be from two to four segments in length and must conform to one of the patterns described in (28).

$$(28) \quad \begin{array}{c} \{V\} \\ (C)V(\{N\}) \\ \{CV\} \end{array}$$

Of particular interest are the morphemes of the shape (C)VCV, composed of two light syllables. In these three and four segment morphemes the final pair of segments must be a member of the following set: ki, ku, ti, or tu¹. A widespread rule of high vowel syncopation deletes the final high vowel of such pairs when the next morpheme is also Sino-Japanese and begins with a voiceless consonant².

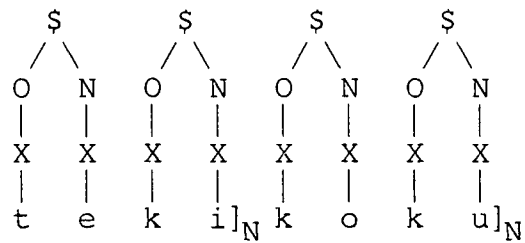
(29) High Vowel Syncopation

$$\begin{array}{c} X \\ | \\ V \\ [+hi] \end{array} \text{ ---> } \begin{array}{c} \emptyset / C \\ [+Sino] \\ [-vcd] \end{array} \text{]}_N \begin{array}{c} C \\ [+Sino] \\ [-vcd] \end{array}$$

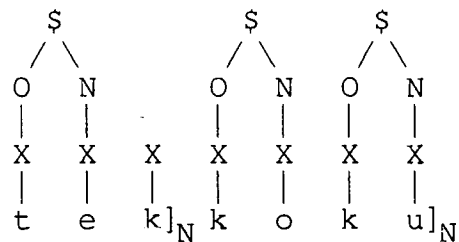
As indicated, the application of the rule deletes the high vowel together with its associated skeletal point -- an example of a rule that acts simultaneously on two tiers.

(30) teki + koku ---> tek-koku 'enemy country'

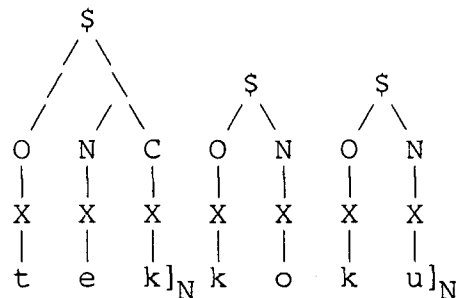
(a) Sino-Japanese compounding, syllabification



(b) high vowel syncopation

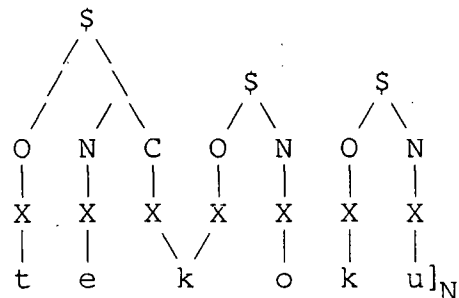


(c) resyllabification



In (30c), the k is permitted to be resyllabified as a coda because it is governed by a following onset.

(d) obligatory contour principle



(31) more applications of high vowel syncope

roku + ka ---> rok-ka 'sixth lesson'
 iti + too ---> it-too 'first class'
 butu + tai ---> but-tai 'solid object'

High vowel syncope does not usually occur when either or both of the elements are native.

(32) miti + kusa ---> mitikusa 'loiter' (road + grass)
 [+nat] [+nat]
 kutu + sita ---> kutusita 'socks' (shoe + under)
 [+nat] [+nat]

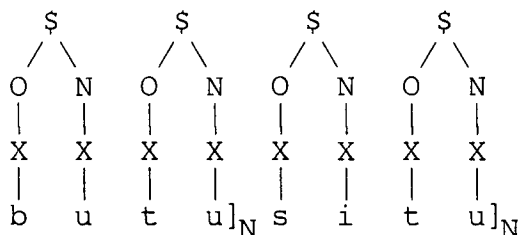
The deletion of the high vowel in the examples of (30) and (31) creates consonant clusters that are permitted in Japanese. That is not always the case.

(33) (a) iti + sen ---> *itsen 'one thousand'
 (b) iti + ki ---> *itki 'first period'
 (c) butu + situ ---> *butsitu 'substance'

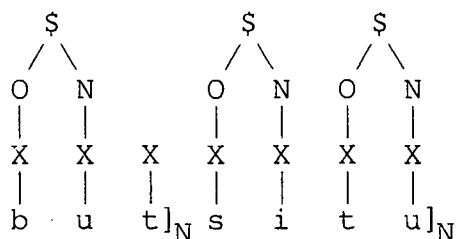
The underlined clusters in (33) are not permitted in Japanese because they are in violation of the coda government principle (26), as revealed in (34).

(34) butu + situ ---> bus-situ (33c)

(a) Sino-Japanese compounding, syllabification

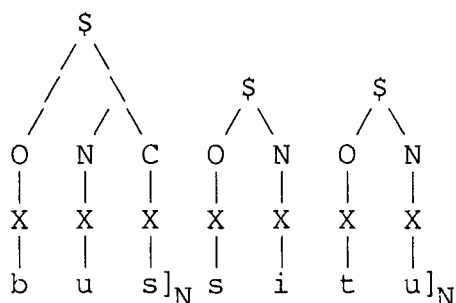


(b) high vowel syncopation

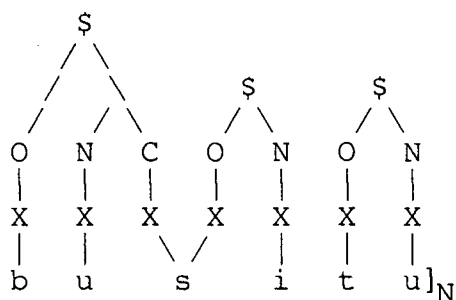


The isolated t in (34b) is resyllabified as a coda and, by the coda government principle, takes on the features of its governing onset and becomes an s.

(c) coda government



(d) obligatory contour principle



The correct derivations for the words in (33), then, result from the application of high vowel syncopation, the coda government principle, and the obligatory contour principle.




- (36) iti + sen ----> is-sen 'one thousand'
 iti + ki ----> ik-ki 'first period'
 butu + situ ----> bus-situ 'substance'

V.2: Generative Analysis of High Vowel Syncopation

The story of high vowel syncopation as described above would be neat and tidy if it were not for other facts. First of all, some high vowels that are in a position to be deleted by (29) are immune to the rule.

(39)	hai + tatu	---->	hai-tatu	'delivery' (Y-Z)
	betu + hai + tatu	---->	betu-hai-tatu	'special delivery' (X-Y-Z)
	sya + zitu	---->	sya-zitu	'realism' (X-Y)
	sya + zitu + ha	---->	sya-zitu-ha	'realist movement' (X-Y-Z)
	zi + ryoku	---->	zi-ryoku	'magnetism' (X-Y)
	zi + ryoku + kei	---->	zi-ryoku-kei	'magnetometer' (X-Y-Z)

As noted by McCawley (1968), the exceptionality of these cases is systematic. The immediate constituent structure of the three in (39) is as follows:

(40)			
	betu-hai-tatu	sya-zitu-ha	zi-ryoku-kei
	[special[delivery]]	[[realist]movement]	[[magnetism]instrument]

Clearly, in each example, the vowel that fails to delete is the one that falls at the major constituent break. To account for this pattern, McCawley proposes that high vowel syncopation is sensitive to boundaries of strength + (morpheme boundary) and not to boundaries of strength # (internal word boundary). Thus, the components of (39) betuhaitatu are joined as betu#hai+tatu and the u of betu is not in the appropriate environment to be deleted. McCawley justifies this assignment of boundaries by noting that the constituents of hai-tatu, sya-zitu, and zi-ryoku are bound in the sense that they never stand alone as words.

The immediate constituents of the words in (40), on the other hand, are freely occurring words. Hence, the words of (40) are examples of "words embedded within words" which by convention carry internal word boundaries. What McCawley is apparently claiming, then, is that high vowel syncopation can only apply between bound morphemes:

Note now that in the [examples in 40] the constituents zi-ryoku, sya-zitu, and hai-tatu are not merely sequences of Sino-Japanese morphemes but are indeed words in the sense that these compounds are formed by rules which embed a word within a word (as contrasted with rules which form compounds by joining together two pieces neither of which is a word, as in psychology, telegraph, etc.). According to convention, when a word is embedded within a word, it carries an internal word boundary with it. (McCawley 1968; 117)

McCawley's claim is demonstrably inadequate. There are many instances of high vowel syncopation between one bound and one free morpheme and even between two free morphemes.

(41) (a) free + bound

(i) tet-tei 'horseshoe'
 from tetu]_F 'steel' and -tei]_B 'hoof'

(ii) tak-ken 'far-sightedness'
 from taku]_F 'desk' and -ken]_B 'view'

(b) bound + free

(i) hit-tan 'stroke of the pen'
 from hitu]_B 'writing' and tan]_F originate

(ii) bos-syo 'dead letter'
 from botu]_B 'dead' and syo]_F 'writing'

(c) free + free

- (i) has-sya 'departure of train'
from hatu 'leaving' and sya 'train'
- (ii) hap-pyaku 'eight hundred'
from hati 'eight' and hyaku 'hundred'
- (iii) gyak-kyoo 'adversity'
from gyaku 'contrary' and kyoo 'state'
- (iv) tak-kyuu 'ping pong'
from taku 'table' and kyuu 'ball'

The components of the words in (41c) are obvious examples of "words embedded within words", and as such should be joined by McCawley's internal word boundary (#) and thus be ineligible for high vowel syncopation.

That something other than boundary information is involved in the high vowel syncopation story is demonstrated by the behavior of the verb suru 'to do'. Suru is an unusual verb in that it can stand on its own or it can be affixed to verbal nouns to derive verbs. Verbal nouns comprise a special lexical category in Japanese that function in some respects like nouns and in other respects like verbs (Kageyama, 1982). Many Sino-Japanese elements count as verbal nouns and can participate in suru derivation. Suru is also unusual in that it is a native element that triggers high vowel syncopation. As illustrated in (42) and (43), suru can combine with bound as well as free Sino-Japanese forms.

(42) bound + suru

- (a) mes-suru 'perish' (from metu-]B)
- (b) tas-suru 'reach' (from tatu-]B)
- (c) bos-suru 'sink' (from botu-]B)

(43) free + suru

- (a) ris-suru 'measure' (from ritu-]F)
- (b) has-suru 'discharge' (from hatu-]F)
- (c) kes-suru 'decide' (from ketu-]F)

Suru can also attach to Sino-Japanese compounds. In all such cases suru fails to trigger high vowel syncopation.

(44) compound + suru

- (a) koo-tatu-suru 'notify verbally' (cf. 42b)
from koo-tatu 'official announcement'
- (b) ma-metu-suru 'wear down' (cf. 42a)
from ma-metu 'abrasion'
- (c) sen-ritu-suru 'shudder' (cf. 43a)
from sen-ritu 'a shiver'

The obvious fact to be accounted for in all these data (40-44) is that, regardless of whether individual elements are free or bound, high vowel syncopation can only apply to the high vowel at the boundary between the innermost two elements. High vowel syncopation will not apply to high vowels adjacent to boundaries created by the addition of third elements. Traditional boundary notation can handle this pattern, but only in a contrived way.

- (45) (a) metu + suru ----> mes-suru 'perish' (42a)
- (b) ma + metu # suru ----> ma-metu-suru 'wear down' (44b)

Since, as noted in (29), the structural description of high vowel syncopation includes a morpheme boundary, the rule operates on (45a) and along with cluster simplification and spreading produces the correct output. The # boundary in (45b) correctly blocks the application of the rule. This analysis, however, is objectionable for one main reason.

Evidently, the rank of the boundaries in (45) is determined solely by a rule something like (46) that totally disregards the nature of the elements that are being joined together.

- (46) Assign rank + to the boundary between the innermost pair of elements in a compound. Assign rank # to any other boundaries that may occur.

This indiscriminate assignment of rank ignores the fact that hatu and sya (41c), for example, are free forms that would normally be joined as hatu#sya.

V.3: Lexical Phonology Analysis of High Vowel Syncopation

Consider now how these several facts might be treated in a lexical phonology framework.

Since the output from each level must be a lexical entry, bound morphemes cannot survive un-compounded to level II. The fact that Sino-Japanese compounding often involves bound forms has lead Kageyama (1982) to conclude that such compounding occurs at level I in Japanese. One would also want to include Sino-Japanese and suru compounding at level I since suru also attaches to bound Sino-Japanese morphemes (42). If these processes do in fact occur in the morphological component of level I, then high vowel syncopation must occur in the phonological component of level I since the rule is sensitive to the boundary information between Sino-Japanese elements of compounds. That boundary information is lost through bracket erasure by the time the compound reaches level II.

An interesting fact about Japanese is that one never finds compounds of three bound forms. The third element, if present, is always

free. Also, as previously noted, high vowel syncope never occurs at the boundary created by the third element. It is difficult to imagine how these two facts could be accounted for in any framework other than the one outlined here. Apparently, the compounding of monomorphemes (usually Sino-Japanese morphemes) takes place at level I and all subsequent compounding involving third members must be postponed until level II. As an example of this level-ordered process, the derivational histories of (42a) and (44b) (see (45)) are compared in (47).

(47)	(a) /metu + suru/	(b) /ma + metu + suru/
Level I		
monomorphemic compd	metu + suru	ma + metu
high V syncope	∅	---
coda government	s	---
Level II		
compounding	---	ma-metu + suru
	<u>mes-suru</u>	<u>ma-metu-suru</u>

In (47), the u of ma-metu cannot be deleted at level I since it is not in a suitable environment for high vowel syncope. At level II, it cannot be deleted, because high vowel syncope is not available at that level.

In the same manner, it is easy to account for the failure of the u of zi-ryoku (39) to delete.

(48)

/zi + ryoku + kei/

Level I

monomorphemic compd
high V syncope

zi + ryoku

Level II

compounding

zi-ryoku + kei

zi-ryoku-kei

Notes for Chapter V:

1. Instances of tu and ku outnumber those of ti and ki by over five to one.
2. The application of high vowel syncope is more restricted in the case of morphemes ending in ki and ku than it is for those ending in ti and tu. In the former, the high vowel is only deleted when the following consonant is a k.

- (a) teki + koku ---> tek-koku 'enemy country'
gaku + koo ---> gak-koo 'school'
- (b) seki + tan ---> seki-tan 'coal'
toku + hon ---> toku-hon 'anthology'

Of the two, ku morphemes are less problematical than ki morphemes which sometimes display optional high vowel deletion and sometimes do not permit it at all.

- (c) seki + kan ---> seki-kan or sek-kan 'sarcophagus'
heki + ken ---> heki-ken 'prejudice' (*hek-ken)
teki + ka ---> teki-ka 'drip' (*tek-ka)

Chapter VI

Accent System: Further Evidence for Levels I and II

The rudimentary level-ordered description developed in the preceding chapter helps to explain a very striking pattern involving the accentual system.

Syllables of Japanese may carry either a high tone (H) or a low tone (L). Only certain patterns of tones are permitted. For example, amongst trisyllabic nouns that are followed by monosyllabic case markers, only four surface patterns are possible.

- (49) H L L L
makura ga 'pillow'
- L H L L
kokoro ga 'heart'
- L H H L
atama ga 'head'
- L H H H
sakana ga 'fish'

Since there is no more than one pitch fall from H to L per word, each pattern can be predicted from the placement of an accent mark (´) marking that pitch fall. Words without a pitch fall are left unaccented, as in sakana ga (50).

- (50) ma´kura ga
koko´ro ga
atama´ ga
sakana ga

All syllables following the accent mark carry L tones, while most of those preceding the accent mark carry H tones. The exception is the first syllable which, in the Tokyo dialect, is L if the following tone

is H. Notice that in isolation atama' and unaccented sakana carry identical tone patterns.

- (51) L H H L H H
 atama sakana

Thus, the accentedness of a word often cannot be determined conclusively from its tone pattern heard in isolation.

In contrast to nouns, verbs and adjectives have only two accentual possibilities regardless of length. To best understand these patterns it is easiest to think in terms of morae rather than syllables. The mora has been lightheartedly defined by McCawley (1977) as "something of which a [heavy] syllable consists of two and a [light] syllable consists of one". Since a heavy syllable consists of what would make up a light syllable, plus additional material, one can take the initial (C)V- of a heavy syllable to be its first mora and the remaining -V or -C to be its second mora. Thus semboo 'envy' can be divided into two syllables (sem-boo) and four morae (se-m-bo-o).

Verb and adjective stems are accented either on the penultimate mora (i.e. the pitch falls after the penultimate mora) or not at all.

- (52) (a) ta'be-]V 'eat'
 tano'm-]V 'ask for'
 ake-]V 'open' (unaccentable)
 susum-]V 'advance' (unaccentable)
- (b) ta'ka-]A 'high'
 kura-]A 'dark' (unaccentable)

Concatenations of derivational suffixes may be attached to the verb or adjective stem. The suffixation of each successive morpheme creates a new, longer stem that, like the shorter stems, is accented on the stem penultimate mora. Previously established accents are dropped in favour of the newest, rightmost accent. Concatenations built on unaccented stems remain unaccented (53a). In (53) the suffixes in parentheses are present indicative inflections that will be ignored for the time being¹.

- (53) (a) $\text{ake}]_{V^+} (\text{ru}) \rightarrow \text{ake}-(\text{ru})$ 'open'
 $\text{ake}]_{V^+} \text{sase}]_{V^+} (\text{ru}) \rightarrow \text{ake-sase}-(\text{ru})$ 'makes open'
- (b) $\text{tabe}]_{V^+} (\text{ru}) \rightarrow \text{ta}'\text{be}-(\text{ru})$ 'eat'
 $\text{ta}'\text{be}]_{V^+} \text{sase}]_{V^+} (\text{ru}) \rightarrow \text{tabe-sa}'\text{se}-(\text{ru})$ 'makes eat'
 $\text{tabe-sa}'\text{se}]_{V^+} \text{rare}]_{V^+} (\text{ru}) \rightarrow \text{tabe-sase-ra}'\text{re}-(\text{ru})$
'makes eat (pas)'
- (c) $\text{yom}]_{V^+} (\text{ru}) \rightarrow \text{yo}'\text{m}-(\text{ru})$ 'read'
 $\text{yo}'\text{m}]_{V^+} \text{ta}]_{A^+} (\text{i}) \rightarrow \text{yom-i}'\text{-ta}-(\text{i})^2$ 'want to read'
 $\text{yom-i}'\text{-ta}]_{A^+} \text{gar}]_{V^+} (\text{ru}) \rightarrow \text{yom-i-ta-ga}'\text{r}-(\text{ru})$
'behaves like he wants to read'

Relating this section to the previous one, verbs can be derived from Sino-Japanese monomorphemes, compounds, and other verbal nouns by suru. One might expect that the derived verbs would all be accented on the stem-penultimate mora (i.e. $\text{stem}]_{VN^+} \text{suru}]_V \rightarrow \text{stem-su}'\text{ru}]_V^3$) according to the pattern evident in (53). Yet the expected accent placement only occurs when suru is attached to a monomorpheme (54a). When suru is attached to a compound, the original accent of the compound prevails (54b).

- (54) (a) a´i]VN
ai-su´ru]V ´love´
- sa´n]VN
san-su´ru]V ´produce´
- (b) se´i-ri]VN
se´i-ri-suru]V ´arrange´
*sei-ri-su´ru
- ki-to´]VN
ki-to´-suru]V ´scheme´
*ki-to-su´ru]V

The difference between the (a) and (b) patterns in (54) can easily be accounted for by placing the verbal and adjectival accent rule in the phonological component of level I.

(55)	(a) /a´i + suru/	(b) /se´ + iri + suru/
level I		
monomorphemic compd	a´i]VN + suru]V	se´]VN+ iri]VN
V/A accent	ai-su´ru]V	se´-iri]VN
level II		
compounding	---	se´-iri]VN+ suru]V
	<u>ai-su´ru</u>	<u>se´-iri-suru]V</u>

As shown in (53), the following suffixes provide input to the level I V/A accent rule: -rare (passive), -sase (causative), -ta (desiderative), and -gar (A-->V). Consequently, consider the effects of the concatenation in (56) (from Martin (1975)):

(56) $\text{tabe}]_{\text{V}}+\text{sase}]_{\text{V}}+\text{rare}]_{\text{V}}+\text{ta}]_{\text{A}}+\text{gar}]_{\text{V}}+(\text{ru}) \text{ ---> } \text{tabe-sase-rare-ta-gar-ru}$
 'make him behave like he wants to be eaten'

Another suffix, the semblative -rasi 'seems like', can fit into this sequence of suffixes before -gar, e.g. $\text{otoko}]_{\text{N}}-\text{rasi}]_{\text{A}}-\text{gar}]_{\text{V}}-(\text{ru})$ 'behaves in a manly fashion'. -rasi derives adjectives from nouns (primarily), from a few verbs, and even from a few adjectives.

(57) $\text{otoko}]_{\text{N}}-\text{rasi}]_{\text{A}}-\text{i} \text{ ---> } \text{otoko-rasi}'-\text{i}$ 'man-like'
 $\text{ame}]_{\text{N}}-\text{rasi}]_{\text{A}}-\text{i} \text{ ---> } \text{ame-rasi}'-\text{i}$ 'rain-like'
 $\text{kitana}]_{\text{A}}-\text{rasi}]_{\text{A}}-\text{i} \text{ ---> } \text{kitana-rasi}'-\text{i}$ 'dirty-looking'
 $\text{niku}]_{\text{A}}-\text{rasi}]_{\text{A}}-\text{i} \text{ ---> } \text{niku-rasi}'-\text{i}$ 'hateful-looking'

The suffix -kata is a verb nominalizer that can attach to virtually any verb (derived or nonderived) to derive an abstract noun. The nouns created by -kata are unusual⁴ in that they seem capable of being accented by the V/A accent rule. Unaccentable verb stems yield unaccentable nouns (58a) and accentable become accentable on the penultimate mora (58b), just like ordinary verbs and adjectives.

(58) (a) unaccentable verb stems

$\text{ake}]_{\text{V}}+\text{kata}]_{\text{N}} \text{ ---> } \text{ake-kata}$ 'way to open'
 $\text{umare}]_{\text{V}}+\text{kata}]_{\text{N}} \text{ ---> } \text{umare-kata}$ 'way of being born'

(b) accentable verb stems

$\text{mi}]_{\text{V}}+\text{sase}]_{\text{V}}+\text{kata}]_{\text{N}} \text{ ---> } \text{mi-sase-ka}'\text{ta}$
 'way of causing to see'
 $\text{kawai}]_{\text{A}}+\text{gar}]_{\text{V}}+\text{kata}]_{\text{N}} \text{ ---> } \text{kawai-gar}-(\text{i})-\text{ka}'\text{ta}^2$
 'way of being loved'

Since all the suffixes -sase, -rare, -ta, -rasi, -gar, and -kata provide input to the V/A accent rule, all of them must be added at the

same level as the rule, i.e. level I. If this were not so and -rare, for example, were added at a later level, then *tabe-sa'se-rare-(ru) 'cause to be eaten' would be the expected accentuation. The suffixes of (59) occur at level I.

- (59) -sase (causative)
- rare (passive)
- ta (desiderative)
- rasi (semblative)
- gar (A-->V)
- kata (N,V,A-->N)

Up to this point, then, the following morphological and phonological processes have been identified at the first two levels of Japanese grammar.

(60) Level I

monomorphemic compd

high vowel syncopation

derivation: -sase
-rare
-ta
-rasi
-gar
-kata

V/A accent

Level II

compounding

Notes for Chapter VI

1. As noted in Chapter II, these inflections are not available until later in the grammar. The minor effects on accent of a few inflections will be discussed in Chapter IX.
2. The extra i is a stem formative which is automatically suffixed to consonant-final verb stems. However, under certain conditions, the i may not be expressed. See Chapter IX.
3. Suru is an irregular verb, making it impossible to decide exactly what constitutes the verb root and what constitutes the inflection. Since this issue does not affect the analysis, suru is introduced here as a complete unit rather than as two separate morphemes.
4. Normally the accentuation of derived nouns is much less predictable.

Chapter VII

-si, -ka, and -teki: Further Evidence for Levels I and II

Using the level ordered description in (60), 'si 'regard as', 'ka 'ize', and teki 'type, -ic, -ical' can now be placed at appropriate levels. Traditionally these morphemes have been analyzed as suffixes (Martin, 1975), but evidence presented in this section challenges that view. The traditional analysis is based mainly on the observation that these morphemes usually occupy positions to the right of lexical morphemes, slots typically occupied by suffixes. Also, as with suffixes, their function seems primarily grammatical.

First consider 'si and 'ka. Both attach almost exclusively to foreign nouns and adjectival nouns (mostly Chinese and English origin) to derive verbal nouns. Adjectival nouns (AN), like verbal nouns, comprise a special lexical category in Japanese. They share properties of both nouns and adjectives. Interestingly, all borrowed foreign adjectives fall into the adjectival noun category (Kageyama, 1982). Martin (1975) suggests that 'si derivatives are bound in the sense that they are usually followed directly by suru. The verbal nouns created by 'ka, on the other hand, may optionally take suru. Both morphemes are lexically pre-accented which causes the pitch of a derived form to fall after the penultimate mora of the stem.

- (61) betu]_B+ 'si]_{VN}----> be's-si 'disregard'
 from betu- 'contempt'
- gen]_B+ 'si]_{VN}----> ge'n-si 'visual hallucination'
 from gen- 'supernatural'
- koku]_B+ 'ka]_{VN}----> ko'k-ka 'blackening'
 from koku- 'black'
- kotu]_F+ 'ka]_{VN}----> ko'k-ka 'ossification'
 from kotu 'bone'

The examples in (61) show that both 'si and 'ka attach to (Sino-Japanese) morphemes (bound and free) and trigger high vowel syncope. This involvement with high vowel syncope firmly establishes 'si and 'ka at level I. But there is evidence that these morphemes may also be added at level II. When attached to Sino-Japanese compounds of two or more elements, high vowel syncope does not occur.

- (62) (a) toku + betu]_{AN}+ 'si]_{VN}+ suru]_V----> toku-betu'-si-suru
 'regard as special' (from tokubetu 'special')
 *toku-be's-si-suru
- (b) doo + itu]_{AN}+ 'si]_{VN}+ suru]_V----> doo-itu'-si-suru
 'regard as identical' (from docitu 'sameness')
 *doo-i's-si-suru
- (c) gen + zitu]_{VN}+ 'ka]_{VN}----> gen-zitu'-ka 'actualization'
 *gen-zi'k-ka

The pattern in (62) is strikingly similar to that involving suru in (44), which indicates that 'si (63) and 'ka must be available at level II as well as at level I.

(63) /toku + betu + 'si + suru/ (62a)

Level I		
S-J compounding	toku]	betu]
	AN	AN
Level II		
'si attachment	toku-betu]	'si]
compounding	toku-betu-	si]
	AN	VN
		+ suru]
		V
	<u>toku-betu-'si-suru</u>	

Conclusive evidence of the level II nature of 'si is found in (64) where 'si is clearly attached outside a level II compound.

- (64) (a) kiken-zimbutu 'a dangerous character'
 (b) kiken-zimbutu-'si-suru 'regard as a dangerous character'
 (c) *zimbutu-'si-suru
 (d) kiken-'si-suru 'look askance at'

In (64b), 'si must be attached to the compound kiken-zimbutu as a whole, and not to the single word zimbutu, since *zimbutu-'si-suru (64c) is ungrammatical. Since the type of compounding shown in (64a) is a level II phenomenon and since 'si is added after the compounding (i.e. is attached to the compound), 'si must occur at least at level II.

It would also appear that 'ka is attached outside level II compounds, since 'ka is never found compound-internally (65c). Therefore, 'ka must also be found at least at level II.

- (65) (a) zyuukagaku-koogyoo 'heavy chemical industry'
 (b) zyuukagaku-koogyoo-ka 'heavy chemical industrialization'
 (c) *zyuukagaku-'ka-koogyoo

There is strong evidence, then, that 'si and 'ka are added at both levels I and II. Using the same type of arguments, it can be determined that teki is also a bi-level morpheme. teki attaches to nouns, the vast majority of which are [+foreign] (mostly Sino-Japanese), to derive adjectival nouns. Translated into English, teki imparts a

meaning something like "-type, -ic, or -ical". All teki derivatives are unaccented even if the stem originally carried a lexical accent¹. As exemplified in (66a), teki attaches to Sino-Japanese monomorphemes and undergoes high vowel syncopation, establishing it at level I. As expected, high vowel syncopation does not apply after attachment to Sino-Japanese bimorphemes (66b), which indicates that a level II teki is involved.

- (66) (a) si-teki 'poetic' (from si]_N 'poetry')
 but-teki 'physical' (from butu]_N 'material')
- (b) gi-zutu-teki 'technical' (from gi-zutu]_N 'technique')
 *gi-zut-teki
 hoo-katu-teki 'inclusive' (from hoo-katu]_N 'inclusion')
 *hoo-kat-teki

The fact that teki can be attached to various kinds of elements ranging from simple nouns to long compounds such as taisyyu-syoosetu-teki 'popular-novelish' has lead Kageyama (1982) to also conclude that teki is found at level II².

So it would seem that si, ka, and teki each occur on at least two different levels. If the three are in fact suffixes as is commonly supposed, then the situation is theoretically complex. Amongst the languages of the world, it is usually observed that each language has a fixed sequence to its suffixes, whereby suffix X always precedes suffix Y (if present) which, in turn, precedes affix Z (if present), and so on. The ordering of the sequence is determined in two ways. Firstly, each suffix is ordered (if necessary) with respect to the other suffixes

within its level and, secondly, suffixes of lower levels always precede those of higher levels. Thus, in (67), a permissible suffix sequence is A-C-Z, but not *C-A-Z or *A-Z-C.

- (67) level I A > B > C
 level II X > Y > Z

Needless to say, if the same suffixes appear at more than one level, then numerous ordering paradoxes are possible. In (68), for example, a sequence such as A-B-A would be possible even though A is ordered before B at level I.

- (68) level I A > B > C
 level II A > Y > Z

If some suffixes in Japanese have bi-level membership, then one would expect to find ordering paradoxes throughout the language. In actuality, such paradoxes are at best rare. It is possible that the grammar of Japanese is complex enough to ensure that paradoxes are filtered out before they surface. In this case, though, there is evidence that the three "suffixes" are actually bound lexical morphemes and not suffixes at all.

Dealing first with si, examination of (61), (62a, b), and (64) reveals certain similarities between the English glosses for si "suffixed" words. Most glosses take the form 'regard as X'. For example, in (61a) ge'n-si 'visual hallucination', gen- is more related to 'hallucination' than to 'visual'. In zu'nsi- 'tour of inspection', zun- means 'tour'. In these two words, then, si seems to mean 'visual' and 'inspection' respectively, both of which are related to "seeing". Even

'regard as X' intuitively involves "seeing", i.e. 'seeing as X'. This impression is borne out by the words in (69) where si is the first member of compounds and, just like the alleged suffix si, carries the meaning "seeing, visual, etc."

- (69) si-tyoo 'sight and hearing'
si'-wa 'lip reading (visible speech)'
si'-ya 'field of vision'

Incidentally, it may also be pointed out that si is written in Japanese with the same character no matter whether its position is word-initial or -final. It is hypothesized here, therefore, that the two si's (word-initial and word-final) are the same morpheme. Since true suffixes never occupy a word-initial position, a case can be made that si is just an ordinary Sino-Japanese verbal noun that is capable of compounding with other Sino-Japanese morphemes.

As with si, ka may also appear as the first member of a compound and can be considered a lexical Sino-Japanese morpheme. An interesting twist is that, at least in the case of (70), the ordering of the members has no discernable effect on the meaning of the compound.

- (70) ko'k-ka 'ossification' (from kotu 'bone' + 'ka)
ka-kotu 'ossification' (from 'ka + kotu)

It is more difficult to prove that teki may occur as the first element of a compound. There are a few instances of compounds that begin with a teki (71) that is written with the same Japanese character as the suffix-like teki of (66), but the problem is demonstrating that the two are one and the same.

- (71) teki-tyuu 'hit the mark'
teki-kaku 'accurate'

Neither of the two teki's has a clearly defined semantic content that is carried with it from compound to compound, so a direct comparison of the meanings of the two teki's is problematical. However, since, in the examples I have studied, Japanese characters are reliable "tags" identifying which morpheme is which, I will assume that the teki of (66) is the same as that in (71). Under that assumption, teki is a lexical morpheme.

It can be concluded, then, that si, ka, and teki are all bound lexical morphemes that may appear at any level that permits compounding (i.e. levels I and II).

Notes for Chapter VII

1. The precise mechanism of this phenomenon is unclear, and a complete investigation is beyond the scope of this thesis.
2. Kageyama apparently rejects the possibility that teki might also be found at level I. However, since his work is based solely on morphological data, he has not considered the crucial phonological evidence that has led me to my bi-level interpretation.

Chapter VIII

Stem Formatives and s/r Deletion

Most verb roots are consonant-final (e.g. kak- 'write') rather than vowel-final (e.g. tabe- 'eat'). Complicated phonological interactions may result when these root-final consonants are brought adjacent to other consonants. Two of these interactions involve stem formatives and s/r deletion.

VIII.1: Stem Formative i

When t- and k-initial suffixes are attached to consonant-final roots at level I, an intervening i materializes (72b-e). This intervening i does not appear following a vowel-final root (72a).

- (72) (a) tabe + ta + (i) ---> tabe-ta-(i) 'want to eat'
(b) tat + ta + (i) ---> tat-i-ta-(i) 'want to stand'
(c) kak + ta + (i) ---> kak-i-ta-(i) 'want to write'
(d) kak + kata ---> kak-i-kata 'way to write'
(e) sin + kata ---> sin-i-kata 'way to die'

The nature of this intervening i has been the subject of considerable debate in the literature. As noted in the introduction to this paper, phonological and morphological analyses have been propounded to account for the insertion, non-insertion, and/or deletion of the i. Evidence for treating the i as epenthetic is weak, since it does not appear to serve a phonological function. If the i were serving a phonological function, its presence would reduce the markedness of the system by breaking up unacceptable consonant clusters, smoothing out syllable contours, or maximizing the number of unmarked syllables. Examination of (72), for example, reveals that the function of the intervening i is plainly not

to break up unacceptable consonant clusters and thereby maximize the number of unmarked CV syllables. Geminate stops such as the t-t and k-k broken up in (72b) and (72d) respectively, and the n-k cluster broken up in (72e) are all perfectly acceptable. Furthermore, the same intervening i appears after consonant-final initial members of verb compounds, regardless of whether the second member of the compound is consonant- (73a) or vowel-initial (73b).

- (73) (a) kak]_V+ yam]_V+ (ru) ---> kak-i-yam-(ru) 'write-stop'
yob]_V+ das]_V+ (ru) ---> yob-i-das-(ru) 'call-stop'
oyog]_V+ kir]_V+ (ru) ---> oyog-i-kir-(ru) 'swim-through'
- (b) yom]_V+ owar]_V+ (ru) ---> yom-i-owar-(ru) 'read-finishes'
kik]_V+ akir]_V+ (ru) ---> kik-i-akir-(ru) 'hear-wearies'
ur]_V+ isog]_V+ (ru) ---> ur-i-isog-(ru) 'sell-busy'

The data of (73b) show clearly that the purpose of the i is not phonological, since its presence adds to the markedness of the string by creating two nuclei adjacent to each other. It would appear that the only consistent function of the i is a morphological one to act as a stem formative to create vowel-final verb roots in all cases. As will become clearer subsequently, it turns out that a morphological analysis involving a stem formative is best able to handle the observed data.

The stem formative i is introduced by rule (74) following each consonant-final verb stem at level I. Once introduced, the stem formative has a rather tenuous existence. As will be shown later, if the derivational function of the stem formative is unused, the i will simply drop. This ephemeral nature suggests the stem formative lacks the permanence of an associated skeletal point. For this reason, the i is

introduced as a floating segment (see chapter III).

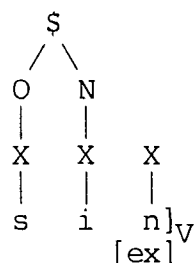
(74) stem formative

$\emptyset \rightarrow i]_V / C]_V \underline{\quad}$

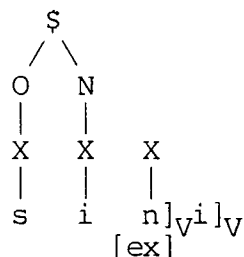
To see how the stem formative functions, consider the three dimensional analysis of (72e) presented in (75).

(75) sin + kata \rightarrow sin-i-kata (72e)

(a) level I, cycle I: extrametricality, syllabification



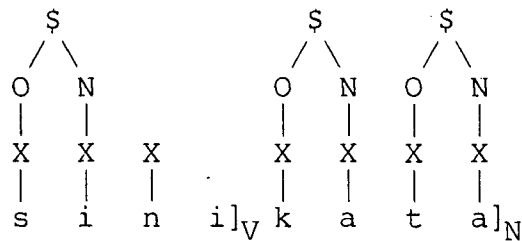
(b) level I, cycle II: stem formative



It is assumed here that the mere segmental presence of the floating i of the stem formative does not disrupt the extrametricality of the n. That is, since it is the skeletal X points rather than the segments themselves which are prosodically relevant, it may be hypothesized¹ that the skeletal point dominating n will retain its extraprosodic status as long as it is the rightmost skeletal point in the string. Presumably only a segment with an associated skeletal point would precipitate the loss of extrametricality.

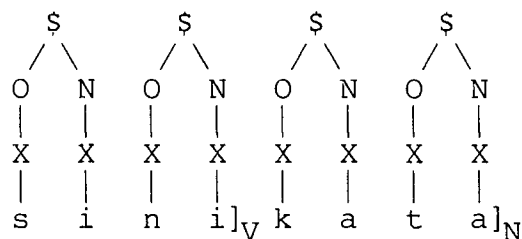
Rules of syllabification are obligated to syllabify all skeletal points that are visible to them. Once that is accomplished, and if the resultant syllabification is unmarked, then syllabification is complete and the rules are "content". In (75b), an unmarked syllable has been created and the extrametrical consonant and the floating i are prosodically invisible. Therefore, syllabification is complete for that cycle.

(75) (c) level I, cycle III: bracket erasure, derivation, loss of extrametricality



The addition of the new material -kata, forces the loss of extrametricality. The formerly extrametrical n is now visible to the rules of syllabification and must be syllabified. In this case, the n cannot be syllabified as a coda, because it cannot be governed directly by the following onset k due to the presence of the intervening i. With no other options, the rules of syllabification are forced to punch some holes in the side of the ship and look for segments without portholes that might be of assistance. The floating i is discovered, provided with a porthole (point), and is pressed into syllabic service (75d).

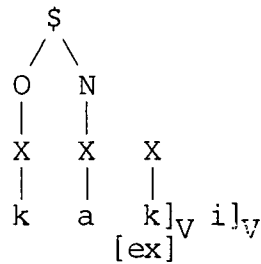
(75) (d) level I, cycle III: resyllabification



Consideration of a second type of example shows that the level I floating stem formative accounts well for patterns evident at level II where the i appears between elements of verbal compounds (73). The derivational history of (73a) is traced in (76).

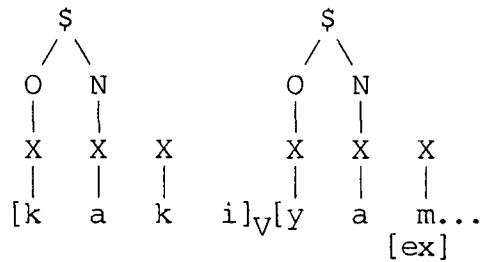
(76) kak + yam + (ru) ---> kak-i-yam-(ru) (73a)

(a) level I, cycle II: extrametricality, syllabification, stem formative

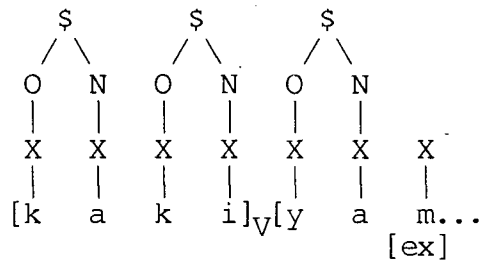


At level I, yam- follows a similar derivational history to kak-. At level II, however, there are some differences which, though illustrated below, will be discussed in detail in chapter IX.

(75) (b) level II, cycle I: compounding, loss of extrametricality



(c) level II, cycle I: syllabification (cf. (75d))



The examples in (73b) are especially interesting since the second members of the compounds are vowel-initial. They will be examined further in section VIII.3.

VIII.2: s/r Deletion

When one of the s- or r-initial suffixes of level I attaches to a consonant-final verb root, the s or r deletes.

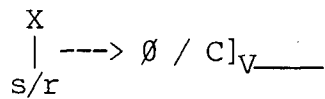
(77)	(a)	ake + <u>s</u> ase + (ru)	---->	ake- <u>s</u> ase-(ru)	'open (caus)'
	(b)	ake + <u>r</u> are + (ru)	---->	ake- <u>r</u> are-(ru)	'open (pas)'
	(c)	hanas + <u>s</u> ase + (ru)	---->	hanas-ase-(ru)	'speak (caus)'
	(d)	isog + <u>s</u> ase + (ru)	---->	isog-ase-(ru)	'hurry (caus)'
	(e)	isog + <u>r</u> asi + (i)	---->	isog-asi-(i)	'is busy'
	(f)	itam + <u>r</u> asi + (i)	---->	itam-asi-(i)	'is sad'
	(g)	yorokob + <u>r</u> asi + (i)	---->	yorokob-asi-(i)	'is joyful'
	(h)	wakar + <u>r</u> are + (ru)	---->	wakar-are-(ru)	'understand (pas)'
	(i)	sin + <u>r</u> are + (ru)	---->	sin-are-(ru)	'die (pas)'

There are two possible analyses of this process, one involving a special s/r deletion rule and the other, with a slight modification, being a consequence of three dimensional representation.

Under the former analysis, the appropriate s/r deletion rule cannot simply delete every s or r in the language that follows a consonant (*s/r ----> Ø / C]V_____). The clusters s-s and n-r, for example, are very common even though the s/r deletion rule functions to delete the second segment in cases like (77c) and (77i). Neither can the appropriate rule simply delete every s or r that follows a consonant-final stem (*s/r ----> Ø / C]_____), since clusters such as n-r and n-s are regularly found across]_N boundaries (e.g. ken]N+ ro]N----> ken-ro 'steep path') (cf. 77i). In fact, s/r deletion only applies to the initial s or r of verbal suffixes, following consonant-final verb roots. A suitable s/r deletion rule, then, would be (78). Note that the rule also deletes the

skeletal point associated with the s or r.

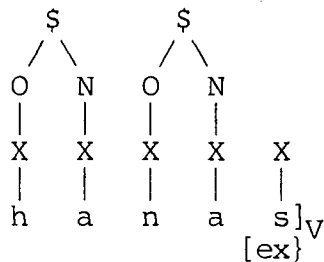
(78) s/r deletion



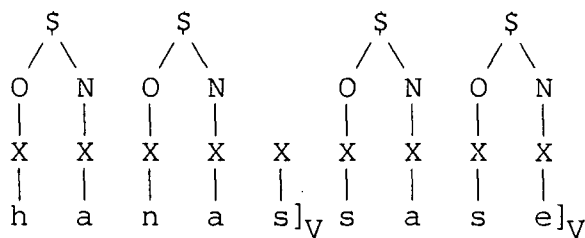
A sample analysis utilizing (78) is presented in (79).

(79) hanas + sase + (ru) \dashrightarrow hanas-ase-(ru) (77c)

(a) level I, cycle I: extrametricality, syllabification

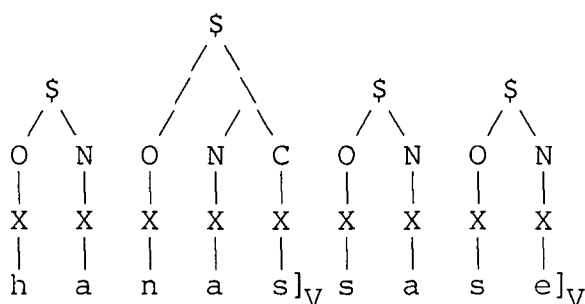


(b) level I, cycle II: derivation, loss of extrametricality



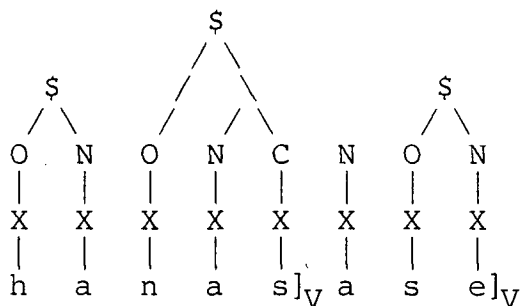
At this point the formerly extrametrical s can be syllabified as a coda since it is governable by a following onset.

(c) level I, cycle II: syllabification



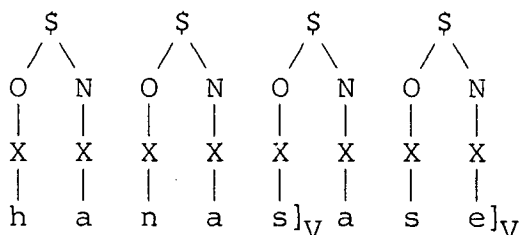
The initial s of sase is then deleted by rule (78).

(79) (d) level I, cycle II: s deletion



Under this analysis, the deletion of the s seems unmotivated since it disrupts a stable syllable structure. Following this disruption, the former coda s is reanalyzed as an onset for the isolated nucleus a.

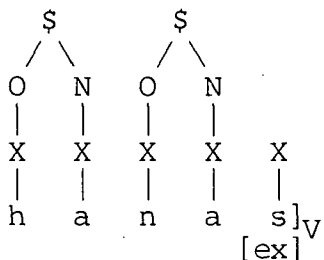
(e) level I, cycle II: resyllabification



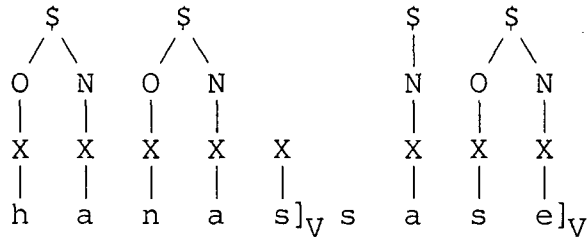
The second possible analysis of s/r deletion posits that the initial s or r of verbal suffixes is lexically floating. The resultant analysis is more elegant than (79) since a rule that disrupts stable syllable structure is not required.

(80) hanas + sase + (ru) ---> hanas-ase-(ru) (77c)

(a) level I, cycle I: extrametricality, syllabification

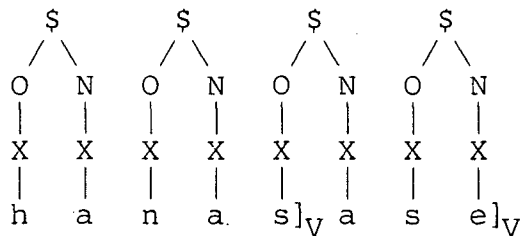


(80) (b) level I, cycle II: derivation, loss of extrametricality



Rules of syllabification proceed to syllabify (80b). In this case, the final s of hanas- can act as an onset for the isolated nucleus a of -sase. The resultant syllabification is completely unmarked and the rules are content. The floating s, then, is not required and simply drops out.

(80) (c) level I, cycle II: resyllabification, deletion of floating segment



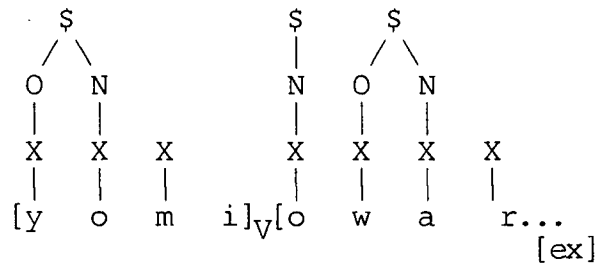
This second, more elegant analysis is chosen in this thesis as the best alternative.

VIII.3: Level II Compounding Revisited

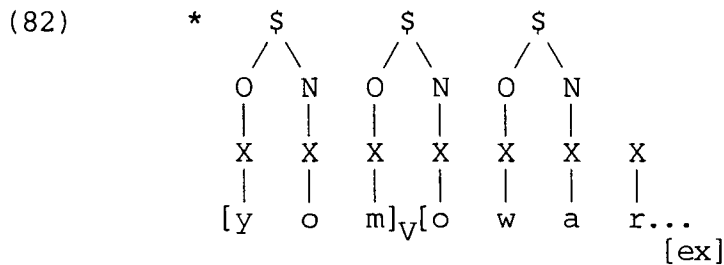
Returning to the examples in (73b), the syllabification of verb compounds whose second elements are vowel-initial is not as one might predict at first. Consider (81).

(81) yom + owar + (ru) ---> yom-i-owar-(ru)

(a) level II, cycle I: loss of extrametricality (cf. 76b)

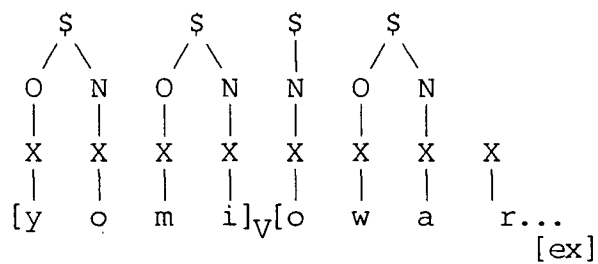


Based on (80b) and (80c), the following syllabification and subsequent deletion of the floating i might be expected.



However, (82) does not occur. Instead, the floating i is provided with a point, and resyllabification produces (81b).

(81) (b) level II, cycle I: resyllabification



Apparently syllabification across a][boundary is prohibited, a constraint that prevents (82) above from occurring.

Notes for Chapter VIII:

1. Following a suggestion of Shaw (personal communication).

Chapter IX

Level III

The principal morphological process that takes place at level III is the affixation of verbal and adjectival inflections. Ten verbal and nine adjectival inflections are recognized by Bloch (1946):

(83)	<u>Verbal</u>	<u>Adjectival</u>
indicative (Ind)	-ru	-i
past indicative (PInd)	-ta	-´katta
non-past presumptive (Pve)	-yo´o	-karo´o
past presumptive (PPve)	-taro´o	-´kattaroo
conditional (Cnd)	-ta´ra	-´kattara
alternative (Alt)	-ta´ri	-´kattari
provisional (Pro)	-re´ba	-´kereba
infinitive (Inf)	-∅	-ku
gerundive (Ger)	-te	-´kute
imperative (Imp)	-∅, -e, -ro	---

As exemplified throughout this paper by the inflections -ru and -i, every verb and adjective must have one (and only one) inflectional suffix¹ attached at the very end of the word. Inflections are always found outside the derivational suffixes of level I, and are never found inside level II compounds (e.g. *mi-ru]_V+ kir-(ru)]_V ´see-cut´). These facts indicate that inflections are added later than level II compounding. In fact, phonological process associated with the affixation of these inflections show that they are found at a completely different level--level III.

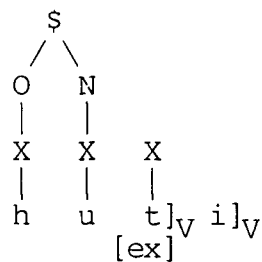
IX.1: Stem Formative Truncation

First of all, it is evident from (84) that, in most cases, no stem formative i or any other type of intervening i is inserted between consonant-final roots and consonant-initial inflections.

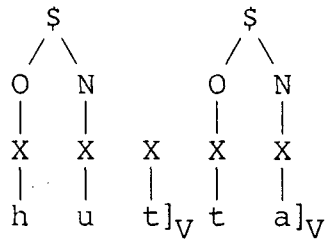
- (84) (a) tat]V+ ta]V ---> tat-ta 'stood'
 *tat-i-ta
- (b) kaw]V+ ta]V ---> kat-ta 'bought'
 *kaw-i-ta
- (c) hur]V+ ta]V ---> hut-ta 'rained'
 *hur-i-ta

Clearly the stem formative that persisted through levels I and II is somehow truncated by the time it gets to level III. In some sense this truncation is reasonable. At early levels, the stem formative's function was derivational, to ensure that all verb roots were vowel-final. Since all derivational morphology is completed by the end of level II in Japanese, there is no need for stem formatives beyond that point. The complete derivation of (84c), then, is presented in (85).

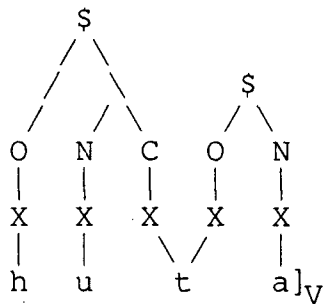
- (85) hut + ta ---> hut-ta (84c)
- (a) level I: extrametricality, syllabification, stem formative



- (b) level III: stem formative truncation, inflection, loss of extrametricality



- (c) level III: syllabification, coda government principle, obligatory contour principle



IX.2: Infinitives/Connectives

The Japanese language frequently uses i-final verbal constructions. These are known variously as infinitives (Martin, 1975) or connectives.

- (86) (a) yom]_V+[] ---> yom-i 'read (inf)'
 (b) sin]_V+[] ---> sin-i 'die (inf)'
 (c) oyog]_V+[] ---> oyog-i 'swim (inf)'

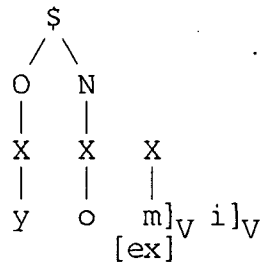
Traditional grammarians identify this final i as a stem formative, presuming it to be of the same origin as any other stem formative².

However, it has been shown in the previous section that stem formatives are truncated at the beginning of level III. This means that the final i of the examples in (86) cannot possibly be a stem formative, since it persists through level III. Furthermore, unlike a stem formative, the final i of the infinitive must be introduced complete with a skeletal

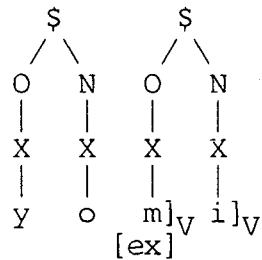
point. Consider (87). (87a) represents the first step in the derivation of yom-i 'read (inf)'. The target structure is represented in (87b).

(87) yom + i ----> yom-i (86a)

(a) level I: extrametricality, syllabification, stem formative



(b) level III:

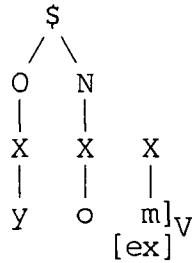


If the floating stem formative in (87a) were the same i present in (87b), then it would be difficult to motivate the target syllabification of (87b). In the first place, the i does not start out with a skeletal point for syllabification rules to work on and, secondly, the m is extrametrical and, hence, invisible to the syllabification rules.

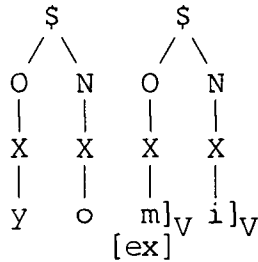
Instead, it is more plausible to truncate the stem formative at the beginning of level III (87c) and then reintroduce an i (with a skeletal point) as an infinitival inflection (87d). I conclude, therefore, that the final i of yom-i is actually an infinitival inflection rather than a stem formative. A major difference between the two i's,

then, is that the inflectional i is accompanied by a skeletal point, whereas the stem formative i is not.

(87) (c) level III: stem formative truncation



(d) level III: inflection, loss of extrametricality, resyllabification



IX.3: Real Epenthesis

An true case of i epenthesis at level III occurs between s-final roots and consonant-initial inflections.

(88) hanas]_V+ ta]_V ---> hanas-i-ta 'speak (PInd)'
 os]_V+ ta]_V ---> os-i-ta 'push (PInd)'
 mas]_V+ tara]_V ---> mas-i-tara 'increase (PInd)'

Unlike the derivational stem formative -i and the infinitival inflectional i discussed above, this -i has no morphological function whatsoever. It is strictly phonological, occurring to break up the impermissible sequence s-t. Consequently, I propose to introduce the -i by the rule formulated in (89).

(89) epenthesis (level III)

$$\emptyset \text{ ---> } \begin{array}{c} X \quad [+cor] \\ | \quad / \quad [+str] \text{ ______ } C \\ i \end{array}$$

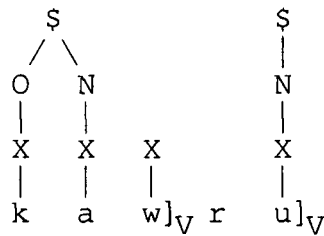
IX.4: s/r Deletion

An s/r deletion phenomenon has already been identified at level I (section VIII.2). The same floating segment analysis is required at level III to delete the r of r-initial inflections following consonant-final roots.

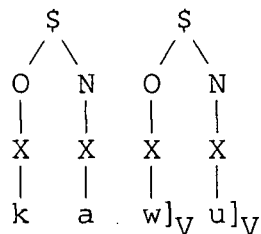
- (90) suwar]_V+ ru]_V ---> suwar-u 'sit'
 hanas]_V+ ru]_V ---> hanas-u 'speak'
 asob]_V+ reba]_V ---> asob-eba 'play (pro)'
 nom]_V+ reba]_V ---> nom-eba 'drink (pro)'

(91) kaw + ru ---> kaw-u 'buy'

(a) level III: inflection, loss of extrametricality



(b) level III: resyllabification, deletion of floating segment



IX.5: Accent

Each Japanese word exhibits either one accent or none at all, regardless of whether that word is a noun, verb, compound, or stem with a long string of suffixes. Situations frequently arise where more than one accent may be assigned to a word by accent rules or by principles of lexical assignment during its derivation. In these cases, there are basic principles which decide which accent will predominate and become the single accent of the word. It so happens that the accent predomination principle of level I is the same as that of level II, while that of level III is different. This provides additional evidence for the autonomous status of level III.

At level I a verb root will receive an accent on its penultimate mora by the V/A accent rule on the first cycle (e.g. ta'be- 'eat'). When a derivational suffix is added on a subsequent cycle, a second accent is added (e.g. ta'be-sa'se- 'eat (caus)'). In such a case it is always the second (or rightmost) accent that predominates (i.e. tabe-sa'se-), while the initial accent is eliminated. No matter how long the concatenation of suffixes is, the Right Accent Predomination Principle (RAPP) still holds (e.g. tabe-sase-rare-ta-ga'r-).

At level II, conflicting patterns of accentuation can arise in several situations. For example, the accent of Sino-Japanese compounds of level I is lexically determined. When ka is added to such compounds, the resultant combination may contain two accents. Once again, RAPP deletes the leftmost accent and preserves the right.

(92) ge'n + dai + 'ka ---> gen-da'i-ka 'modernization'

/ge'n + dai + 'ka/

level I

monomorphemic compd ge'n + dai

level II

compounding ge'n-da'i + ka

RAPP gen-da'i-ka

gen-da'i-ka

The compound noun accent rule of level II is complex and a complete discussion of it is beyond the scope of this paper (see McCawley (1977)). Suffice it to say that regardless of the accentuation of the individual elements, the accent of the compound, if present, is always borne by the rightmost member.

(93) no'ogyoo]_N+ kumiai]_N ---> noogyoo-ku'miai 'agricultural union'

tu'uka]_N+ ryo'ori]_N ---> tuuka-ryo'ori 'Chinese cooking'

iso'ppu]_N+ monoga'tari]_N ---> isoppu-monoga'tari 'Aesop's fables'

By contrast, at level III it is the leftmost accent that survives accentual conflicts. Several of the verbal and adjectival inflections in (83) contain lexical accents which surface when they are attached to unaccented stems. However, when these inflections are added to accented stems, the accent of the stem is preserved by the Left Accent Predominance Principle (LAPP) and the accent of the inflection is lost.

(94) (a) unaccentable stems

ake + ta'ra	--->	ake-ta'ra	'open (cnd)'
susum + re'ba	--->	susum-e'ba	'advance (pro)'
kura + 'katta	--->	kura'-katta	'was dark'

(b) accentable stems

ta'be + ta'ra	--->	ta'be-tara	'eat (cnd)'
tano'm + re'ba	--->	tano'm-eba	'ask for (pro)'
ta'ka + 'katta	--->	ta'ka-katta	'was high'

On the topic of accent, a rule of V/A accent adjustment will also be needed to account for the "accent attraction" phenomenon of the indicative adjectival inflection -i and the r-initial verbal inflections following vowel-final stems. This readjustment rule will draw the accent from its basic stem-penultimate mora position and reassign it to the stem-final mora position.

(95) (a) adjectives

ta'ka + ku	--->	ta'ka-ku	'is high (inf)'	
ta'ka + i	--->	taka'-i	'is high'	(*ta'ka-i)

(b) verbs

ta'be + ta	--->	ta'be-ta	'eat (PInd)'	
ta'be + ru	--->	tabe'-ru	'eat'	(*ta'be-ru)
ta'be + re'ba	--->	tabe'-reba	'eat (pro)'	(*ta'be-reba)

Notes for Chapter IX:

1. Many of the adjectival inflections are clearly bimorphemic, being composed of an adjectival element followed by the corresponding verbal inflection from column 1. The most common adjectival element is kar which is found in -kat-ta, -kar-o'ó, -kat-taroo, -kat-tara, -kat-tari. The coda government principle transforms the r of kar to t in most of the examples. The adjectival inflections -i, -ker-eba, -ku, and -ku-te are exceptional.
2. Since traditional grammarians consider the final i to be a stem formative and not an inflection, and since each verb must end with an inflection, traditional grammarians have been forced to invoke a \emptyset inflectional suffix for infinitives (see (83)).

Chapter X

Conclusion

The following morphological and phonological processes have been identified at the three levels within the Japanese lexicon.

(96)	<u>morphology</u>	<u>phonology</u>
level I	monomorphemic compounding	extrametricality
	stem formative	high vowel syncope
	derivation: -sase	V/A accent
	-rare	
	-ta	RAPP
	-rasi	
	-gar	
	-kata	
level II	compounding	RAPP
level III	stem formative truncation	epenthesis
	inflection	LAPP
		accent adjustment

In addition to the phonological processes identified above, a principle of coda government defined in (26) is assumed to hold throughout the lexical component.

The level ordered grammar outlined in (96) provides elegant solutions to the two problems introduced in Chapter I involving i insertion and high vowel syncope. With respect to i insertion, the desiderative suffix -ta behaves differently from the homophonous perfective inflection because the two are found at different levels in the grammar: the former at level I and the latter at level III. More specifically,

the i which is introduced as a stem formative at level I and often appears in conjunction with the level I -ta is truncated at the beginning of level III and, hence, is never found in conjunction with the level III -ta.

In the same way, whether or not high vowel syncopation deletes the high vowel between two elements of a Sino-Japanese compound depends entirely on what level the compound was established at. If the compound was formed at level I, then high vowel syncopation will apply since the rule is found at level I. Compounds formed later than level I will never trigger high vowel syncopation.

Perhaps most significantly, evidence from numerous morphological and phonological interactions has positioned each of the various processes of (96) at its appropriate level. The result is a well-motivated grammar that can be expected to shed light on issues beyond the scope of this thesis.

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