In: Takeru Honma, Masao Okazaki, Toshiyuki Tabata and Shin-ichi Tanaka (eds.) A New Century of Phonology and Phonological Theory. A Festschrift for Professor Shosuke Haraguchi on the Occasion of His Sixtieth Birthday. Tokyo, Kaitakusha, pp. 26-65.

Weak Layering and Word Binarity

Junko Ito and Armin Mester
University of California, Santa Cruz

This paper, originally written in 1992 and widely circulated at the time as a working paper (Linguistic Research Center, LRC-92-09, University of California, Santa Cruz), contributed, together with other works, to the discovery that prosodic parsing is often nonexhaustive (here, concerning the syllable/foot level of the hierarchy), and goes on to argue for a non-templatic conception of prosodic-morphological targets (see (21) and (22) in section 2 and related discussion, as well as (35) in section 4), along lines later known as "generalized template theory" in the work of McCarthy and Prince. An OT-analysis of the main findings appeared in Ito, Mester, and Kitagawa 1996 ("Prosodic Faithfulness and Correspondence", *Journal of East Asian Linguistics* **5**, 217-294), but the 1992 paper itself remained unpublished. We feel there is enough of value in the original work to merit its publication ten years later, in a slightly edited form, and we are grateful to the editors for including it here as an expression of our respect and admiration for Professor Shosuke Haraguchi's teaching and his important contributions to Japanese and general phonology.

0 Introduction

The Strict Layer Hypothesis of Selkirk 1984 has been an important guiding principle for a number of proposals and analyses in the development of Prosodic Hierarchy Theory (Selkirk 1980, 1984, 1986, Nespor and Vogel 1986, Hayes 1989, 1990, and others).

(1) Prosodic Hierarchy:

Φ	Phonological Phrase
Wd	Prosodic Word
F	Foot
σ	Syllable
μ	Mora

Our goal is to reassess the status of restrictions on layering from the vantage point of current phonological theory. The conception of a weakly layered hierarchy developed in this paper incorporates some of the more recent findings in metrical theory (Hayes 1991, etc.) and Prosodic Morphology (McCarthy and Prince 1986 et seq.) and is compatible with restrictive theories of the minimal word, the foot, and the syllable (section 3). While preserving the central insights and motivations of Strict Layering, the new conception has significant empirical advantages in crucial areas of prosodic structure assignment. We will concentrate on prosodic structure below the level of the prosodic word (1) - both for practical reasons connected with the focus of this investigation and because it is still unclear whether the higher echelons of the hierarchy are fully parallel to syllables, feet, and prosodic words in terms of their formal nature and their relations with respect to each other.[1]

Empirically, our investigation will focus on the structural and templatic properties of prosodic words in Japanese, a topic that has occupied a number of researchers in recent years.[2] In the course of our discussion, we will touch on several other issues in phonological theory, such as binary branching

[1] For discussion of the issues involved, see Kaisse 1985, Beckman and Pierrehumbert 1986, Selkirk 1986, Hyman, Katamba, and Walusimbi 1987, Inkelas 1989, and literature cited there. For a general overview, see the papers collected in Zwicky and Kaisse 1987 and Inkelas and Zec 1990.

[2] The work in question represents a wide range of perspectives and includes phonetically oriented research (Pierrehumbert and Beckman 1988, Kubazono 1989), prosodic-morphological studies (Poser 1984, 1990, Ito 1990, Mester 1990), analyses of language games (Tateishi 1989, Katada 1990, Haraguchi 1991, Ito, Kitagawa, and Mester 1992), psycholinguistic work (Kubozono 1985), government-based approaches (Yoshida 1991), and lexical-prosodic-phonological investigations (Ishihara 1989). The papers collected in Haraguchi (1992) represent a broad panorama of work currently pursued in Japan.

conditions (section 4), edge-based alignment requirements (section 5), and global constraints on the accessibility of phonological structure (section 6).

1 F*-templates and their limitations

Realized as a single heavy syllable or as a sequence of two light syllables, the bimoraic trochaic foot ($_F[\mu\mu] = \{_F[\bar{\sigma}], {}_F[\breve{\sigma}\breve{\sigma}]\}$) has been established as the Minimal Word (McCarthy and Prince 1986) for a wide variety of languages. After Poser's (1984a,b) initial demonstration that foot structure is present in Japanese, a language with a non-stress accent system (Beckman 1986), the bimoraic foot has turned out to play a pervasive role within Japanese prosodic morphology and phonology (Ito 1990, Ito and Mester 1991, Ito, Kitagawa, and Mester 1992, Kubozono 1989, McCarthy and Prince 1991a, 1991b, Mester 1990, Perlmutter 1992, Poser 1990, Tateishi 1989). The collective result of this research is a set of templates involving one or more foot constituents, i.e. statable as integer multiples of feet (henceforth "F*-templates").

Against this background, one of the perhaps most surprising empirical findings is the existence of a large class of templatic formations which are systematically beyond the reach of F*-templates. As first documented and analyzed in Ito 1990, the case in point involves the complex but highly systematic array of prosodic shapes of word clippings, a productive word formation pattern of contemporary Japanese (often involving shortened loanwords) which abounds with almost daily neologisms.[3] Many such truncations conform to the familiar single-footed (2a) or double-footed structures (2b).[4]

[3] Such truncations are by no means limited to loanwords and are known from earlier stages of the Japanese language. Thus Komatsu (1981, 172) points to word clippings attested from the Muromachi period (15th-16th century): *(o-)nasu* 'eggplant' *(<nasubi), (o-)kabu* 'turnip' *(<kabura), (o-)hiya* 'cold sake' *(<†hiyasi),* etc. (o- is a common honorific prefix).

[4] Our transcriptions are approximately phonemic and largely follow the *kuNreisiki* style of Romanization, with some minor modifications. Note in particular the following: ti = [t͡ʃi], tu = [t͡su], si = [ʃi], zi = [d͡ʒi], hi = [çi], hu = [ɸu]; 'Cy' denotes palatalized consonants; and N, the moraic nasal of Japanese, assimilating in place to following stop consonants (e.g. *seNbee* [sembe:] 'rice cracker').

(2) a. F-structures:

Wd	suto (raiki)	'strike'
|	hisu (terii)	'Hysterie (Ger.)'
F	rabo (ratorii)	'laboratory'
	nega (tibu)	'negatives'
	ope (reesyoN)	'operation'

b. FF-structures:

Wd	torikuro (roetireN)	'trichloro-ethylene'
	rihabiri (teesyoN)	'rehabilitation'
F F	koNbini (eNsu)	'convenience store'
	asupara (gasu)	'asparagus'
	baateN (daa)	'bartender'

The FF-structure is often found with shortenings of compounds (3); but the resulting shortenings are simplex unaccented words, and not compounds.

(3) Wd

F	F	
seku (syuaru)	hara (sumeNto)	'sexual harassment'
haN (gaa)	suto (raiki)	'hunger strike'
zii (Nzu)	paN (tu)	'jeans'
mayo (neezu)	dore (ssiNgu)	'mayonnaise dressing'
fami (rii)	koN (pyuutaa)	'family computer
zyapa (N)	reN (ta kaa)	'Japan Rent-a-Car'
aka (saka)	puri (Nsu)	'Akasaka Prince (Hotel)'
oba (saN)	buru (zyoa)	'aunt bourgeois"

Closer inspection reveals, however, that the typology of output shapes is significantly richer than what examples like (2) and (3) might lead us to expect. As Ito 1990 shows in detail, a statement like "*x* is a licit loanword shortening iff the size of *x* is F or FF" goes wrong in both directions.

First, the paradigm contains a systematic gap: One of the two types of single-F-structures is entirely absent, namely monosyllabic feet. As (4) shows, such forms are impossible as word clippings (compare the licit single-F cases repeated in (21), which all consist of two light syllables.)

(4) Problem 1: Monosyllable ban

Wd	*dai (ya mondo)	'diamond'
|	*koN (bineesyon)	'combination'
F	*paa (maneNto)	'permanent (wave)'
|		
$\bar{\sigma}$		

Second, there is an additional output pattern intermediate in size between 1F (2a) and 2F ((2b), (3)). These are trimoraic clippings as illustrated in (4), consisting of a bimoraic foot (a heavy monosyllable (5a) or two light syllables (5b)) plus one additional light syllable.

(5) Problem 2: "1½F"

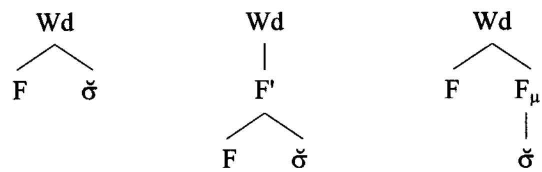
a.	Wd	daiya	(moNdo)	'diamond'
		paama	(neNto)	'permanent (wave)'
	F	koubi	(neesyoN)	'combination'
	|	siNpo	(ziumu)	'symposium'
	$\bar{\sigma}$ $\breve{\sigma}$	appe	(Ndizitisu)	'Appendizitis' (Ger.)
b.	Wd	terebi	(zyoN)	'television'
		basuke	(tto)	'basket'
	F	domesu	(tikku)	'domestic'
		arumi	(nyuumu)	'aluminum'
	$\breve{\sigma}\breve{\sigma}$ $\breve{\sigma}$	anime	(esyoN)	'animation'

The first problem, the monosyllable ban, has so far received little attention in the theoretical literature on Japanese, beyond direct statements encoding the observation, as in Ito (1990, 222). But research on minimal word effects over the last years has turned up a number of similar cases in other languages. Examples from the literature include Turkish (Ito and Hankamer 1989), Axininca Campa (Spring 1990a, 1990b, Black 1991), Cantonese familiar names (Yip 1992), Chibemba (Hymen 1992), and Ojibwa (Piggott 1992). One of the goals of this paper is to show that the monosyllable ban (4) is not an isolated fact, but is intrinsically connected to the second problem outlined above in (5) (through a configurational binarity requirement explored in section 4 below).

It is this second problem, the existence of "1½F"-structures, that has come under considerable theoretical scrutiny in recent years (McCarthy and Prince

1991a, 1991b, Ito and Mester 1991, and Perlmutter 1992). Approaching the issue from a general perspective and generalizing beyond particular proposals, we can distinguish three types of solution. The alternatives will be referred to as the weak layering (or F$\breve{\sigma}$-) theory (6a) (tacitly adopted in (2)-(5) above for expositional purposes), the superfoot (or F'-) theory (6b), and the degenerate foot (or FF-) theory (6c).

(6) a. Weak Layering Theory(F$\breve{\sigma}$): b. Superfoot Theory (F'): c. Degenerate Foot Theory (FF):



Structures like (6a), while minimal in terms of structural complexity, violate the Strict Layer Hypothesis (Selkirk 1984) of standard prosodic theory, which does not permit syllables to be immediately dominated by a Wd-node, without an intervening foot node. We will return to this issue in section 2, which develops a conception of Weak Layering where structures like (6a) find a natural place.

The superfoot theory (6b) and the degenerate foot theory (6c) constitute different attempts to mold trimoraic structures into strictly layered representations. The superfoot theory (6b) responds to the problem by enriching the prosodic hierarchy with a higher-level footlike constituent F' (here dubbed 'superfoot'), an idea that goes back to earlier proposals in metrical phonology (see Prince 1980, Selkirk 1980, and McCarthy 1982, among others).[5] We can think of the superfoot as being characterized by a rule "$F' \rightarrow F+\breve{\sigma}$" (with the option of adding further expansions). The superfoot restores uniform layering by incorporating the categorial nonuniformity of the string "Fσ" in its very definition. As a result, every syllable of the trimoraic form is now immediately dominated either by F' or its daughter F, an ordinary bimoraic foot. The core of this proposal is that the superfoot must be

[5] A related idea is a direct extension of the trochaic foot inventory by allowing trimoraic feet with the structure [$\bar{\sigma}$ $\breve{\sigma}$] -but even a [$\bar{\sigma}$ $\breve{\sigma}$] foot is insufficient to cover [$\breve{\sigma}\breve{\sigma}\breve{\sigma}$] (see Ito 1990 and Prince 1990 for discussion).

recognized as a genuine additional prosodic category, intermediate in size between F and Wd in the prosodic hierarchy and of a janus-faced nature in that it can dominate both F and σ. In order to be more than a way of upholding Strict Layering, it seems clear that the superfoot theory (6b) would need independent motivation, by demonstrating that the new prosodic constituent F' also plays a role in longer forms, where it would not be coextensive with the whole word.

The degenerate foot theory (6c) takes the opposite tack and ensures uniformity of layering by analyzing the extra light syllable as a suprasyllabic prosodic constituent all by itself. As proposed by Perlmutter 1992, the most direct way of implementing this is to regard it as another foot, defined as monomoraic ("F_μ"). Here the doctrine of Strict Layering is being upheld not by postulating an additional higher constituent F', but by extending the typology of feet downwards. The resulting FF_μ-template, however, faces troublesome questions regarding the status of the monomoraic foot. The problem is that the degenerate foot is here being admitted not just as marginal 'last resort' expansion, as in other approaches to foot typology (see e.g. Hayes 1991), but as a full-fledged element of the foot inventory that can be called on *as such* in templatic constraints. This kind of situation is to our knowledge otherwise uninstantiated (see section 5 for further discussion).

Compelling evidence in favor of the weak layering theory (6a) will emerge in the sections below. It turns out that central generalizations would be missed if the additional light syllable in trimoraic forms were treated either as belonging to higher foot-constituent F' (6b) or as an independent monomoraic foot F_μ (6c). Only the weak layering theory (6a) accounts for all of the evidence, and it becomes a viable option once the formal properties of prosodic representations are properly understood.

2 The Prosodic Hierarchy and Weak Layering

While a hierarchical organization of prosodic categories as in (7) has received ample support and continues to be a theoretically fruitful hypothesis in current work, the same cannot be said of the laws governing the construction of phonological representations out of the units of the hierarchy.

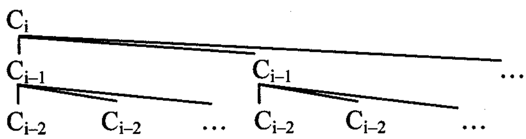
(7)

Wd Prosodic Word
|
F Foot
|
σ Syllable
|
μ Mora

What remains to be reevaluated here is the status of the Strict Layer Hypothesis (Selkirk 1984), which holds that every prosodic constituent must be exhaustively dominated by a constituent of the immediately superordinate type.

(8) Strict Layer Hypothesis (Selkirk 1984, 26)
A category of level i in the hierarchy immediately dominates a (sequence of) categories of level *i*-1.

Letting "C_i" stand for a prosodic constituent of hierarchical level *i*, (counting upwards from the lowest level, i.e., $\mu = C_1$, $\sigma = C_2$, etc.; C_{max} denotes the highest constituent), phonological representations consistent with (8) must be exclusively built up out of neatly layered patterns of the general kind depicted in (9).

(9)


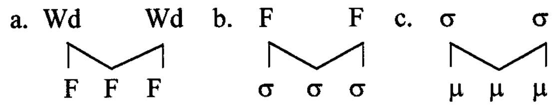
Nespor and Vogel (1986, 7) are careful to point out that the usual understanding of Strict Layering amounts to a conjunction of two assumptions, here restated as (10a and b).

(10) a. **Proper Bracketing**: Every C_j ($\neq C_{max}$) has one and only one mother node (i.e., a given prosodic constituent cannot simultaneously be part of two or more higher prosodic constituents).

b. **Strict Succession:**[6] Every C_j ($\neq C_{max}$) is immediately dominated by C_{j+1} (i.e., category levels are never skipped).

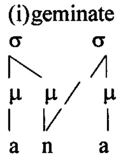
[6] This X-bar-theoretic term is borrowed from Kornai and Pullum (1990, 28-29).

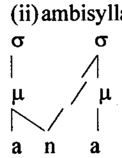
(10a) and (10b) are clearly independent constraints on tree form within the standard theory (we use this term to loosely refer to the family of all theories that subscribe to some version of (10)). Proper bracketing (10a) is widely accepted as valid: No prosodic tree counts as wellformed which contains subconfigurations as in (11a-c). Feet are never shared between prosodic words, syllables are never 'ambipodal', nor are moras ever ambisyllabic.[7]

(11)


Strict Succession (l0b), on the other hand, has been a controversial assumption. Any theory of prosodic trees must exclude structures as in (12), where moras act as independent elements immediately dominated by the Wd node, and (l0b) certainly rules out such structures.

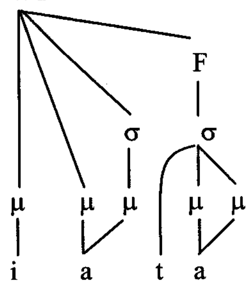
[7] Note that this implies nothing with respect to the general question of (segment) ambisyllabicity. The formulation in (l0a) prohibits overlap within prosodic structure proper, but does *not* require that prosodic constituent structure always impose a proper bracketing on the associated melodic string. In a moraic conception of the skeleton (as the interface between syllables and melody elements), where onsets do not project prosodic positions (see e.g. Hyman 1984, McCarthy and Prince 1986, Zec 1988, Hayes 1989, and Steriade 1991 for different implementations), melodic overlap is in fact the distinguishing characteristic of geminate structures (see (i), where orthographic a and n stand in for root nodes of feature-geometric structures). The (prosodic) domination relation defining constituentship and the (autosegmental) association relation interpreted as temporal coordination are two fundamentally different formal relations; only the former, but not the latter, obeys proper bracketing. As an interesting side result, we note that (lea) is fully compatible with a Kahnian conception of ambisyllabicity (Kahn 1976), as illustrated in (ii):

(i)geminate consonant:


(ii)ambisyllabic consonant:


Just as the geminate structure in (i), the ambisyllabic structure in (ii) shows melodic overlap, but not prosodic overlap in the sense of (l0a). The conceptual argument from "improper bracketing" sometimes found in earlier discussions of ambisyllabicity (Kiparsky 1979, Selkirk 1982, van der Hulst and Smith 1982, and Borowsky, Ito and Mester 1983, among others) is therefore without force here. See Gussenhoven 1986 for some empirical arguments in favor of Kahnian ambisyllabicity.

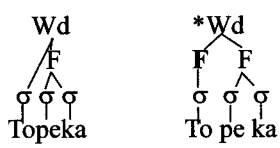
(12)



But there are many indications that (10b) overshoots the mark by burdening prosodic trees with unmotivated constituent structure. As a result, certain kinds of non-uniform configurations which are empirically well-motivated are simply unattainable under Strict Succession.

In particular, there is significant evidence that the foot level does not always constitute a uniform and uninterrupted layer of F-nodes underneath Wd (McCarthy and Prince 1991a,b). Pierrehumbert and Beckman (1988, 147-149) have argued for surface extrametricality in cases like *Topeka* (13), where the (unstressed) initial syllable must remain unfooted (13a); crucially, it does not constitute a foot as in (13b) (see Nespor and Vogel (1986, 91-92 and 98), where footings as in (13b) are posited in order to comply with the Strict Succession clause of Strict Layering).

(13)



Besides general Occam's-razor-type considerations militating against unmotivated structure, such examples show that Strict Succession (l0b), while excluding unwanted structures like (12), in fact obscures prosodic form in important respects. A parallel case are trimoraic Japanese words as in (14) (see the examples in section 1). We will argue that the only structure that correctly captures their phonological characteristics is (14a), where the final light syllable is an immediate daughter of the Wd-node and not part of any foot.

(14) a.

What is needed, then, is a conception of layering that admits non-uniformly-layered structures like (13a) and (14a) while continuing to exclude unwanted structures like (12). Our proposal begins with the observation that within the theory of Prosodic Licensing (Ito 1986, 1989, Goldsmith 1990, and others), layering requirements, strict or otherwise, can be viewed as licensing requirements. Strict Layering amounts to the position that a constituent can be prosodically licensed only by a constituent of the next higher level.[8] In our conception, the actually observed licensing requirements governing prosodic constituents are the result of the interplay of several partially independent principles, discussed in turn as **mora confinement** (15), **proper headedness** (17), and **maximal parsing** (18).

At the lowest levels of prosodic organization, that of moras and syllables, we find that Strict Layering in fact holds true. On the strength of the arguments for exhaustive syllabification (developed in the literature concerned with segment deletion and epenthesis as syllabification-induced effects, see Selkirk 1981, Broselow 1982, 1992, Steriade 1982, Levin 1985, Ito 1986, among others), it is reasonable to assume that moras can only exist as parts of syllables.[9] This is stated in (15).

(15) **Mora Confinement:** μ is licensed only by σ.

What is special about the Strict Layering assumption of the standard theory is its projection of the particular relationship holding between moras and syllables onto all higher prosodic levels. It turns out, however, that the relationship of syllables to feet is significantly different: It is not at all true that syllables can only exist as parts of feet. Recent work in metrical theory has converged on a tightly constrained universal inventory of foot shapes (see

[8] Similar considerations regarding Prosodic Licensing and Strict Layering are found in Inkelas 1989, 334-344.

[9] But see Bagemihl 1991 for a partially different view, with important supporting evidence. The effects of more confinement might conceivably extend beyond licensing, see section 4 for discussion.

Hayes 1991 for a comprehensive proposal). For example, in the case of Japanese, previous research has accumulated an impressive amount of evidence for a strictly bimoraic foot (most extensively documented in Poser 1990). By their very definition, such feet cannot exhaustively parse arbitrary sequences of syllables, but must result in certain light syllables remaining unfooted. Word structures with unfooted syllables like $_{wd}[\breve{\sigma}\ [\bar{\sigma}\ ]]$ or $_{wd}[\ [\bar{\sigma}]\breve{\sigma}[\bar{\sigma}\ ]]$ must be made available simply to account for the existing words of the language. This holds for the native lexicon and is particularly evident from longer monomorphemic loanwords *(katakanago),* which can consist of heavy and light syllables with few, if any, restrictions on their relative order. Even a random perusal of the first pages of a standard *katakanago* dictionary turns up a host of such words:

(16)	appu	'up'	akoodo	'accord'
	atomu	'atom'	aabento	'evening' (Ger. Abend)
	awaa	'hour'	aatisaN	'artisan'

If the Japanese foot is strictly bimoraic, such examples contain unfooted light syllables that are prosodically licensed by the word and not by a canonical foot.[10] (We will return to this issue immediately below in the context of Maximal Parsing (18).)

(17) **Proper Headedness:** Every (nonterminal) prosodic category of level i must have a head, that is, it must immediately dominate a category of level $_{i-1}$.

As a minimal wellformedness condition governing all prosodic constituents, we propose Proper Headedness (17), a structural requirement with parallels in other areas of linguistic theory. Every prosodic constituent must have a head, here defined as an immediately dominated category of the immediately

[10] It is an independent question whether there is a late process of "Stray Adjunction" that freely adjoins all unfooted syllables to adjacent feet, as postulated in earlier versions of metrical theory (Hayes 1980) and recently reiterated in Kager 1992, where a distinction is posited between 'parsing' feet and 'surface' feet. We find the evidence for such Stray Adjunction weak at best and concur in this respect with the conclusions in Hayes 1991 and Halle and Kenstowicz 1991. In any event, in a word like *aatisaN* the medial syllable *ti* is not licensed by a canonical bimoraic foot, even if stray adjunction were to take place at some point in the derivation.

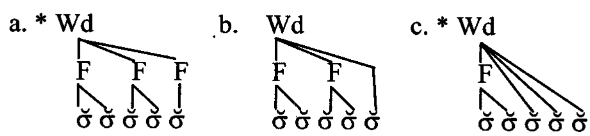
subordinate prosodic rank (we are leaving open the possibility of recursive structures, where head and mother node are categories of the same rank). Thus every Wd must contain at least one F, every F at least one σ, every σ at least one μ. In this conception, the hierarchical layering need not be uniform at every level, and representations like (14) are fully wellformed. The minimal word effects demonstrated in McCarthy and Prince (1986) and numerous subsequent studies are consequences of (17): If every Wd must contain F qua headedness, then any minimality condition on F carries over to Wd (see sections 3 and 4 for further discussion). In other words, if feet must be bimoraic, so must words, etc.[11]

Once the existence of unfooted syllables within the prosodic word has been recognized, the possibility of longer sequences of unfooted syllables has to be considered. In our conception, the satisfaction of headedness has the status of a **minimal** requirement; within prosodic phonology, it is complemented by a principle that forces the building of further structure. Our guiding assumption is that prosodic structures are optimal to the extent that they are maximally parsed, with all footable syllables grouped into feet, etc. As formulated in (18), the maximal parsing requirement recaptures the essence of the Exhaustive Parsing Constraint of Selkirk (1986, 384) and other proposals in a similar vein.[12]

(18) **Maximal Parsing:** Prosodic structure is maximally parsed, within the limits imposed by other (universal and language-particular) constraints on prosodic form.

Consider the representations in (19) (modeled on the situation in Japanese), all based on a string of five consecutive light syllables.

(19)



[11] This kind of argument appears first in Prince (1980, 535).

[12] (18) is a wellformedness condition on prosodic structures that remains in force throughout the derivation, and not a condition on the application of particular rules or algorithms; but it should be noted that it is closely related to algorithm-oriented approaches like the Exhaustivity Condition of Halle and Vergnaud (1987, 15) or the Strict Parsing Condition of Inkelas (1989, 334-344).

The representation (19a) (that would be forced by Strict Layering) contains an illicit monomoraic foot and is ruled out as a violation of foot minimality. (19b) and (19c) fulfill foot wellformedness, but leave certain syllables unparsed. The status of the unparsed syllables, however, is very different in the two cases. In (19b), the final unparsed syllable, being monomoraic, cannot support a foot on its own. On the other hand, two of the unparsed syllables in (19c) could potentially form a foot. We hypothesize that this difference is precisely the reason why a representation like (19c) is always inferior to the more fully footed alternative (19b), and hence excluded.[13]

Different from Strict Succession (l0b), Maximal Parsing (18) is not an absolute requirement that automatically rules out all representations containing a configuration where a constituent C is immediately dominated by C_{i+2} (instead of C_{i+1}), like (19b): Optimization is not absolute, but always relative to other constraints on prosodic form, as defined by foot theory and other modules of phonological theory. This is why structures as in (14) above are admitted. At the same time, foot-wise underparsed structures like (19c) are excluded since a more fully footed alternative structure (19b) is readily available.

Maximal Parsing (18) sets an optimization target for prosodic well-formedness or "better-formedness"); as such, it finds a natural place in the optimality-theoretic approach to phonology developed by Prince and Smolensky (1991, 1992), see also Goldsmith (1991, 1992). Besides cases of foot-wise underparsing, as in (19c), (18) is also intended to account for another general property of prosodic structure that motivated Strict Layering: While unfooted syllables are in general possible and must be admitted, it is still true that they are disfavored in many circumstances. Thus structures like (20) are not optimal by virtue of having an unfootable light syllable trapped between feet.

(20) Wd

F σ F

Recent work (see for example Hayes 1992, Mester 1992, and Prince 1990) has turned up a number of strategies (like lengthening, shortening, deletion, etc.) that

[13] Except if in particular circumstances the number of feet were limited to a single one by an independent and overriding requirement, see Blevins 1990 for discussion.

languages invoke in order to avoid unfootable light syllables and to achieve contiguous footing. It is precisely the unfooted status of such syllables that leads to an understanding of their behavior. In such cases, then, (18) is enforced in a 'structure-changing' and not merely 'structure-filling' way. Along these lines, we can differentiate between a (weaker) general version of Maximal Parsing ("parse everything parsable") and a stricter version ("parse everything").

It is important to distinguish such prosodic improvement strategies demonstrably at work within the lexicon from the somewhat broader range of structures populating the existing lexicon (see e.g. (16) above). A theory of prosodic structure is adequate only to the extent that it successfully deals with both issues. We hope to get closer to this goal by incorporating a principle like (18) as an optimization target, leaving its further development (and integration into the context of optimality-theoretic phonology) for future research.

For expository purposes, we will henceforth refer to the ensemble of assumptions constituted by (15), (17), and (18) as WEAK LAYERING. It would be a mistake to view Weak Layering as a theory that is trying to deny the main tenets of Strict Layering - many of them remain valid, if only as approximations. Where Strict Layering insists on a single immutable law of structure, Weak Layering differentiates sharply between the absolute and inviolable requirement of Headedness (17) and the optimization target of Maximal Parsing (18). Weak Layering, we submit, provides prosodic theory with the right amount of flexibility that is necessary for an explanatory and at the same time descriptively adequate account of the facts.

To illustrate the concrete results of our discussion, consider (21) and (22). In terms of Weak Layering, the structures in (21) are all wellformed since Wd dominates a head of the appropriate immediately subordinate type ("F") and Maximal Parsing is observed; the structures in (22), in contrast, all fail to satisfy Weak Layering: (22a) is headless (Wd does not dominate F) and in addition violates Maximal Parsing; (22b) fulfills Headedness but violates Maximal Parsing; and (22c) violates Headedness while being compatible with the general ('structure-filling') version of Maximal Parsing.

```
(21)  a.  Wd      b.  Wd      c.  Wd
           |          / \         / \
           F         F   σ̆       F   F
```

(22) a. Wd $\breve{\sigma}\ \breve{\sigma}$ b. Wd $F\ \breve{\sigma}\ \breve{\sigma}$ c. Wd $\breve{\sigma}$

The fact that the representations in (21) now count as fully wellformed is important for the Japanese word clippings, because precisely these three word structures (F, F$\breve{\sigma}$, and FF) constitute the overwhelming majority of clippings (98.5% of the database discussed in Ito (1990, 217 and 221)).

Regarding the basic prosodic target of all word clippings (cf. (21a-c)), Weak Layering allows for a much simpler answer than the one given in Ito 1990 and subsequent work: They must be well-formed PROSODIC WORDS, nothing more and nothing less. As such, they must minimally contain one foot (by Headedness (17)), but they are free to contain more material, as long as Maximal Parsing (18) is obeyed. This is virtually the null hypothesis and requires no extra stipulation, since it holds for all words within the language, and it opens up the right array of structures. The unity of the various truncation results would be missed if already at this basic level of analysis the cases were split into a multitude of templates: There is simply no single species of prosodic words (minimal or otherwise) that could be invoked to cover e.g. both bimoraic and fourmoraic forms.

Word clippings indeed possess a number of special properties observed in Ito (1990) that do not automatically flow from the 'null hypothesis' (i.e. that they must constitute prosodic words): almost trivially, they tend to be short; less trivially, they display asymmetries of structure that call for an explanation. The reintroduction of case-specific templates built out of different prosodic categories would be a non-explanation in this case, since the additional constraining factors hold across all kinds of clippings and do not even involve individual prosodic categories: They are either of a more abstract configurational nature (binary branchingness, see section 4) or concern the edge alignment of different prosodic categories (see section 5).

As in many other areas, it turns out to be a mistake to try to formulate one complex condition or template to encode all restrictions. Far superior is a modular approach that appeals to independently motivated principles, seeking to explain the observed patterns as the result of their interactions. Before turning to these topics, the next section develops in somewhat more detail the implications of Weak Layering for the macrostructures of prosodic words.

Comparing the central predictions with those of Strict Layering, we will introduce evidence that argues in favor of the weakly layered structures.

3 Minimal versus Supraminimal Word.

Minimal word theory (McCarthy and Prince 1986) and the weak layering conception of the prosodic hierarchy are intimately connected.

(23) $_{\mathrm{Wd}}[\cdots F\cdots\ F\cdots F\cdots\quad \ldots]$

The general form of a prosodic word is illustrated in (23): a sequence of feet (minimally one, because of Proper Headedness (17)), and without a fixed upper limit) potentially interspersed with unfooted material (here represented by "..."). Maximal Parsing (18) restricts such unfooted domains to single light syllables.

In Weak Layering, a prosodic word is minimal, in the most general sense, if it fulfills Proper Headedness minimally. We define a MINIMAL (PROSODIC) WORD as in (24).

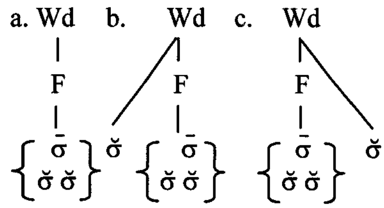
(24) **MinWd** $=_{\mathrm{def}}$ a prosodic word whose foot layer contains only one element.

The general form of a minimal prosodic word is therefore as in (25). All prosodic words that are not minimal in terms of (24) are SUPRAMINIMAL.

(25) $_{\mathrm{Wd}}[\cdots F\cdots]$

Within the class of minimal words, Weak Layering captures the important distinction between STRICT MINIMAL WORDS and LOOSE MINIMAL WORDS introduced by McCarthy and Prince 1991a, 1991b: The strict version contains one foot and nothing else (26a); the loose version, while also restricted to one foot, in addition allows for unfooted material (26b), again restricted to light syllables by Maximal Parsing (18). We will argue, following McCarthy and Prince 1991, that the 'loose' (26b) is precisely where the Japanese trimoraic forms fit in.[14]

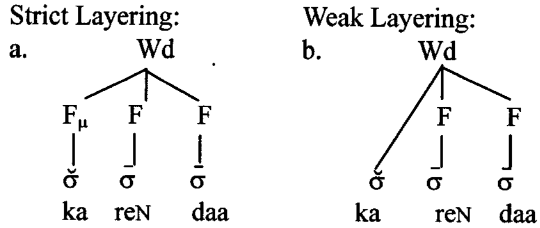
[14] McCarthy and Prince 1991 show that structures as in (26b) play an important role in a number of other cases, including Ponapean reduplication and Cupeño Habilatives.

(26) 

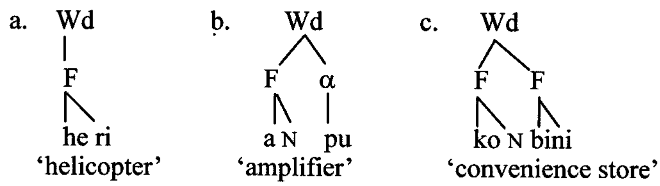
In terms of Weak Layering, the loose minimal word is simply the minimal word, as generally defined in (24). The strict minimal word is obtained by excluding unfooted material (i.e. by enforcing the strict version of Maximal Parsing (18)). Cases of 'necessarily loose' minimal words, where only trimoraic structures (26b) and no bimoraic structures (26a) are admitted, arise from a separate maximization factor (see Ito, Kitagawa, and Mester 1992 for an example; the analysis of Ponapean in McCarthy and Prince 1991a, 1991b also involves maximization in the syllable weight dimension).

Compared with Weak Layering, the word structures predicted by Strict Layering are characterized by rigorous uniformity. Here a prosodic word must be pure sequence of feet (i.e. "..." in (23) and (25) must always be empty). Since a minimal prosodic word consists of nothing besides a single foot, this admits only (26a) - every other word structure is supraminimal. Since Strict Layering means that syllables must be footed in all circumstances, the distinction between strict and loose minimal words becomes vacuous. Herein, as we will see, lies the weakness of Strict Layering and of analyses based on it.

As already discussed in section 1, in order for the limited inventory of word structures allowed for by Strict Layering (i.e. $_{Wd}[F^*]$) to establish contact with the empirical facts of the Japanese lexicon, the typology of licit foot types must be extended by admitting monomoraic feet. Otherwise countless words of Japanese would receive no representations. (27) contrasts the structures assigned to an example like *kareNdaa* 'calendar': Where Strict Layering restores uniformity by interpolating a subminimal monomoraic foot (27a) between $\breve{\sigma}$ and Wd, Weak Layering leaves the initial light syllable unfooted (27b): This results in different word structures: three feet in (27a) vs. two feet in (27b).

(27)


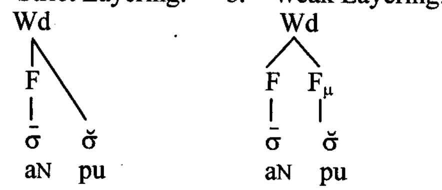
In this section, our primary concern is not with foot minimality per se. We will instead focus on the related but separate issue of the prosodic macro-structures assigned by the two theories. These structures contrast particularly sharply in the case of word clippings, as illustrated in (28).

(28)


A bimoraic form like [*heri*] (28a) is a minimal word, and a fourmoraic form like *[koNbini] (28c)* is a supraminimal word in either theory. But the status of trimoraic forms like [*aNpu*] (28b) diverges: In Weak Layering (29a), they are minimal words because the foot layer contains only one element, and $\alpha = \breve{\sigma}$. In Strict Layering (29b), they are supraminimal because the extra material beyond the bimoraic F must also be represented as an F-level element (hence $\alpha = F_\mu$). Such a major discrepancy in prosodic type ought to have some consequences, allowing us to put the two theories to an empirical test.

The prosodic type question is partially independent of the issue of subminimal monomoraic feet. Whereas Strict Layering virtually entails the existence of such feet (cf. (27a) and (29b)), Weak Layering is by no means committed to their nonexistence. Such elements could easily be accommodated as a degenerate option if compelling evidence for them were to emerge (perhaps a rather remote possibility in light of some recent work, like Kiparsky's (1992) catalexis). But even admitting them into Weak Layering Theory would by no means entail invoking them for every syllable left unparsed by canonical minimality-respecting footing (see Hayes 1991 for detailed discussion of such issues). We would still be left with the prosodic type question whether (29a) or (29b) is the correct structure for a word like *aNpu*.

(29) a. Strict Layering: b. Weak Layering:



Evidence for the minimal word status of trimoraic Fσ̆-structures comes from the Japanese reversing argot *zuuja-go* analyzed by Tateishi 1989 and Ito, Kitagawa, and Mester 1992 from the perspective of prosodic morphology (what follows is a brief summary of the main results of the latter study). The output patterns of *zuuja-go* fall into two categories, depending on the size of the input: If the input is less than or equal to three moras, the *zunja-go* output is an Fσ̆-structure (30a); and if the input is equal to or larger than four moras, the output has an FF structure (30b).

		INPUT		ZG-OUTPUT		
(30) a.	≤	3μ:		F +	σ̆	
		1μ	me	ee	me	'eyes'
		1μ	hi	ii	hi	'fire'
		2μ	zyazu	zuu	zya	'jazz'
		2μ	mesi	sii	me	'food'
		3μ	beesu	suu	be	'base'
		3μ	piyano	yano	pi	'piano'
b.	≥	4μ:		F +	F	
		4μ	koohii	hii	koo	'coffee'
		4μ	ikebana	bane	ike	'flower arrangement'
		5μ	maneezyaa	zyaa	mane	'manager'
		5μ	rekoodea	daa	reko	'recorder'
		6μ	toroNbooN	boN	toro	'trombone'

Two central observations can be made about (30): First, trimoraic inputs pattern with unambiguously minimal (1μ, 2μ) inputs (30a) and not with unambiguously supraminimal inputs (30b); for example, *beesu* (3μ) is treated like *mesi* (2μ) and unlike *kochii* (4μ). Second, the outputs converge into two types of patterns: Fσ̆ (30a) and FF (30b).

The key principle operative here is the preservation of prosodic type. *Zuuja-go* is type-preserving in the sense that underneath all the prosodic and segmental changes that may occur upon reversal, something remains invariant: Minimal words remain minimal, and supraminimal words remain supraminimal.[15] In order to be subsumed under this simple generalization, trimoraic Fσ̆-structures must constitute minimal words both in the input and in the output. This constitutes an argument that the basic prosodic type of trimoraic words is that of minimal words, as predicted by Weak Layering (24) and McCarthy and Prince's (1991a,b) notion of a loose minimal word. Regarding them as supraminimal FF-structures, as predicted by Strict Layering and analyses based on it, amounts to a miscategorization.

4 Word Binarity

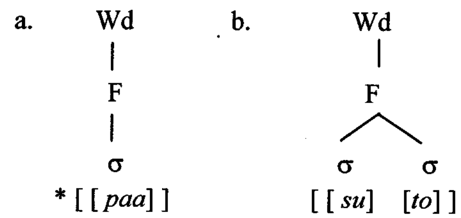
4.1 The Binary Branching Requirement

Recall that the prosodic typology of Japanese word clippings raised two simultaneous challenges for F*-templates: Besides the existence of a richly populated class of foot-wise recalcitrant trimoraic forms like *daiya,* now properly classified as minimal word structures of the form Fσ̆, there is also the absence of monosyllabic single F-clippings like **paa* (31a) (cf. *paamaneNto* 'perm'), foot-wise equivalent to the numerous bisyllabic single F-clippings like *suto* (31b) 'strike').

The crucial difference, we suggest, lies *not* in the direct syllable count (as in Ito 1990, 222), but in the configurational criterion of branchingness: the foot is branching in (31b) but not in (31a). We formulate this branchingness condition as a general word structure requirement (32).

[15] For details regarding the operation of *zuuja-go* reversal, the reader is referred to Ito, Kitagawa, & Mester 1992, where the uniform Fσ̆-form of minimal word outputs (often implemented by vowel lengthening) is analyzed as an instance of output maximization.

(31)



(32) **Word Binarity:** P-derived words must be prosodically binary.

The term 'p-derived words' refers to lexical items related to other, more basic words by means of prosodic-morphological operations, and takes up the notion of derivedness shown in Ito 1990 (cf. also Kiparsky 1991) to be crucial in delimiting the scope of minimality conditions.

The idea of Word Binarity (32) revives, to a limited extent and in a different context, the notion of branchingness that played a central role in early versions of Metrical Theory (Prince 1976, Liberman and Prince 1977, Selkirk 1980, McCarthy 1979, Halle and Vergnaud 1978, Hayes 1980, and others). In these works, tree-labeling rules like the Lexical Category Prominence Rule ("In a pair of sister nodes $[N_1N_2]$, N_2 is strong iff it branches", see Liberman and Prince 1977) carried the main analytical burden, coupled with general constraints on tree geometry requiring uniform (left- or right-) branching. Subsequent research developed decisive arguments against this kind of approach and resulted in a theory built instead on End Rules (Prince 1983) and a substantive inventory of feet as rhythmic elements (Hayes 1987, McCarthy and Prince 1986; see Kager 1989 and Hayes 1991 for recent synopses).

While tree-geometric branchingness conditions thus no longer play the central role once assigned to them, it would be premature to conclude that they have no place whatsoever in prosodic theory. For higher-level prosodic categories like the phonological phrase, a branching parameter has been motivated in Cowper and Rice 1987 for Mende (but see also Hayes (1990, 99-100)) and in Bickmore 1990 for Kinyambo (see in particular Bickmore (1990, 15) for the proper notion of branchingness involved). We will here argue that binary branching also plays a crucial role at the word level.

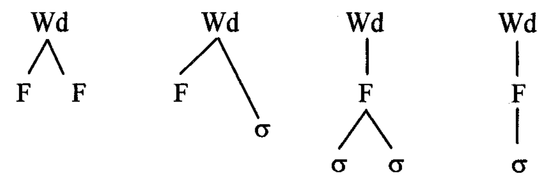
For the Word Binarity requirement (32), a monosyllabic foot like (31a) $^*{}_{\mathrm{wd}}[_{\mathrm{F}}[_{\sigma}[\mathit{paa}]]]$ counts as structurally unary (and hence fails as a clipped form), whereas a bisyllabic foot like (31b) ${}_{\mathrm{wd}}[_{\mathrm{F}}[_{\sigma}[\mathit{su}]_{\sigma}[\mathit{to}]]]$ 'strike' is structurally binary (and therefore a wellformed clipping). In other words, syllable-internal branching (i.e. bimoraicity) does not count for (32); only suprasyllabic branching is visible for such word-level conditions. We state this inaccessibility of syllable-internal structure in (33). We suspect that (33) is not a separate principle, but rather a consequence of more fundamental constraints. In section 6, we will explore the possibility of deriving the effects of Syllable Opacity from a general locality constraint on the accessibility of internal prosodic structure.[16]

(33) **Syllable Opacity:** Syllable-internal structure is opaque for word-level conditions.

What makes Word Binarity (32) more than a replacement for the monosyllable ban of Ito 1990 is that is has much more far-reaching effects. First, it is a remarkable fact that every licit instance of clipping contains a configuration with binary branching: the FF-structure (34a) and the F$\breve{\sigma}$-structure (34b) exhibit binary branching at the Wd-level; the bisyllabic F-structure (34c) branches at the F-level; word binarity fails only when there is unary structure all the way down to the syllable level (34d).

[16] An alternative possibility would be the more radical one of denying the mora the status of a structural unit in the prosodic hierarchy, whose terminal element would then be the syllable. In some sense, such an outcome would not be entirely surprising, given that the evidence for moras as constituents (and domains) is not as robust as that for syllables and feet (see Levin 1988, McCarthy and Prince 1986, Nespor and Vogel 1986, and Steriade 1991). From such a perspective, moras would count for weight without constituting autonomous structural units (see also the discussion in section 2 regarding Mora Confinement); and they would not be directly accessible to operations like extrametricality rules or prosodic circumscription. But this conforms neither to much of current theory nor to well-established analytical practice: Thus Lombardi and McCarthy (1991, 67) show that the circumscriptional computation of the Choctaw y-grade must crucially involve the extrametricality of initial moras (interacting with more prefixation, as the latter applies to the result of mapping the melodic content of a circumscribed iambic foot to an iambic template). It is an open question whether all such direct manipulations of moraic structure can be reduced to higher-level operations with moraic effects. We will return to some of the issues involved in section 6.

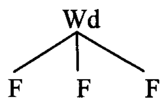
(34) a. b. c. d.



e.g.: *[seku][hara]* *[paa][ma]* *[[su][to]]* **[[paa]]*
cf.: (3) (5) (2) (4)

In the general case, a word binarity condition like (32) functions only as a minimality requirement (see the discussion at the end of this section). But for Japanese clippings, it simultaneously acts as a maximality condition, such that only strictly bipartite word structures are admitted.[17] Thus it rules out not only unary structures (34d), but also structures with a degree of branching higher than binary. For example, it straightforwardly accounts for the unacceptability of ternary FFF-structures like (35), which would e.g., be admitted by the simplest theory based on F*-templates.

(35)



*koN bini eN (su)
cf. koN bini (38)

Notice that invoking a minimal word template for clippings is not a viable alternative here because of the existence of supraminimal FF-clippings. The only templatic requirement for clippings is that they must be wellformed prosodic words (the 'null hypothesis' discussed at the end of section 2). Coupled with Word Binarity (32) (and the Left Edge Matching requirement to be discussed in section 5), this directly derives all and only the correct structures.

One could attribute the nonexistence of shortenings as in (35) to a functional motive - after all, the whole point of truncation is to make words shorter - but

[17] As H. Kubozono has pointed out to us, strictly binary word structures conceivably have real functional advantages in ensuring a certain degree of structural and melodic parallelism between the shortened form and its source word, aiding the language user in the by no means trivial task of establishing the right correspondence.

we should still not overlook the fact that we do not find examples of three-footed shortenings or of any other conceivable ternary structure, e.g. shortenings with two feet plus an extra syllable, as in (36).

(36) Wd Wd

F F σ̆ F σ̆ F
*asu para ga (su) *koN bi nee (syoN)
cf. koN bi

Even among fourmoraic forms, word structures with ternary branching are not attested (37).

(37) Wd
σ̆ F σ̆
*de mo N su (toreesyoN)

Such forms have no analysis as two feet because of syllable integrity (*[demo] [Nsu]). The heavy syllable [*moN*] automatically projects a bimoraic foot and the two flanking light syllables result in an overall ternary branching structure.[18]

The binary branching requirement captures Ito's (1990) generalization that the ban on monosyllabic feet holds only for words consisting of nothing but a single foot, and does not extend to longer words. As illustrated in (38a) for FF-structures and in (38b) for Fσ̆-structures, once branchingness is already satisfied at a higher level, the individual feet are again free to be either monosyllabic or bisyllabic.

It is only when the word is coextensive with the foot that branchingness must necessarily be satisfied within the foot (see (31a) vs. (31b) above).

(38) a.	Wd	[σ̆ σ̆][σ̆ σ̆]	asu pare	(gasu)	'asparagus'
		[σ̆σ̆][σ̄]	e a koN	(disyonaa)	'air conditioner'
	F F	[σ̄][σ̆ σ̆]	koN bini	(eNsu)	'convenience store'
		[σ̄][σ̄]	baa teN	(daa)	'bartender'

[18] There are a handful of forms like *apaato (meNto)* 'apartment house', *depaato (meNto)* 'department store', *achiibu (meNto)* 'achievement test' - but there is good reason to classify these as backformations and not as prosodic truncations, given their isolated status and the fact that they always involve a specific suffix (Ito 1990, 236).

b. Wd

F $\breve{\sigma}$ $[\breve{\sigma}\ \breve{\sigma}]\ \breve{\sigma}$	ani me	(esyoN)	'animation'
F $\breve{\sigma}$ $[\bar{\sigma}]\ \breve{\sigma}$	koN bi	(neesyoN)	'combination'

Word Binarity (32) provides an empirical argument against the superfoot theory discussed in section 1 above. Given its additional prosodic constituent F' intervening between Wd and F, superfoot theory incorrectly predicts that words could also be shortened to F'F' (39), an impossible shape for truncated forms.

(39)

Wd

F' F'

F $\breve{\sigma}$ F $\breve{\sigma}$

*seku sya hara su

'sexual harassment' (cf. seku-hara)

The crucial point is that the superfoot theory cannot explain why cutting down to either $_{F}[\bar{\sigma}]$ or $_{F}[\breve{\sigma}\ \breve{\sigma}]$ is *obligatory* in two-footed structure.[19] This suggests that the sequence F$\breve{\sigma}$ does not form a constituent F' below the Wd level, in conformity with the weak layering theory (as well as degenerate foot theory).

The prominent role of the bipartite word structure is not limited to the clippings analyzed so far. As Ito 1990 has shown, it is also found in many other templatic formations, e.g., in hypocoristics (Poser 1984, 1990), the overwhelming majority of which consist of a bimoraic stem (derived by truncation) followed by a suffix *(mido-tyaN,* etc.). And the analysis of *zuuja-go* in Ito, Kitagawa, and Mester 1992 shows that the essence of this language game consists in capitalizing on the word binarity requirement, ranking it (for the purposes of the game) above other prosodic requirements. Perlmutter 1992 has emphasized the pervasive role of such binary structures, and indeed the prosodic morphology of Japanese should give expression to

[19] It is of course possible to have true compounds (with compound accentuation), consisting of independent trimoraic clippings, like *hamu saNdo 'ham* sandwich' or *koNbi saNdo* 'combination sandwich', where each of the compound members is an independent word (cf. the clippings *koNbi* and *saNdo)*. This stands in stark contrast to FF shortenings like *pasokoN* 'personal computer' or *saradore* 'salad dressing', where the source of the truncation is a compound (see section 1 above), but the clipped form itself is a simplex (unaccented) word: In such cases, the parts are typically not used in isolation (i.e. **sara, *core, *paso, *koN*).

this generalization. Our suggestion here is that it would be a mistake to try to express this 'template of templates' in terms of particular prosodic categories - we are dealing with a requirement that is more abstract and genuinely structural, namely Binarity (32). As the earlier examples illustrate, binary branchingness can be instantiated by rather different constellations of prosodic categories (FF, F$\breve{\sigma}$, $\breve{\sigma}\breve{\sigma}$). Besides undermining basic notions of foot theory, nothing would be gained by forcing a single template ("FF"?) onto such divergent prosodic forms. Abstract configurational properties can and should not be expressed in terms of particular category-based templates.[20]

4.2 *Obligatory Bisyllabicity*

Looking beyond Japanese, we will briefly consider some of the proposals that have appeared in the literature to deal with situations similar to the one under discussion here where a ban against monosyllabicity has been observed. We anticipate that branchingness also lies at the heart of such cases of obligatory bisyllabicity, with the relevant target defined by a supervening structural requirement of binarity.

The cases in question (see section 1) are similar to the Japanese case in that minimal bisyllabicity emerges as a condition on words without being reducible to the (quantity-sensitive) foot established for the language, which can be realized by a single heavy syllable.

It would be a mistake to use such cases to play bisyllabicity out against the standard inheritance account of minimal word effects (see section 3), and to argue for a fundamental restatement of minimal word theory in terms of a two-syllable requirement (see Piggott 1992). First, from a conceptual point of view, word minimality by inheritance constitutes the maximally simple account in requiring no separate "theory of minimal words", with its own specific laws; it enjoys the status of a null hypothesis over any proposal positing specific conditions. Second, the foot-wise equivalence of $_F[\breve{\sigma}\ \breve{\sigma}]$ and $_F[\bar{\sigma}\ ]$ that comes with word minimality qua inherited foot minimality is in fact

[20] But they clearly fall under the notion of templates in a more general sense explored by Steriade 1988, among others: not as mapping targets, but as more abstract sets of conditions imposed on the output ('filters'), accompanied by matching procedures. This is in fact the conclusion arrived at by Ito (1990, 232-235) regarding the size and position requirements of Japanese prosodic morphology, a result which has also been further supported by Perlmutter 1992.

fully borne out by minimal word facts in many languages where heavy monosyllables constitute not only licit feet, but also licit minimal words. Familiar cases include Latin (Hayes 1991, Mester 1992) and English, see Hayes (1991) and McCarthy and Prince (1986 et seq.) for further examples (Fijian, etc.). Finally, we take it to be a telling sign that in Japanese (Ito 1990), Axininca (Spring 1990a,b, Black 1991), and Cantonese (Yip 1992), the general minimality picture cannot be captured by a blanket statement requiring bisyllabicity in all situations. Rather, bisyllabicity is enforced only in a subset of the total set of environments, with foot minimality accounting for the rest of the environments.

These considerations show that bisyllabicity cannot replace the standard conception of the minimal word, but rather acts as an additional constraint operative in certain contexts. Within Prosodic Morphology, a bisyllabicity requirement in a quantity-sensitive language raises a theoretical problem: Its statement must refer to *two* elements instead of *one* constituent. In the relevant cases no single prosodic constituent established for the language can be used to ensure bisyllabicity: Quantity-sensitive feet are unsuitable because they are built on the moraic equivalence of the bisyllabic $_F[\breve{\sigma}\ \breve{\sigma}]$ with the monosyllabic $_F[\bar{\sigma}\ ]$, and the prosodic word itself is trivially unsuitable because of circularity.

We could shrug off such scruples and directly stipulate "Min(Wd) = σσ" as an extra requirement, taking comfort in the fact that counting up to two is, after all, permitted in phonology (McCarthy and Prince 1986); but the fact remains that we are referring to a non-constituent. This could be avoided by leaving the constraint in the form posited by Ito (1990), as an inequality statement outlawing a single syllable: "Min(Word) > σ". This sidesteps the constituency problem, but now the theory is committed to such inequality statements in addition to equivalences of the general form "MCAT = PCAT" linking morphological and prosodic categories in the standard theory of Prosodic Morphology (McCarthy and Prince 1991a, 1991b).

Another possibility is to turn to universal foot theory and recruit some other constituent suitable to serve as a syllable counter. The syllabic trochee [σσ], as a quantity-insensitive foot defined by bisyllabicity, suggests itself as a natural candidate. The idea would be to invoke the syllabic trochees, as a universally admitted foot type, in addition to the quantity-sensitive foot established for the language, i.e. the moraic trochees [μμ] for Japanese (or the iamb, in cases like Axininca). We could then stipulate that words must minimally constitute syllabic trochees [σσ], in addition to what is required of them by inheritance within the prosodic hierarchy (bimoraicity). This amounts to a superposition of two types of feet as minimality templates (a natural option in optimality-theoretic Phonology, as Alan Prince has pointed out). Bisyllabicity could indeed be secured in this way - but at the price of grafting an otherwise unmotivated foot onto words, with no other purpose in the language besides serving as a syllable counter. Even though there is nothing in principle objectionable about such an approach - multiple foot types can coexist within a single language, see McCarthy and Prince 1990 for the most convincing example of this kind -, for cases like Japanese we see no reason to take pride in such a proliferation of feet, which must always remain a stipulation.

Another approach to the problem is the one in Black (1991, 202), who attempts to derive obligatory bisyllabicity within foot theory without stepping beyond the limits of the foot demonstrably valid for the language (the quantity-sensitive iamb). The proposal is to derive bisyllabicity as a foot optimality effect, by ranking the bisyllabic expansion $_F[\breve{\sigma}\ \breve{\sigma}]$ higher than the monosyllabic expansion $_F[\bar{\sigma}]$ in terms of foot wellformedness ($_F[\breve{\sigma}\bar{\sigma}]$ independently occupies the highest rank, see Black 1991 for further details and Prince 1990 for the general approach to foot optimality presupposed in this analysis). The general question raised by this proposal is whether there is any independent evidence for the ranking of $_F[\breve{\sigma}\ \breve{\sigma}]$ over $_F[\bar{\sigma}]$ as *feet* (i.e. independent of the minimal word issue under discussion).[21]

Instead of all of these possibilities, we suspect that genuinely configurational conditions are at work in these cases. The Japanese evidence is particularly important here since it shows that bisyllabicity (implemented in any of the forms surveyed above) is in fact insufficiently general. What is involved is a much broader requirement of bipartite word structure, which is not foot-bound in that it can be satisfied not only by $_{wd}[_F[\breve{\sigma}\ \breve{\sigma}]]$, but also by

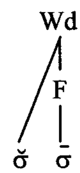
[21] One relevant consideration might be that the Axininca foot is iambic (right-headed), and there might conceivably be an intrinsic tension between right-headed feet and the left-prominent profile of heavy syllables (Prince 1983). If true, this would lead us to expect obligatory bisyllabicity effects to be particularly characteristic of iambic languages like Axininca and Ojibwa (Piggott 1992) (and perhaps Turkish, in the analysis of Barker 1989, see also Ito and Hankamer 1989 and Kiparsky 1992).

$_{\text{wd}}$[F$\breve{\sigma}$] and $_{\text{wd}}$[FF], which are beyond the reach of foot-internal (or directly syllable-counting) conditions. As a constraint that is satisfied by a branching *configuration* and not by the presence of one particular *category*, a binary branchingness requirement makes immediate sense of the number *two* in situations where the search for an appropriate category proves elusive.

5 Left Edge Matching

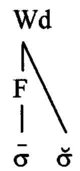
One type of word structure is systematically avoided for clippings, even though it satisfies the binary branching requirement. The case concerns $\breve{\sigma}$F-structures as in (40), where the foot is located at the right edge and not at the left edge (cf. the licit mirror-image F$\breve{\sigma}$-structures in (41)).

(40)



	(cf. (43))	
*de moN	(sutoreesyoN)	'demonstration'
* ro kee	(syoN)	'location'
* gya raN	(tee)	'guarantee'

(41)



dai ya	(moNdo)	'diamond'
paa ma	(neNto)	'permanent (perm hair style)'
koN bi	(neesyoN)	'combination'

The illformedness of all examples like (40) brings into focus another important element of the prosodic mechanisms shaping the structure of word clippings. We need to ensure that truncated forms begin with a foot and not with a loose syllable (Left Edge Requirement, Ito 1990). One way of achieving this result would be to require foot parsing to always apply from left to right throughout the prosodic word, such that the first foot would always be flush with the left edge (see Poser 1984 for suggestions along these lines). But as Poser 1990 has demonstrated, the evidence for directional footing in Japanese is conflicting and in general quite weak. Instead of viewing the asymmetry between (40) and (41) as an effect of directional foot construction iterating through the word from left to right, it is preferable to conceive of it in terms of constraint satisfaction, in this case involving a local constraint governing left word edges. Borrowing an idea from McCarthy and Prince (in prep.), we formulate it as Left Edge Matching (42).[22]

(42) Left Edge Matching: $_{Wd}[\equiv {}_{F}[$
("Left word edges preferentially coincide with foot edges.")

(42) entails that structures like (40), where the initial word edge does not coincide with a foot edge, are disfavored. Words like *demoNsutoreesyoN* have instead shortenings with single F-structures as in (43), which always fulfill (42).

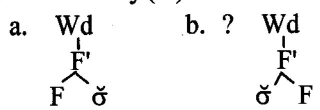
(43) Wd
| de mo (NsutoreesyoN) 'demonstration'
F ro ke (esyoN) 'location'
gya ra (Ntee) 'guarantee'
σ σ

In contrast to $\breve{\sigma}$F-structures like (40), the mirror-image F$\breve{\sigma}$-structures in (41), with the foot at the left word edge, are fully wellformed and in fact richly attested among clippings.

Left Edge Matching (42) is a principle that only makes sense under Weak Layering, or more generally, in theories that do not require every syllable to be footed. Under Strict Layering, Left Edge Matching, as well as Right Edge Matching, are always trivially fulfilled. The directional asymmetry prominently displayed by contrasts like *koNbi (41)* vs. **demoN (40)* would then require some other account (which goes beyond a direct statement of the observation). For superfoot theory (see section 1), the left edges of superfoot and word coincide in both (44a) and (44b). Since the latter is in fact excluded, it appears that the edge of the superfoot is actually not relevant, undermining the status of the postulated constituent as a foot.

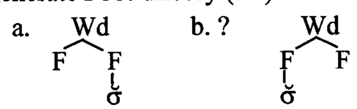
[22] An alternative to (42) would be to impose a positional constraint on prosodic heads and require them to be left-peripheral within their domains. Since the head of Wd is F, this would also have the desired effect of bringing the foot to the left word edge. But it would require further investigation to determine whether such a broad generalization about the position of heads can in fact be upheld (Japanese compounds are right-headed, for example).

(44) Superfoot Theory (F') :



Degenerate foot theory (45), on the other hand, is built on the idea that light syllables can constitute licit feet in their own right which can be called on in templates, just like normal bimoraic feet (see section 1). It remains unexplained, then, why such feet can only occur in second position (45a) and not in first position (45b) - after all, the left edge of the word coincides perfectly with a foot edge in both cases. The illformedness of (45b) suggests that the edge of the degenerate foot in fact does not act as a foot edge, again undermining the status of this constituent as a genuine foot.

(45) Degenerate Foot Theory (FF) :



In order to rule out (45b), the Left Edge Matching constraint (42) would have to be revised so as to require that the left word edge coincides with the edge of a foot of *bimoraic size*. The addition of such a size requirement on the foot should not be taken lightly, because the revised version now requires simultaneous access to multiple levels of the prosodic hierarchy (i.e. Wd, F, σ, μ). In the case of initial monosyllabic feet, we cannot determine whether the word edge coincides with a 'legitimate' foot edge by inspecting the structure of Wd or even the structure of F; rather, non-local access to the internal moraic structure of the syllable contained within F (mono- or bimoraic) is needed. In phonology, locality considerations are usually invoked for string-wise adjacent constituents, but clearly also apply in the hierarchical dimension. This issue is the topic of the next section.

6 Further Implications

Here we take up one of the issues left unresolved in section 4, namely the status of the syllable opacity condition in (33) that declares syllable-internal structure opaque for word level conditions. It is of course possible that this opacity effect is just an idiosyncratic property of syllables. A far more interesting hypothesis, however, would be to reduce it to a general locality constraint limiting the accessibility of internal prosodic structure. Extending a speculation in Liberman and Pierrehumbert (1984, 231), we envisage a locality condition on access to structural information, as formulated in (46).

(46) **Hierarchical Locality:** A condition operating at prosodic level Ci has access only to structural information at C_i and at the subjacent level C_{i-1}

In terms of (46), foot-internal structure is visible at the word level (e.g. branchingness can be determined), but syllable internal structure is opaque; only at the level of the foot can syllable-internal structure be directly accessed. Similar restrictions follow for higher domains: At the level of the phonological phrase, the internal structure of prosodic words will be visible, but not the internal structure of feet or syllables, etc. In other words, within any given domain only the internal structure of the subjacent domain can be accessed. In terms of prosodic categories, this is always the head domain (or a potential head domain) of the larger domain.[23]

Strict Layering can be viewed as an attempt to give direct expression to the notion of hierarchical closeness that is involved here (by insisting that Wd and σ must always be separated by F, etc.). But structures by themselves cannot ensure locality. We suggest that a general locality constraint like (46) is a better way of implementing the idea. The ranking of categories that defines the prosodic hierarchy already tell us that F and not σ is the immediate hierarchical successor of Wd, etc. It is therefore not necessary to write this fact into every representation, by literally sealing off the syllable layer against the word by a protective layer of feet. Such structures are highly questionable from the perspective of foot theory (section 2), and for the case of Japanese they are also empirically incorrect as word structures (section 3). Given that any theory has to impose *some* locality condition, it might be significant that (46) ensures locality of access in the minimalist word structures of Weak Layering Theory.

[23] This restriction to (potential) head domains points to a connection with the theory of prosodic circumscription, as developed by McCarthy and Prince (1990), in particular in the domain- and not operation-based version sketched there (id., p.243).

Hierarchical Locality (46) is compatible with the existence of rules that directly affect melody elements at the edges of prosodic domains, like the phonological word or the phonological phrase ("domain limit rules" in the sense of Selkirk 1980 and Nespor and Vogel 1986), which are clearly demanded by the facts. (46) is intended as a condition on the interpretation of structural descriptions and not as a direct constraint on rule form. This allows for certain rules that are explicitly stated so as to simultaneously access nonadjacent prosodic levels (see Chomsky (1977, 76-77) for discussion of the 'logic of markedness' involved here). A case in point are rules of word-final vowel shortening encountered in numerous languages, e.g. Choctaw (Lombard) and McCarthy (1991, 41)) or Axininca (Black (1991, 195)). Such rules license their nonlocal access to internal prosodic structure through their own complex structural description ("$\mu\mu]_{\sigma}]_{Wd}$"), and directly manipulate more structure at the end of the prosodic word, two domains that are not adjacent within the hierarchy.[24]

The adoption of a locality condition, however, raises the stakes and compels analysts to explore possibilities of deeper explanation. For example, the complexity of frequently encountered rules like word-final vowel shortening might be due to the fact that we are taking the process too much at face value, as an effect of the phonological word on more structure not mediated through the foot. We might instead hypothesize that what is really involved in such cases is a foot-based constraint, namely Extrametricality, in the sense explored in Prince and Smolensky (1991) and Mester (1992). In these proposals, Final-σ Extrametricality is conceived of as a constraint demanding that word-final syllables remain unfooted. For heavy syllables in final position, this sets up a conflict: On the one hand, such syllables intrinsically require footing (cf. Prince 1983); on the other hand, this is precisely what Extrametricality rules out for word-final syllables. Within an optimality-theoretic approach (Prince and Smolensky 1991, 1992) that orders constraints in a dominance hierarchy of preferences, we can hypothesize that there are (at least) three ways of resolving the conflict. The first possibility is for Final-σ Extrametricality to yield, resulting in footing of final heavies (as in English in the case of long-vowelled finals, see Hayes 1982, Halle and

[24] This is similar to the situation discussed at the end of section 5 regarding a revision of Left Edge Matching which would require "$_{Wd}[_{F}[\mu\mu$".

Vergnaud 1987, Kager 1989, among others). The second possibility is for intrinsic footing to yield, with the consequence that final heavies remain unfooted (as in Latin, see Prince 1990, Hayes 1991, and Mester 1992). The third possibility is for neither of the two requirements to give in to the other, and this might be the situation in languages like Choctaw or Axininca. In order to fulfill both constraints, underlying quantity (i.e. more structure) has to yield, resulting in shortening of long vowels (and deweighting of coda consonants, if present). In such a scenario, the effect of the word-end on syllable-internal mora structure is always indirect, mediated through foot structure, and hence fully compatible with (46). At the same time, new theoretical connections emerge between superficially isolated phonological events in different languages. Locality conditions like (46) thus constitute a powerful incentive to find deeper explanations, even if we continue to permit nonlocal rule statements as convenient devices capturing the facts in areas where the underlying principles are not yet properly understood.

7 Summary

This paper has developed a particular view regarding the layering conditions governing the hierarchical representations of prosodic phonology, and has applied it to a rich prosodic-morphological system of word truncations encountered in modern Japanese. In developing this conception of a weakly layered prosodic hierarchy, and drawing on principles of Proper Headedness and Maximal Parsing, the analysis has motivated a configurational principle requiring binary branching word structures and provided support for an edge-based domain alignment requirement that obeys hierarchical locality.

References

Bagemihl, Bruce (1991) "Syllable Structure in Bella Coola," *LI* **22.4**, 589-646.

Barker, Chris (1989) "Extrametricality, the Cycle, and Turkish Word Stress," *Phonology at Santa Cruz 1,* 1-34.

Beckman, Mary E. (1986) *Stress and Non-stress Accent*, Foris Publications, Dordrecht, Holland, and Riverton, U.S.A.

Beckman, Mary E. and Janet B. Pierrehumbert (1986) "Intonational Structure in Japanese and English," *Phonology Yearbook 3,* 255-309.

Bickmore, Lee (1990) "Branching Nodes and Prosodic Categories: Evidence form

Kinyambo," in Inkelas and Zec (1990), pp. 1
Black, H. Andrew (1991) "The Phonology of the Velar Glide in Axininca Campa," *Phonology* **8**, 183-217.
Blevins (Levin), Juliette (1985) *A Metrical Theory of Syllabicity,* Doctoral Dissertation, MIT, Cambridge, Massachusetts.
Blevins (Levin), Juliette (1988) "Dissecting the Skeleton," ms., University of Texas, Austin.
Blevins, Juliette (1990) "Alternatives to Exhaustivity and Conflation in Metrical Theory," ms., University of Texas, Austin.
Borowsky, Toni, Junko Ito, and Armin Mester (1983) "The Formal Representation of Ambisyllabcity: Evidence from Danish," *Proceedings of NELS* **14**, pp. 38-48.
Broselow, Ellen (1982) "On Predicting the Interaction of Stress and Epenthesis," *Glossa* **16**, 115-132.
Broselow, Ellen (1992) "Parametric Variation in Arabic Dialect Phonology," in E. Broselow, M. Eid, and J. McCarthy (eds.) *Perspectives in Arabic Linguistics IV.* John Benjamins, Amsterdam.
Chomsky, Noam (1977) "On WH-Movement," in Peter W. Culicover, Thomas Wasow, and Adrian Akmajian, eds., *Formal Syntax*, Academic Press, New York etc., pp. 71-132.
Cowper, Elizabeth A., and Keren D. Rice (1987) Are phonosyntactic Rules necessary?" *Phonology Yearbook 4,* 185-194.
Goldsmith, John (1990) *Autosegmental and Metrical Phonology,* Blackwell, Oxford.
Goldsmith, John (1991) "Phonology as an Intelligent System," in D.J. Napoli and J.A. Kegl (eds.), *Bridges between Psychology and Linguistics: A Swarthmore Festschrift for Lila Gleitman.* Lawrence Erlbaum Associates, Hillsdale NJ, 247-267.
Goldsmith, John (1992) "Harmonic Phonology," to appear in J. Goldsmith (ed.), *The Last Phonological Rule: Reflections on Constraints and Derivations in Phonology,* University of Chicago Press, Chicago.
Gussenhoven, Carlos (1986) "English Plosive Allophones and Ambisyllabicity," *Gramma* **10.2**, 119-141.
Halle, Morris and Jean-Roger Vergnaud (1978) "Metrical Structures in Phonology," ms., MIT, Cambridge, MA.
Halle, Morris and Jean-Roger Vergnaud (1987) *An Essay on Stress,* MIT Press, Cambridge, MA.
Halle, Morris and Michael Kenstowicz (1991) "The Free Element Condition and Cyclic versus Noncyclic Stress," *LI* 22, 457-501.
Haraguchi, Shosuke (1991) *A Theory of Stress and Accent,* Foris, Dordrecht.
Haraguchi, Shosuke, ed. (1992) *Nihongo no Mōra to Onsetsukōzō ni kansuru sōgōteki Kenkyū* (1) [Research on the Moraic and Syllabic Structure of Japanese], Mombushō Research Report 03208104, Tsukuba University, Japan.
Hayes, Bruce (1980) *A Metrical Theory of Stress Rules.* Doctoral dissertation, MIT, Cambridge, MA. [Published by Garland, 1985.]
Hayes, Bruce (1982) "Extrametricality and English Stress," *LI* **13**, 227-276.

Hayes, Bruce (1987) "A Revised Parametric Metrical Theory," in J. McDonough and B. Plunkett, eds., *Proceedings of NELS* **17**, 274-289.

Hayes, Bruce (1989a) "Compensatory Lengthening in Moraic Phonology," *LI* **20**, 253-307.

Hayes, Bruce (1989b) "The Prosodic Hierarchy in Meter," in Kiparsky, Paul and Gilbert Youmans, eds., *Phonetics and Phonology. Volume 1. Rhythm and Meter.* Academic Press, San Diego etc., pp. 201-260.

Hayes, Bruce (1990) "Precompiled Phrasal Phonology," in Inkelas and Zec, eds., pp. 85-108.

Hayes, Bruce (1991) *Metrical Stress Theory: Principles and Case Studies,* ms., UCLA, Los Angeles.

Hewitt, Mark (1992) *Vertical Maximization and Metrical Theory,* Ph.D. dissertation, Brandeis University.

Hulst, Harry van der, and Norval Smith (1982) An Overview of Autosegmental and Metrical Phonology, in (eds.) *The Structure of Phonological Representations. Part I.* Foris Publications, Dordrecht, Holland and Cinnaminson, U.S.A, pp. 1-45.

Hyman, Larry M. (1985) *A Theory of Phonological Weight,* Foris, Dordrecht.

Hyman, Larry M., Francis Katamba, and Livingstone Walusimbi (1987) "Luganda and the Strict Layer Hypothesis," *Phonology Yearbook* **4**, 87-108.

Hyman, Larry M. (1992) "Minimality and the Prosodic Morphology of Cibemba Imbrication," ms., UC Berkeley, CA.

Inkelas, Sharon (1989) *Prosodic Constituency in the Lexicon,* Doctoral dissertation, Stanford University. [Published by Garland, New York, 1991.]

Inkelas, Sharon, and Draga Zec, eds. (1990) *The Phonology-Syntax* Connection. The University of Chicago Press, Chicago and London.

Ishihara, Masahide (1989) *The Lexical Prosodic Phonology of Japanese Verbs,* PhD dissertation, University of Arizona, Tucson.

Ito, Junko (1986) *Syllable Theory in Prosodic Phonology.* Ph.D. dissertation, U.Mass., Amherst. [Published by Garland, New York, 1988.]

Ito, Junko (1989) "A Prosodic Theory of Epenthesis," *NLLT* **7**, 217-259.

Ito, Junko (1990) "Prosodic Minimality in Japanese," in K. Deaton, M. Noske, and M. Ziolkowski ads., *CLS 26-II: Papers from the Parasession on the Syllable in Phonetics and Phonology,* 213-239.

Ito, Junko and Jorge Hankamer (1989) "Notes on Monosyllabism in Turkish," *Phonology at Santa Cruz* **1**, 61-69.

Ito, Junko, Yoshihisa Kitagawa, and Armin Mester (1992) "Prosodic Type Preservation in Japanese: Evidence from *zuuja-go," SRC Working Papers* SRC-92-05, UC Santa Cruz.

Ito, Junko & Armin Mester (1991) *Linguistics 224: The Prosodic Phonology of Japanese,* lectures and handouts from LSA Linguistic Institute Course, UC Santa Cruz, CA.

Kager, René (*1989*) *A Metrical Theory of Stress and Destressing in English and* Dutch, Foris, Dordrecht.

Kager, René (1992) "Alternatives to the Iambic-Trochaic Law," to appear in *NLLT.*

Kahn, Daniel (1976) Syllable-based Generalizations in English Phonology, PhD. dissertation, MIT, Cambridge, MA. [Published by Garland.]

Kaisse, Ellen M. (1985) *Connected Speech: The Interaction of Syntax and* Phonology. Academic Press, Orlando.

Katada, Fusa (1990) "On the Representation of Moras: Evidence from a Language Game," *LI* **21.4**, 641-646.

Kiparsky, Paul (1979) "Metrical Structure Assignment is Cyclic," *LI* **10**, 421-441.

Kiparsky, Paul (1991) "Blocking in Non-Derived Environments," ms., Stanford University, CA.

Kiparsky, Paul (1992) "Catalexis," ms., Stanford University and Wissenschaftskolleg zu Berlin.

Komatsu, Hideo (1981) *Nihongo no On'in* [Japanese Phonology]. Chuōkōronsha, Tokyo, Japan.

Kornai, Andras and Geoffrey K. Pullum (1990) "The X-bar-Theory of Phrase Structure," *Language* **66**, 24-50.

Kubozono, Haruo (1985) "Speech Errors and Syllable Structure," *Linguistics and Philology* **6**, 220-243.

Kubozono, Haruo (1989) "The Mora and Syllable Structure in Japanese: Evidence from Speech Errors," *Language and Speech* **32**, 249-278.

Kubozono, Haruo (1991) "Nihongo no Onsetsukyokai to Onseturyo[Syllable boundary and syllable weight in Japanese]," *Japanese Phonetics* Society Bulletin, 17-22.

Liberman, Mark and Alan S. Prince (1977) "On Stress and Linguistic Rhythm," *LI* **8**, 249-336.

Lombardi, Linda, and John J. McCarthy (1991) "Prosodic Circumscription," *Phonology* **8**, 37-71.

McCarthy, John J. (1979) "On Stress and Syllabification," *LI* **10.3**, 443-465.

McCarthy, John J. (1982) "Prosodic Templates, Morphemic Templates, and Morphemic Tiers," in van der Hulst and Smith (eds.) *The Structure of Phonological Representations I,* 191224.

McCarthy, John J. (1986) "OCP Effects: Gemination and Antigemination," *LI* **17**, 207-263.

McCarthy, John J. (1992) "Template Form in Prosodic Morphology," to appear in *Proceedings of FLSM* **3**.

McCarthy, John J. and Alan S. Prince (1986) "Prosodic Morphology," ms., University of Massachusetts at Amherst and Brandeis University.

McCarthy, John J. and Alan S. Prince (1990) "Foot and Word in Prosodic Morphology: The Arabic Broken Plural," *NLLT* **8**, 209-283.

McCarthy, John J. and Alan S. Prince (1991a) "Prosodic Minimality," lecture presented at Univ. of Illinois Conference *The Organization of Phonology.*

McCarthy, John J. and Alan S. Prince (1991b) *Linguistics 240: Prosodic* Morphology, lectures and handouts from LSA Linguistic Institute Course, UC Santa Cruz, CA.

McCarthy, John J. and Alan S. Prince (in prep.) "Constraint Satisfaction in Prosodic Morphology and Phonology".

Mester, Armin (1990) "Patterns of Truncation," *LI* **21.3**, 478-485.

Mester, Armin (1992) "The Quantitative Trochee in Latin," to appear in *NLLT.*

Nespor, Marina and Irene Vogel (1986) *Prosodic Phonology,* Foris, Dordrecht.

Perlmutter, David (1992) "Pervasive Word Formation Patterns in a Grammar," BLS handout.

Pierrehumbert, Janet & Mary Beckman (1988) *Japanese Tone Structure,* MIT Press, Cambridge, Mass.

Piggott, G.L. (1992) "Satisfying the Minimal Word," ms., McGill University, Montreal, Quebec, Canada.

Poser, William J. (1984a) "Hypocoristic Formation in Japanese," M. Westcoat et al. (eds.) *Proceedings of WCCFL* **3**, 218-229.

Poser, William J. (1984b) The Phonetics and Phonology of Tone and Intonation in Japanese. Cambridge, MA: MIT dissertation.

Poser, William J. (1990) "Evidence for Foot Structure in Japanese," *Language* **66.1**, 78-105.

Prince, Alan S. (1976) "'Applying' Stress," ms., U.Mass., Amherst.

Prince, Alan S. (1980) "A Metrical Theory of Estonian Quantity," *LI* **11**, 511-562.

Prince, Alan S. (1983) "Relating to the Grid," *LI* **14**, 19-100.

Prince, Alan S. (1990) "Quantitative Consequences of Rhythmic Organization," in K. Deaton, M. Noske, and M. Ziolkowski (eds.) *CLS 26-II: Papers from the Parasession on the Syllable in Phonetics and Phonology.*

Prince, Alan S. and Paul Smolensky (1991) *Linguistics 247: Connectionism and Harmony Theory in Linguistics*, lecture notes and handouts from LSA Summer Institute, UCSC, Santa Cruz. [Technical Report CU-CS-533-91, Department of Computer Science, University of Colorado, Boulder.]

Prince, Alan S. and Paul Smolensky (1992) "Optimality. Constraint Interaction in Generative Grammar," revised and augmented handout of WCCFL presentation, Brandeis University, Waltham, and University of Colorado, Boulder.

Selkirk, Elisabeth O. (1980) "The Role of Prosodic Categories in English Word Stress," *LI* **11**, 563-606.

Selkirk, Elisabeth O. (1981) "Epenthesis and Degenerate Syllables in Cairene Arabic", in Borer and Aoun eds., *Theoretical Issues in the Grammar of Semitic Languages,* MIT Working Papers in Linguistics **3**, 209-232.

Selkirk, Elisabeth O. (1982) "The Syllable", in Hulst, Harry van der and Norval Smith, eds. *The Structure of Phonological Representations. Part II.* Foris Publications, Dordrecht, Holland and Cinnaminson, U.S.A, pp. 337-383.

Selkirk, Elisabeth O.(1984) *Phonology and Syntax: The Relation between Sound and Structure,* MIT Press, Cambridge, MA, and London, England.

Selkirk, Elisabeth O. (1986) "On Derived Domains in Sentence Phonology," *Phonology* **3**, 371-405.

Spring, Cari (1990a) "How many Feet per Language?" in Aaron L. Halpern (ed.) Proceedings *of WCCFL 9,* CSLI, Stanford.

Spring, Cari (1990b) *Implications of Axininca Campa for Prosodic* Morphology *and Reduplication,* Ph.D. dissertation, University of Arizona, Tucson, Arizona.

Steriade, Donca (1982) *Greek Prosodies and the Nature of Syllabification*, PhD

dissertation, MIT, Cambridge, Massachusetts.
Steriade, Donca (1988) "Reduplication and syllable transfer in Sanskrit and elsewhere," *Phonology 5,* 73-155.
Steriade, Donca (1991) "Mores and Other Slots," in Meyer, Denise et. al. (eds.) *Proceedings of FLSM 1,* pp. 254-280.
Tateishi, Koichi (1989) Theoretical Implications of the Japanese Musician's Language. *WCCFL* **8**, 384-398.
Yip, Moira (1991) "Prosodic Morphology in Four Chinese Dialects, *Journal of East Asian Linguistics* **1**, 1-35.
Yoshida, Shohei (1991) "A Government-based Analysis of the 'Mora' in Japanese," *Phonology* **7.2**, 331-351.
Zec Draga (1988) *Sonority Constraints on Prosodic Structure,* Doctoral Dissertation, Stanford University.
Zwicky, Arnold and Ellen Kaisse, eds. (1987) *Phonology Yearbook* **4**: *Syntactic Conditions on Phonological Rules.* Cambridge University Press, Cambridge.

Department of Linguistics
University of California
Santa Cruz, CA 9564
USA

ito@ucsc.edu
mester@ucsc.edu