Recursive prosodic phrasing in Japanese

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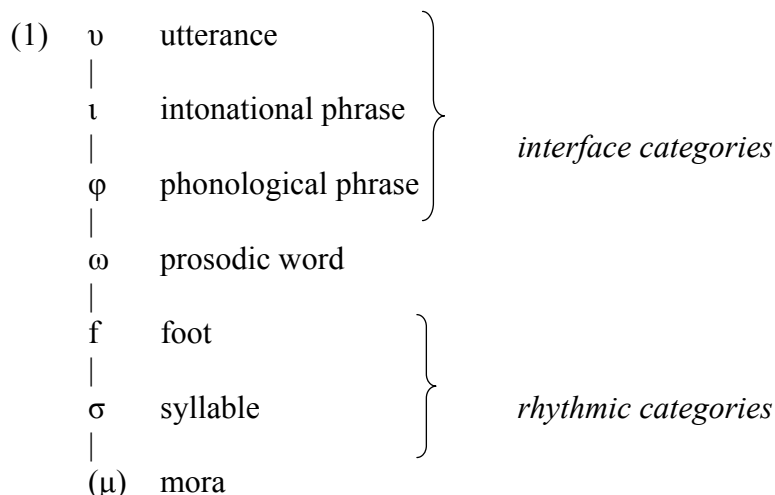*University of California, Santa Cruz*
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1. Background and identification of the problem

A key result of studies in phrasal phonology since the 1970's has been the finding that, cross-linguistically, phrase-level phonological processes do not make use of the vast set of potential domains that are in principle made available by grammatical (i.e., syntactic and morphological) structure.[*] Rather, they are localized in a small set of domains that are phonological in nature, even though defined in reference to grammatical structure, and that turn out to play a decisive role in language after language. The model that developed in response to this central finding is prosodic hierarchy theory (Selkirk 1978, Nespor and Vogel 1983, Inkelas (1989:4), etc., building on key insights in earlier work (such as Halliday 1960 and Pike 1967): Speech is organized into a set of prosodic domains that form a hierarchy of containment, with each non-terminal constituent made up of a sequence of constituents at the next level down (*Strict Layer Hypothesis,* see Selkirk 1984 and Nespor and Vogel 1986, among others).

The hierarchy comprises two groups of categories, as shown in (1). The word-internal units (syllable, foot, and perhaps mora) are intrinsically defined in terms of sonority-related phonetic factors and speech rhythm, whereas the parsing of higher-level units (prosodic word, phonological phrase, intonational phrase, etc.) is regulated by constraints, alignment-based and other, on the correspondence between syntactic/morphological and phonological constituents. We will sometimes refer to the word-internal prosodic units as *rhythmic* categories, and the larger prosodic units as *interface* categories.

(1) υ   utterance
     |
     ι   intonational phrase   ⎫
     | ⎬ *interface categories*
     φ   phonological phrase   ⎭
     |
     ω   prosodic word
     |
     f   foot   ⎫
     | ⎬ *rhythmic categories*
     σ   syllable   ⎭
     |
     (μ) mora

While the general form of the rhythmic categories is relatively uncontroversial, apart from specific issues (such as the status of the mora as a genuine prosodic constituent vs. a property of syllables, see Ito and Mester 2003(1992)), the picture is far less clear for the interface categories. Although the overall research program has been vastly successful in advancing our understanding of the relation between syntactic structure and phonological form, many questions, both of detail and of principle, have remained open, even as to the exact number and/or content of the units of the hierarchy. To make matters worse, categories are sometimes literally defined in terms of the processes associated with their instantiations in specific languages, resulting in labels like 'accentual phrase', 'tone group', etc. While this is mnemonically useful for the description of a single language, the lack of truly cross-linguistically valid and constant properties associated with these units creates additional obstacles in identifying categories between languages and grammars (see Selkirk 2005 and Truckenbrodt 2006 for discussion). The underlying research program has valued the postulation of new descriptive categories, designed to serve as domains for various processes in various languages, over restrictiveness.

One of the main points of dispute is, perhaps unsurprisingly, the mid range of the prosodic hierarchy, where at least two distinct phrasal categories have been proposed, the minor phrase and the major phrase (alternatively named 'accentual phrase' and 'intermediate phrase'). The distinction seems to have grown out of research on Japanese, one of the best-studied prosodic systems. The two kinds of phrases are first distinguished in McCawley 1968, followed by Haraguchi 1977, Poser 1984, Beckman and Pierrehumbert 1986, Kubozono 1988, and Selkirk and Tateishi 1988. The distinction was then adopted for many other languages, including Basque, English, German, Italian, and Korean.

This paper reopens the question whether two distinct phrasal categories are truly necessary. Is a model of prosodic parsing possible that accounts for all the facts, both in Japanese and in other languages, with a single phonological phrase category? We will argue that such a conception is not only possible, but in fact necessary: Multiple categories create problems.

The starting point of the new approach is the simple observation that a single phrasal category does not mean a single layer of structure at a given level of prosody. Equating the two presupposes subscribing to the doctrine, long abandoned as part of orthodox strict layering, that only a new category can introduce a new level of structure. Even though prosodic structure shows nothing like the depth of embedding created by recursion in syntax,[1] it is a far cry from this uncontroversial observation to the strict layering conclusion that, given a prosodic hierarchy with *n* categories, each path (from root to terminal node) in a prosodic tree must have a length of exactly *n* layers. On the contrary, both level skipping and level repetition have been well motivated, resulting in paths with fewer and more levels, respectively. Level skipping occurs in weakly layered structures, as argued in Ito and Mester 2003(1992), and level repetition is found in recursive prosody, as was assumed in early prosodic theory (see, for example, Nespor and Vogel

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[1]As shown by time-honored examples like the following (after Chomsky and Halle 1968), where syntactic structure and ι-phrasing are radically different:
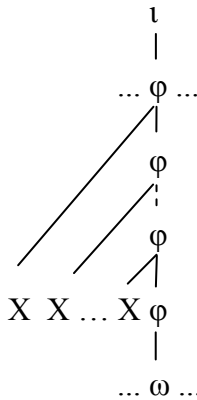
  ι(This is   the cat)ι   ι(that chased   the rat)ι   ι(that ate   the malt)ι
 CP[DP[CP[DP[CP[DP[   ]DP]CP]DP]CP]DP]CP
  All embedding is removed, resulting in a flat sequence of three ι-phrases whose left edges coincide with those of clauses (CPs), and not of the syntactically superordinate DPs.
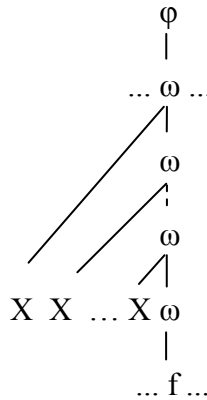
1983) and forcefully argued by Ladd in a number of publications (see Ladd 1996 for a summary). Constituent does not equal category once recursive structures are admitted. Following this growing body of work, we allow for additional layers to arise through recursion, in particular, through adjunction, as shown in (2).

(2) Prosodic recursion
   a. φ-recursion   b. ω-recursion

The crucial point is that recursion imposes further levels of structure on the string being parsed without claiming that each time a different category is involved.

2. Interface categories in Japanese

The phrase-level prosody of Japanese distinguishes the two phrasal interface categories in (3).

(3) |
    MaP   major (≈ 'intermediate') phrase
    |
   MiP   minor (≈ 'accentual') phrase
    |

    The rationale for this supposedly irreducible distinction is that MaP and MiP are domains for different processes. The three main generalizations are summarized in (4).

(4) a. MiP: Domain of accent culminativity
   b. MiP: Domain of initial lowering
     c. MaP: Domain of downstep

How can a model with a single and undifferentiated category φ ('phonological phrase') make the necessary distinctions? The key lies in a better understanding of what the facts really imply about 'domains', and of the ways in which domains relate to categories.

The first generalization (4a) is more of a definition than an argument for a domain, and simply states that there can be at most one accent (H*L) in a MiP (hence the alternative name 'accentual phrase'). The generalization in (4b) is schematically illustrated in (5) (after Selkirk and Tateishi 1991), where several unaccented prosodic words are joined into a single MiP. The central observation is that MiP, the domain of accent culminativity, is also the locus of initial lowering (a %L boundary tone followed by a phrasal H- tone).

(5) Initial lowering within MiP
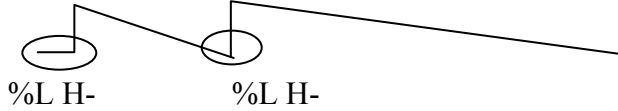
%L H-   %L H-

  a.   [MaP(MiP Oomiya-no) (MiP Inayama-no yuujin-ga inai)]
                                 friend isn't there
        'Mr. Inayama's friend from Oomiya isn't there.'
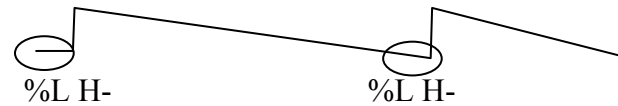
%L H-   %L H-

  b.   [MaP(MiP Oomiya-no Inayama-ga)(MiP yuujin-o yonda)]
                             friend   called
        'Mr. Inayama from Oomiya called his friend.'

Downstep (or catathesis) is to the lowering of the pitch register following an accented syllable (Poser 1984). This is illustrated in (6) (after Selkirk and Tateishi 1991), where each prosodic word is accented and therefore projects a MiP of its own). The domain of downstep is MaP in the sense that post-accent lowering takes place throughout MaP, and the pitch register is reset only at the beginning of the next MaP, not at the beginning of each MiP.

(6) Downstep within MaP

H*L   H*L   H*L
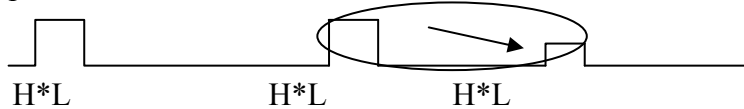
  a.   [MaP(MiP Aóyama-no)][MaP(MiP Yamáguchi-no)(MiP aníyome-ga inai)]
   sister-in-law isn't there
        'Mr. Yamaguchi's sister-in-law from Aoyama isn't there.'

H*L   H*L   H*L
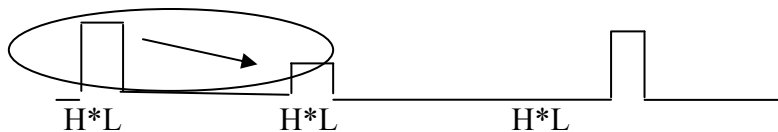
 b.   [MaP(MiP Aóyama-no) (MiP Yamáguchi-ga)][MaP(MiP aníyome-o yonda)]
                                               sister-in-law called
        'Mr. Yamaguchi from Aoyama called his sister-in-law.'

A schematized diagram (with two MaPs, each with two MiPs) illustrating initial lowering (at the beginning of each MiP) and downstep (indicated by arrows within MaP) is given in (7).

(7)

⌟ = %L   ⌐ = H*L (lexical pitch accent)
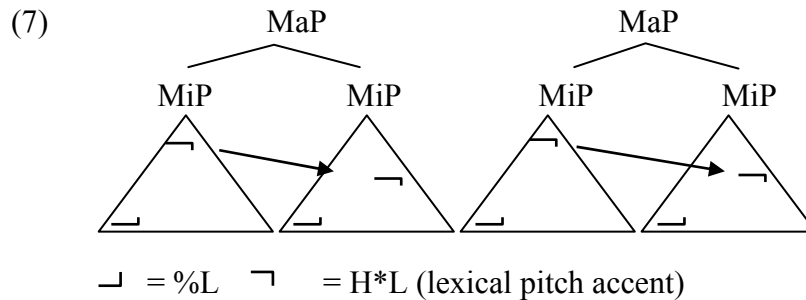
How solid are these domain arguments? Are they sufficient grounds to motivate distinct categories? What goes wrong if both MaP and MiP are simply recursive undifferentiated φs, as in (8)?

(8)
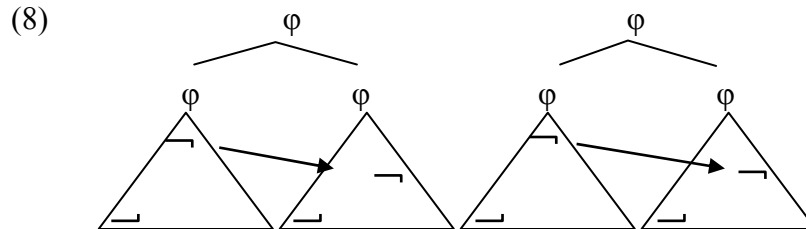
The surprising result is that nothing goes wrong: As far as initial lowering and downstep are concerned, there is no reason to distinguish between different kinds of phrases, MaP and MiP (or intermediate phrase and accentual phrase).

First, by accent culminativity a MiP contains maximally one accent; since downstep requires two accents, the first one downstepping the second, it cannot have any effect within a single MiP. Since it already follows from the structural description of downstep that it cannot apply within MiP, there is no need to specifically exclude it from this domain. Only one kind of phonological phrase φ is needed, then, as in (8), where the lowest φs (not containing other φs) are automatically excluded as 'domains of downstep'.

In a similar way, there is no need to exclude initial lowering from MaP. As long as every MaP begins with a MiP, lowering is already predicted in any case: [$_{MaP}$ [$_{MiP}$ %L …]…]. Moreover, the observation that the degree of initial lowering is more extreme at MaP edges than at MiP edges (Selkirk et al. 2003) casts doubts on the idea that all initial lowering can be reduced to MiP-lowering. For this reason alone, it seems more adequate to locate a %L tone at the left edge of every phrase φ (we will return to this issue below in section 4.3).

Downstep and initial lowering, then, work without problems in the one-φ model. Our immediate conclusion is that initial lowering applies to all φ-phrases (not just to MiP), and likewise downstep applies to all φ-phrases (not just to MaP). The more interesting conclusion is that we

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can contemplate abolishing the entire MaP/MiP distinction: Let there be only one phonological phrase φ.
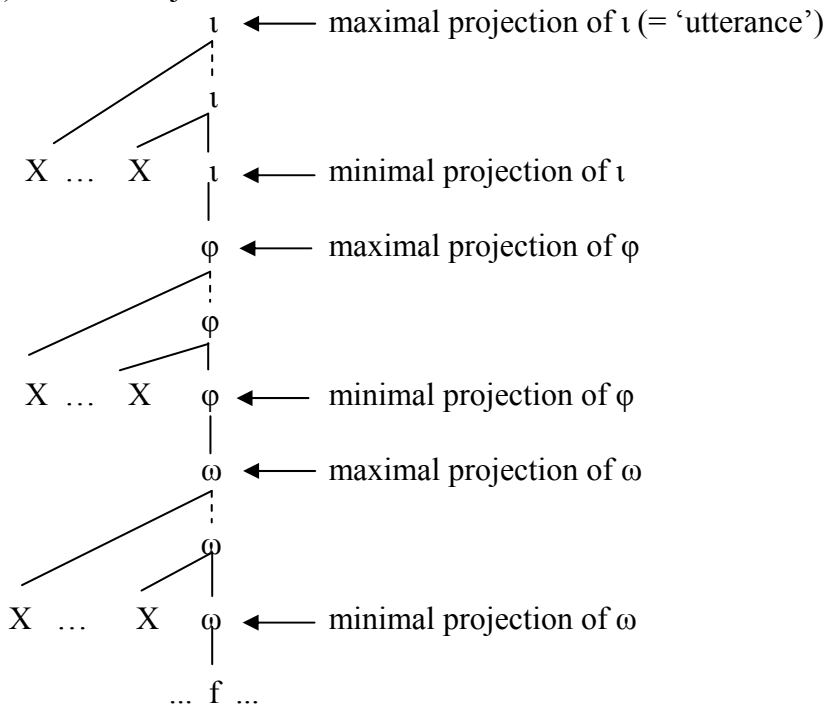
3. Prosodic projection theory

What the facts and generalizations seem to demand is not enough *categories,* as the standard view of prosodic form has it, but rather enough *levels of structure.* But structure can be provided in a number of ways, the 'level = category' approach is just one of a number of possibilities, and arguably not the optimal one. In this context, it is significant that work over the last twenty years has firmly established recursivity as an indispensable attribute of prosodic form in a number of languages. Thus recursive phrasing at the level of the intonational phrase and the phonological phrase has been demonstrated by Ladd 1986, 1996, Inkelas 1989, and Gussenhoven 2005; pro-sodic word recursion is shown to be necessary for compounds and function word complexes by Booij 1996 and Ito and Mester 2007, to appear-b, to appear-a. Further development, with additional evidence, is found in Kubozono 1988, 1993, 2005, van den Berg et al. 1992, Truckenbrodt 2002, and Féry and Truckenbrodt 2005, among others. Extensive study and motivation of recursive structures in prosody can be found in two recent dissertations (Wagner 2005 (MIT) and Schreuder 2006 (Groningen)).

Building on this line of work, we will here outline a model that we refer to as *prosodic projection theory*. Each prosodic category defines its own network of projections, where the usual tree-structural notions apply, such as minimal and maximal projection and head vs. non-head. Phonological and phonetic processes are part of the realization of this structure, and signal important boundaries by selecting different subconstituents as their domains. Using standard tree-structural terminology, the largest projection of a prosodic category κ is the 'maximal κ', its smallest projection is the 'minimal κ', as defined in (9).

(9) κ_{max} = κ not dominated by κ
    κ_{min} = κ not dominating κ

The schematic structure in (10) shows how these definitions apply to the interface categories *intonational phrase* (ι), *phonological phrase* (φ), and *prosodic word* (ω). Taking up a suggestion by Shigeto Kawahara, we propose that *utterance* (υ), usually posited as the highest category in the prosodic hierarchy, is not a separate category, but rather the maximal projection of the *intonational phrase* (ι). The empirical prediction is that *utterance* cannot be recursive; its only role is to gather up the smaller chunks of prosodic structure.

(10) Prosodic adjunction:

ι ⟵ —— maximal projection of ι (= 'utterance')

ι

X … X   ι ⟵ —— minimal projection of ι

φ ⟵ —— maximal projection of φ

φ

X … X   φ ⟵ —— minimal projection of φ

ω ⟵ —— maximal projection of ω

ω

X … X   φ ⟵ —— minimal projection of ω

… f …

4. Recursive φ vs. MiP/MaP

How do prosodic projection theory and MiP/MaP theory match up? In specific instantiations, MiP simply corresponds to the minimal φ, MaP to the maximal φ, as depicted in (11), leaving us wondering whether we have just recreated MiP and MaP under different names.

(11) MiP/MaP vs. minimal-φ/maximal-φ

MaP ⟶ φ (maximal φ)

MiP   MiP ⟶ φ   φ (minimal φ)

ω …   ω …   ω …   ω …
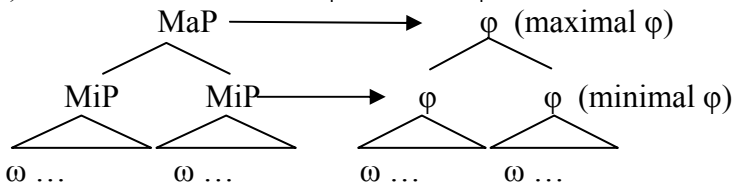
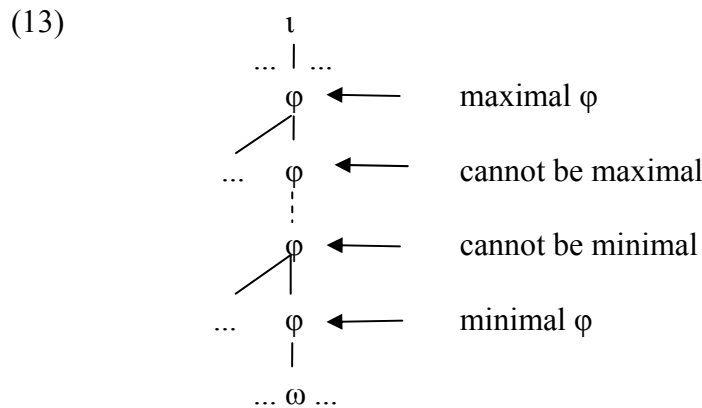Closer inspection reveals, however, that the two theories are far from being notational variants. There are significant differences between the two, and the evidence favors the single φ-category approach. MiP/MaP theory faces a dilemma in that it gives rise to two diametrically opposed problems at the same time: It provides too much structure in some respects, and too little structure in others.

4.1 Too much structure in MiP/MaP

Recursivity is an established attribute of prosodic form—in OT-terms, the anti-recursivity constraint is violable (Selkirk 1996). But whenever this constraint is low-ranking in the grammar, MiP/MaP theory in principle allows both phrases to appear recursively, as in (12).

(12)

$$
\begin{array}{l}
\iota \\
... \mid ... \\
\text{MaP} \\
\qquad \left.\begin{array}{l} \\ ... \quad \text{MaP} \end{array}\right\} \quad \text{Recursive MaP} \\
\\
\text{MiP} \\
\qquad \left.\begin{array}{l} \\ ... \quad \text{MiP} \end{array}\right\} \quad \text{Recursive MiP} \\
\\
... \omega ...
\end{array}
$$
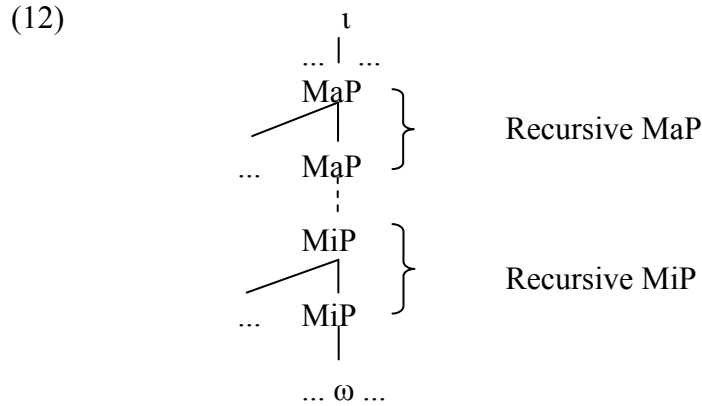
Such nested MaP/MiP structures have no equivalent in prosodic projection theory. While MaP and MiP are actual categories and can be recursive, 'maximal φ' and 'minimal φ' are relational terms, not separate categories, and it makes no sense for something to be 'recursively maximal' or 'recursively minimal' in a single projection: Only one instance of a category is maximal, and only one is minimal (see (9)).

(13)

$$
\begin{array}{ll}
\iota & \\
... \mid ... & \\
\varphi \leftarrow & \text{maximal } \varphi \\
... \quad \varphi \leftarrow & \text{cannot be maximal} \\
\varphi \leftarrow & \text{cannot be minimal} \\
... \quad \varphi \leftarrow & \text{minimal } \varphi \\
... \omega ... &
\end{array}
$$

Given the independent need for recursive structures, the single-φ approach is thus inherently more restrictive than the MiP/MaP approach in (12).

Whether this difference is of consequence remains an empirical question, and will require careful investigation. Interestingly, Selkirk (2000: 25) argues explicitly that in English recursive MaP structures need to be ruled out by specifically assuming high ranking NONRECURSIVITY-

MAP. If 'MaP' ≈ maximal φ, this follows automatically without invoking other constraints or ranking.[2]

4.2 Too little structure in MiP/MaP

Evidence that the standard MiP/MaP approach does not provide enough structure to represent the ways downstep plays out in Japanese was first pointed out by Kubozono (1993:205-208), who found that a sequence of four accented MiPs with the grammatical structure [ÁB́][ĆD́], while exhibiting downstep throughout, i.e., clearly constituting a single MaP, has a systematically higher pitch on Ć than what the flat prosodic structure $_{MaP}$[MiP MiP MiP MiP] predicts. Kubozono (1989: 58-59) argues that one way of understanding this metrical boost is as a phonetic reflex of a binary, recursively restructured MiP-MiP sequence as in (14).
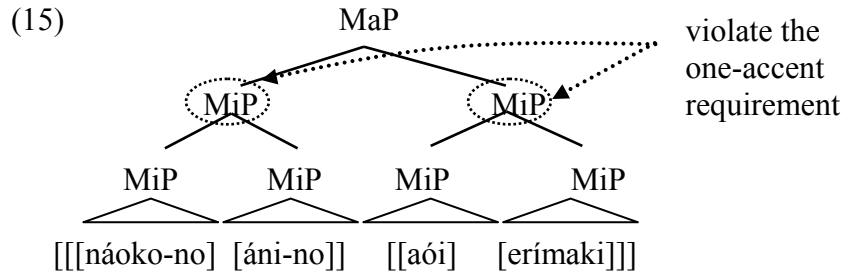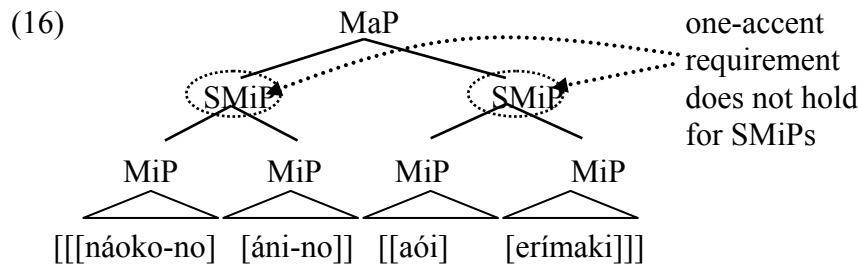
(14) Recursive MiPs
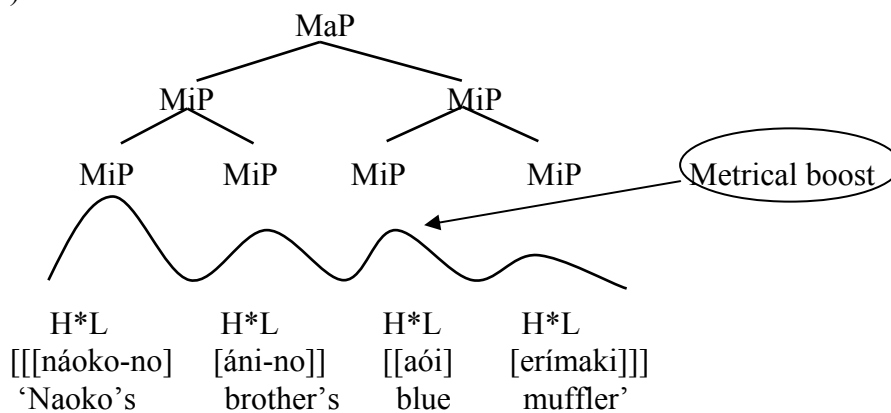
This is a subtle finding with important consequences, and the proposed recursive MiP structure clearly makes sense of the metrical boost, which remains baffling under the standard view.[3] But now a different and unexpected problem arises: Each of the higher MiPs contains two accents, inherited from the two subordinate MiPs, and therefore violates accent cumulativity, the defining property of MiP.

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[2] Kratzer and Selkirk 2007 use recursive MaPs in explaining the accentual variation found with main clause word order in German. MaP recursivity is not essential to the proposal, however, which can be straightforwardly recast with extended word projections (ω-recursion) for MiP and φ-phrase recursion for MaP (see Ito and Mester 2008).

[3] Among other things, it involves the recognition that the notion downstep has a *paradigmatic* component, besides the obvious *syntagmatic* one: Kubozono argues that Ć in [ÁB́][ĆD́] in (14) is downstepped relative to B́, even though at roughly the same pitch as B́, because it is significantly lower in pitch than Ć in [ÁB][ĆD́], where it follows unaccented B.

(15)

MaP

MiP   MiP

MiP   MiP   MiP   MiP

[[[náoko-no] [áni-no]] [[aói] [erímaki]]]

violate the
one-accent
requirement

The contradictory domain desiderata—nonrecursive MiPs to observe accent cumulativity vs. recursive MiPs to account for the metrical boost—did not go unnoticed (Shinya et al. 2004), and the response was the standard one of introducing yet another category, 'SMiP' ('Superordinate Minor Phrase'), between MiP and MaP. SMiP, and not MiP, takes care of the metrical boost, and the one-accent requirement holds of MiP, not of SMiP.

(16)

MaP

SMiP   SMiP

MiP   MiP   MiP   MiP

[[[náoko-no] [áni-no]] [[aói]   [erímaki]]]

one-accent
requirement
does not hold
for SMiPs

In the φ-only model, the problematic contradiction does not arise, because the one-accent requirement holds of minimal φ, and the branching φs are necessarily non-minimal. The metrical boost, on the other hand, is associated, as in Kubozono's conception, with φ in a right-branching recursive configuration, which is necessarily non-minimal.

(17)

φ

φ   φ

φ   φ   φ   φ

[[[náoko-no] [áni-no]] [[aói]   [erímaki]]]

non-minimal
φs

minimal
φs
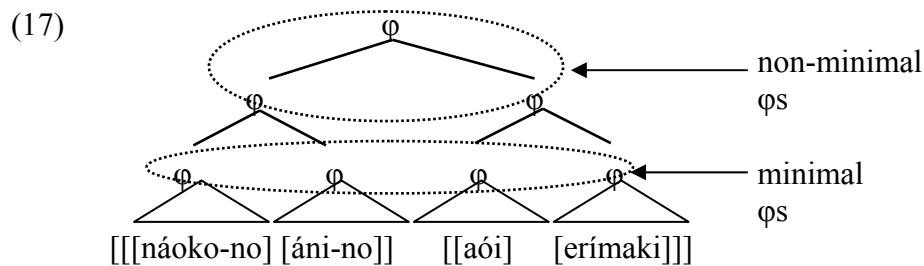
No new intermediate category (such as SMiP) is necessary in the φ-only approach. The larger lesson to be learned here is that separate labels become a liability where recursive structures are called for: They require further elaboration of the labeled hierarchy, dimming the prospects for a cross-linguistically valid hierarchy.[4]

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[4] See also Wagner 2005 for a more radical departure from the standard labeled hierarchy, with arguments for a 'label-free' purely metrical model of prosodic structure.

4.3 Cumulative lowering in recursive φ

Comparing the MiP/MaP approach, where lowering occurs MiP-initially, with the φ-only approach, where lowering occurs at the beginning of *every* φ, we find that the two theories make different predictions for left edges. If lowering is cumulative, the φ-only approach predicts more significant lowering for A in (18a), which initiates two φs, than for B and C. On the other hand, as long as nothing else is said, MiP/MaP theory predicts that A should be in no way different from B and C in (18b).

(18)   a. $[_\varphi \ [_\varphi \ A \ ][_\varphi \ B \ ][_\varphi \ C \ ] \ ]$
       b. $[_{MaP}[_{MiP} A][_{MiP} B][_{MiP} C] \ ]$

The facts here favor the φ-only approach: Selkirk et al. 2003 found that the degree of initial lowering is more extreme at left edges—a puzzling result for the view that initial lowering is a MiP-exclusive property. Such upwards-inheritance of strengthening effects is a general feature of the prosodic hierarchy, according to Fougeron and Keating 1997 and Flack 2007. What accounts for the different degrees of initial lowering? In the φ-only approach, lowering occurs at the beginning of all φs, and if it is cumulative, more significant lowering is immediately predicted at the left edge of structures like (18a) without special pleading. The MiP/MaP approach, on the other hand, needs a separate stipulation that MaP edges have more extreme lowering.

4.4 Initial lowering in weakly layered structures

We have so far considered one way in which prosodic structures are not strictly layered, namely, through level-repetition (recursivity). A second way is by skipping prosodic levels, as in situations where syllables remain unfooted and are directly dominated by the prosodic word (see Ito and Mester 2003(1992), Selkirk 1996, Peperkamp 1996, and Kabak and Schiering 2006 for examples). In terms of Ito and Mester to appear-a, these involve violations of the constraint PARSE-INTO-X, where X is some level of the prosodic hierarchy.[5] It turns out that the MiP/MaP approach and the φ-only approach make different predictions in cases where level-skipping is involved, i.e., when MaP does not begin with MiP and directly dominates ω (skipping the MiP level), as in (19a), to be compared with the structurally equivalent φ-only structure (19b). The circled prosodic word is not MiP-initial in (19a), which would mean no initial lowering. On the other hand, it is φ-initial in (19b), predicting lowering. In order to force initial lowering MaP-initially, the MiP/MaP approach must stipulate that every MaP begins with a MiP: $[_{MaP}[_{MiP}\ldots]\ldots]$.

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[5] Or in the terminology of Selkirk 1996, violations of EXHAUSTIVITY$_Y$, which demands that the higher category Y dominate only X.

(19)   a. MiP/MaP theory: MaP

MiP   MiP   MiP

ω   ω …   ω …   ω …

b. φ-only theory: φ

φ   φ   φ

ω   ω …   ω …   ω …
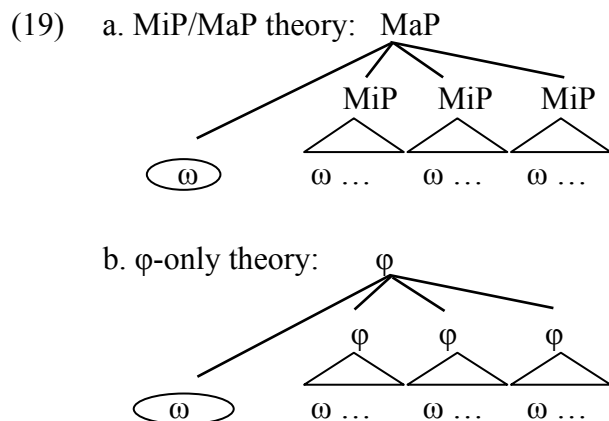
No examples are known to us that would directly bear on this issue, but plausibility is certainly on the side of the φ-only theory, especially in light of the fact that lowering effects in general increase with the level of phrasing (see the previous section).

5. Summary and further consequences

In prosodic hierarchy theory, a large number of different interface categories have been proposed in order to provide enough separate domains for different processes, including *utterance, intonational phrase, phonological phrase, major phrase, intermediate phrase, minor phrase, accentual phrase, tone group, clitic group, prosodic word,* and *minor word.* The totality of these categories has never been instantiated in a single language, however, and their crosslinguistic identification (Does the X-Phrase of Language A really correspond to the X-Phrase of Language B?) has remained a largely unsolved problem. Even within a single language, the insistence on strictly layered representations has led to a considerable multiplication of categories. Whenever a process is found to operate in a slightly different domain than some other process, the model required setting up two separate categories. Once repetition of levels through recursion becomes an option, however, 'domain' no longer equals 'category', raising the suspicion that perhaps some of the categories proposed in the earlier prosodic literature are in reality only larger recursive structures built on a single basic interface category. Loosening the doctrine of strict layering allows us to strengthen the theory on the category side, and limit the interface categories to a small and universally well-defined set, much like the broadly agreed-on set for rhythmic categories (foot, syllable, and mora).

In this paper, we reviewed the evidence for the distinction between the central interface categories proposed for Japanese, major phrase and minor phrase. While everyone agrees that constituents of different sizes are involved, we have argued here that there is no need to postulate two separate interface categories, and that the evidence favors a model with a single category φ 'phonological phrase', with the option of recursion. Since the φ-only theory is more restrictive, given that recursion has been shown to be necessary on independent grounds, it is up to the proponents of theories with a larger number of interface categories to show that additional categories are in fact necessary.

In a more general vein, we hypothesized that there are only three universal interface categories: *intonational phrase* (ɩ)*, phonological phrase* (φ)*,* and *prosodic word* (ω)*.* Additional structure is imposed on the string through recursion. Investigations along these lines, where relational notions such as maximal and minimal projections of categories play a natural role, have resulted in some interesting and promising results in a variety of languages. Woodbury 2002 shows in detail, using both prosodic and segmental phenomena as evidence, that Cup'ik prosody distinguishes two 'word' constituents: The grammatical word minus all enclitics, and the grammatical word plus all enclitics. In our terms, the two domains ('PW–' vs. 'PW' in Woodbury's notation) correspond exactly to the minimal and the maximal prosodic word (ω), respectively. The analysis of the word-level stress domain and the *Ezafe* construction in Persian (Kahnemuyipour 2003) can be interpreted along similar lines, with an appeal to minimal and maximal projections of ω.

In work on the prosody of Irish, Dowd 2009 has identified the maximal ω as the domain of synthetic agreement; and Bennett and McCloskey 2008 show with several diagnostics (including pause, downstep, and lengthening) that phonological phrases (φ) are right-aligned to XP, and that the syntactically baffling distribution of weak pronouns has a prosodic rationale (see also Elfner 2008): They appear at the right edge of the maximal φ. Henderson 2008 shows that in K'ichee' *h*-final allomorphs occur as phonological phrase markers. In conjoined phrases, they are optionally found on the first conjunct, which can be understood as recursive φ-phrasing, with *h*-final allomorphs appearing either on the minimal or the maximal φ.

In our own work, we have shown that prosodic projection theory can be fruitfully applied to illuminate the interplay between *rendaku,* accent, downstep, and initial lowering in Japanese complex compounds (Ito and Mester 2007), the prosodic conditioning of intrusive-*r* in non-rhotic English (Ito and Mester to appear-b), and the phonology of English and German function word complexes, which involves various segmental fusion processes (Ito and Mester to appear-a).

While these preliminary results inspire some confidence in the general outlook on prosody presented here, it remains to be seen in future work whether a prosodic projection theory with such a minimal set of interface categories can be upheld crosslinguistically.

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