THE SYNTAX-PROSODY MAPPING IN JAPANESE REVISITED
IS IT BRANCHINGNESS OR XP-EDGES THAT MATTER?

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0   Introduction

It has been widely assumed that a syntactic representation is mapped onto an independent prosodic structure, which determines the phonological representation and phonetic implementation of segments, tones and prominences (Selkirk 1986, Nespor & Vogel 1986, among many others) A question is raised as we think about the syntax-prosody mapping what syntactic properties are relevant to prosodic phrase formation Selkirk (1986), Selkirk & Shen (1990) and Selkirk & Tateishi (1988, 1991) and others have proposed that it is the edges of syntactic categories such as X^0 or XP that prosodic structure formation is sensitive to On the other hand, Cowper & Rice (1987), Bickmore (1990), Kubozono (1992, 1993) and others consider it to be the branchingness of a syntactic node that prosodic phrasing beholds In this paper, I will provide evidence from Japanese intonation and prosodic phrase formation to support the former proposal The outline of this paper is the following In Section 1, I will give basic fats and preliminary assumptions about Japanese intonation Section 2 will introduce two different proposals for Japanese syntax-prosody mapping by Selkirk & Tateishi (1988, 1991) and Kubozono (1992, 1993) Section 3 will introduce different predictions made by those two proposals In Section 4, I will argue that Selkirk & Tateishi's proposal is on the right track based on the results obtained in a production experiment Section 5 will cast a light on some residual issue an interaction between a syntax-prosody interface constraint and a purely prosodic constraint NONFINALITY

1   Basic Facts and Assumptions of Japanese Intonation

In Japanese, each lexical item is specified for unaccented or accented An accented word has one and only one bitonal pitch accent notated as H*+L associated with some designated mora In this paper, we will only focus on cases with accented words Each accented word together with a case marker or a postposition that follows it is usually mapped onto a single Minor Phrase (or Accentual Phrase) in the phonological representation I assume that a Minor Phrase is a domain delimited by Low boundary tone (henceforth, L%) and High Phrasal tone (henceforth, H-) following Pierrehumbert & Beckman (1988) L% is associated with the first and the last mora of each Minor Phrase and H- is associated with the second mora of a Minor Phrase Tones introduced here behave as the phonetic targets, and phonetics interpolates F0 between those targets, which results in an intonational contour A schematic representation of an accented Minor Phrase together with those tones and its intonational contour is shown in Figure 1
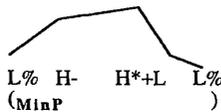

L% H- H*+L L% (MinP)	Figure 1 A schematic representation of a Minor Phrase with pitch accent, boundary tones, and its F0 contour

If there is a sequence of two accented Minor Phrases, it has been reported by Poser (1984) and Pierrehumbert & Beckman (1988) that the pitch range associated to the second accented Minor Phrase may be drastically lowered as in Figure 2
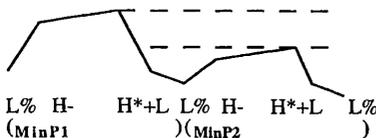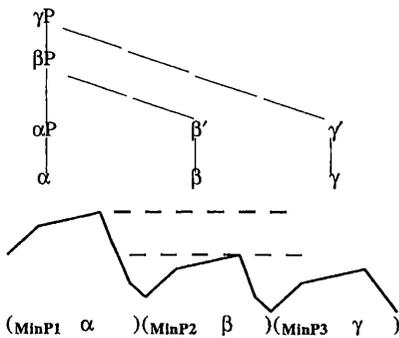


L% H- H*+L L% H- H*+L L% (MinP1)(MinP2)	Figure 2 A schematic representation of a sequence of two accented Minor Phrases and an F0 contour associated with them

Selkirk & Tateishi's data in (1991) and Kubozono (1992, 1993), however, show that the magnitude of downtrend, i e the magnitude of pitch range lowering, at the second Minor Phrase depends on what the corresponding syntactic structure is it is lessened when the corresponding syntactic structure is right branching, it is kept large when the corresponding syntactic structure is left branching Now consider the following supposed Japanese three-word structures in (1) and (2) The tree structure in (1) is a left branching syntactic structure, and the downtrend at the second word (or the second Minor Phrase) of that structure is quite large On the other hand, the one in (2) is a right branching syntactic structure and the magnitude of downtrend at the second word (or the second Minor Phrase) is smaller Kubozono (1992, 1993) and Selkirk & Tateishi (1988, 1991) give different accounts for this fact In Section 2, those two different approaches and their different predictions are introduced

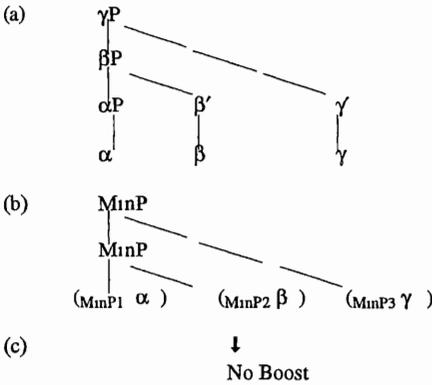(1) 3-Word Left Branching Syntactic Structure   (2) 3-Word Right Branching Syntactic Structure
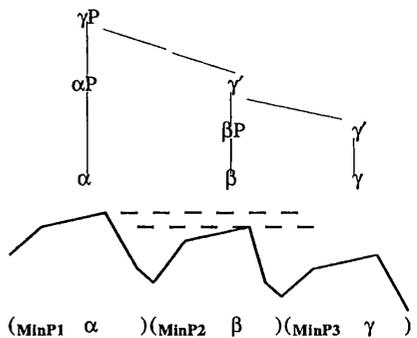
2   Kubozono vs Selkirk & Tateishi

In this section, I will compare two hypotheses of syntax-prosody mapping in Japanese Kubozono's (1992, 1993) and Selkirk & Tateishi's (1988, 1992) Those two hypotheses make exactly the same prediction for the intonational patterns associated with the left-branching structure in (1) and the right branching structure in (2)
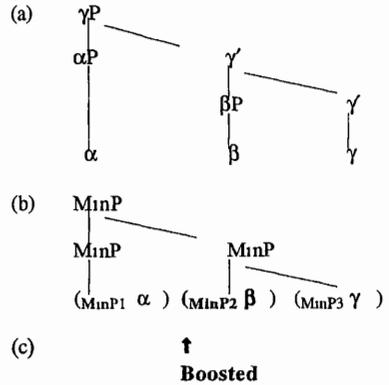
2 1   Kubozono (1992, 1993)

Kubozono assumes that prosodic representation is strictly binary and directly reflects the branching structure of syntax Hence, if the given syntactic structure is right-branching, the prosodic structure is also right-branching, if the syntactic structure is left-branching, then the prosodic structure is also left-branching At the same time, he assumes a recursive prosodic structure following Ladd (1986), and proposes that prosodic constituents in Japanese are arranged in a binary branching hierarchical structure, which allows embedding of prosodic constituents within constituents of the same type According to his model, morphological words taken from the syntactic domain into the phonological domain undergoes Minor Phrase Formation first Secondly, Minor Phrases obtained in the last process are combined together forming a recursive Minor Phrase structure that directly encodes the original syntactic binary branching structure Then, it is at the left edge of a binary Minor Phrase dominating two Minor Phrases where the reduction of a pitch range lowering (or a boost of pitch range) takes place

(3) Left Branching Structure

(4) Right Branching Structure

(a)
γP
βP
αP
α β γ
β' γ

(a)
γP
αP
γ'
βP
α β γ

(b)
MinP
MinP
(MinP1 α) (MinP2 β) (MinP3 γ)

(b)
MinP
MinP   MinP
(MinP1 α) (MinP2 β) (MinP3 γ)

(c)
↓
No Boost

(c)
↑
Boosted

In (3a) and (4a), I present two syntactic structures (3a) is a left-branching structure and (3b) is a right-branching structure Those two different syntactic structures are mapped onto left-branching and right branching recursive Minor Phrase structures as in (3b) and (4b) respectively The second word β in the left-branching Minor Phrase structure in (3b) does not coincide with the left edge of a branching Minor Phrase Hence, there is no pitch range boost (i e no reduction of downtrend) takes place at the second word β in (3) On the other hand, the second word β in the right-branching Minor Phrase structure in (4b) coincides with the left edge of a branching Minor Phrase As a result, phonetics raises the pitch range of the second word β as shown in (4c) This model well explains and makes the correct prediction for the paradigm shown in (1) and (2) such that the downtrend observed at the second word of a right-branching syntactic structure is smaller than that observed at the second word of a left-branching syntactic structure In Section 4, however, I will argue against this approach given some evidence that downtrend reduction (or a pitch range boost) also take place at the second word of certain types of left-branching structures

2 2   Selkirk & Tateishi (1988, 1991)

The other model to account for the paradigm presented in (1) and (2) is Selkirk & Tateishi's (1988, 1991) Though Kubozono assumes strictly binary branching recursive prosodic structures that is parallel to syntactic ones, they assume that prosodic structures are not necessarily binary branching and recursive Also, they propose that it is at the left edge of a prosodic node of a certain category where downtrend reduction (or a pitch range boost) takes place but it is not at the left edge of a 'binary' prosodic node It has been proposed by Selkirk (1978, 1986), Nespor & Vogel (1986), Pierrehumbert & Beckman (1988) and many others that there is a prosodic hierarchy consisting of layers of categorically distinct prosodic constituents as shown in (5)

(5)   Prosodic Hierarchy

Utt	Utterance
IntP	Intonational Phrase
MajP	Major Phrase
MinP	Minor Phrase
PWd	Prosodic Word
Ft	Foot
σ	Syllable

Each prosodic category in the prosodic hierarchy above is associated with certain phonological features or certain intonational events. Selkirk & Tateishi consider the left edge of each Major Phrase in Japanese to be associated with a pitch range boost. In addition, adopting Selkirk's (1986) end-based syntax-prosody mapping hypothesis, they propose that the formation of a Major Phrase in Japanese is sensitive to the presence or absence of the left edge of a certain syntactic projection, i e XP. That is, there is a constraint that forces the left edge of each XP to be aligned with the left edge of a Major Phrase. I call this constraint ALIGN$_L$(XP,MajP) in terms of McCarthy and Prince's (1993) Generalized Alignment.

(6) ALIGN$_L$(XP,MajP)
  For each XP, there is a MajP such that the left edge of the XP and that of the MajP coincide

Let us now consider how Selkirk & Tateishi's model works to account for the difference between the intonational pattern associated with a left-branching syntactic structure and that associated with a right-branching syntactic structure. (7a) is again a supposed Japanese left-branching syntactic structure consisting of three words, i e α, β and γ. (8a) is a right-branching syntactic structure that also consists of α, β and γ. In the right branching structure in (8a), the second word β must form a maximal projection by itself because β is a left-hand member of a binary branching constituent that dominates both β and γ. In this case, γ is the head of the constituent and β occupies either the complement position or the spec position of γ, or adjoins to some projection of γ. Japanese is a head-final language and it is only the rightmost element in a binary syntactic constituent that can be a head. If some element is not a head of a certain phrase, i e if it is a complement of a head, specifier or an adjunct, it must form a maximal projection by itself because it cannot project any further (Muysken 1982, Chomsky 1995, and among others). This is why the second member β in (8a) projects a maximal projection by itself. On the other hand, the second member β in the left branching structure in (7a) does not have to project a maximal projection because it is the head of the constituent that immediately dominates both the first and the second noun. Given the XP-MajP alignment constraint in (6), Selkirk & Tateishi derives the prosodic representations in (7b) and (8b) from the syntactic structures in (7a) and (8a) respectively. In (7b), the prosodic representation that corresponds to the left-branching syntactic structure in (7a), there is no MajP break between α and β. It is because the left edge of the second word β does not coincide with the left edge of an XP in (7a), and there is no need for a MajP boundary to appear at the left edge of β in (7b). On the other hand, in the case of the right-branching counterpart in (8), there is an XP left edge aligned with the left edge of the second word, β. Hence, according to the XP-MajP alignment constraint in (6), the left edge of β is aligned with the left edge of a Major Phrase. As mentioned above, it is at the left edge of a MajP where reduction of downtrend (or a pitch range boost) takes place according to Selkirk & Tateishi. As a result, the second word β in (8) is realized higher than the second word β in (7)

(7) Left-Branching Structure
(8) Right-Branching Structure

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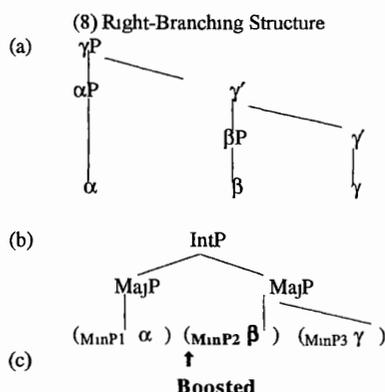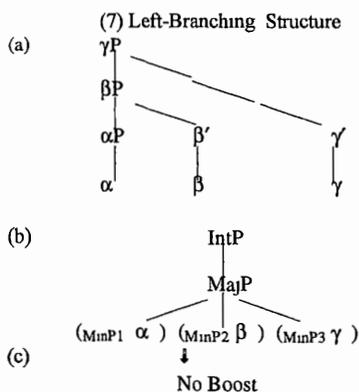
So far, both Kubozono and Selkirk & Tateishi can give an account for the different F0 contour patterns between the left branching structure in (1) (or (3), (7)) and the right branching structure in (2) (or (4), (8)) For Kubozono, the reason that the second word in the right branching structure is realized higher than that in the left branching structure is because the former occupies the leftmost position of a branching syntactic and prosodic node but the latter does not In his model, syntactic branchingness is directly reflected in prosodic representations, and it is at the left edge of a branching prosodic node where pitch range boost takes place For Selkirk & Tateishi, on the other hand, the second word in the right branching structure is realized higher than that in the left branching structure because the former occupies the leftmost position of a Major Phrase but the latter does not In their model, syntactic branchingness does not have to do with prosodic phrase formation Rather, the left edge of an XP picks up the left edge of a Major Phrase, where a pitch range boost takes place In the next section I will argue that there is a case where those two models make different predictions

3   Different Predictions

Kubozono's and Selkirk & Tateishi's model make different predictions for a certain type of left branching structures left branching structures with non-restrictive modification Consider a sequence of two nouns (N1 and N2) in left branching structures in (9) and (10) Those two nouns together form an NP and the preceding one modifies the other in both (9) and (10) However, their modification relation is different N1 and N2 in (9) form a restrictive modification structure but those in (10) form a non-restrictive modification structure In (9), modification of the second noun by the first "restricts" the meaning of the entire NP For example, in (9b), the second noun *shonenmánga* ('boys' comics') by itself denotes a set of any kind of boys' comics By being modified by the first noun *taishojídai* ('Taisho era'), the meaning of the entire NP that exclusively dominates the first and the second noun is restricted into a set of a specific kind of boys' comics, i e a set of boys' comics written in the Taisho era Following Jackendoff (1977), Kameshima (1989) and others, I assume that the first noun in this case adjoins to a projection of the second noun that is smaller than a maximal projection, i e to N' On the other hand, in (10), the second noun by itself denotes a specific entity or an individual and modification of the second noun by the first does not bring any semantic change in what the entire NP that exclusively dominates the first and the second noun denotes For example, in (10b), the second noun *shonennáifu* ('Shonen Knife') is a name and denotes a specific rock band Being modified by the first noun *yumeibándo* ('famous band'), the second noun still denotes the same rock band Here, N1 and N2 in (10b) form a non-restrictive modification structure I assume, following Kameshima (1989) and many others, that the first noun in (10) adjoins to a maximal projection, i e NP

(9) [N1 N2] ---> Restrictive Modification

NP3
NP2
NP1   N'2   N'3
N1   N2   N3
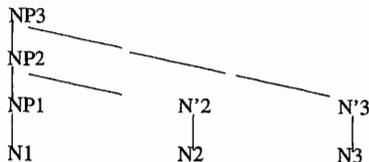
(a) *sumiremóyo-no handobákku-no uregúai*
patterns of violet-Gen handbag-Gen sales
'the sales of handbags with the patterns of violet.'

(b)*taishojídai-no shonenmánga-no heiseibájon*
Taisho era-Gen boys' comics-Gen Heisei-version
'the Heisei-version of boys' comics written in the Taisho era '

(10) [N1 N2] ---> Non-Restrictive Modification

NP3
NP2
NP1   NP2   N'3
N1   N2   N3
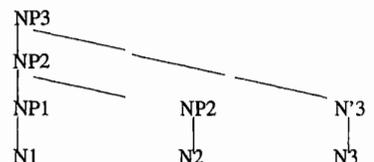
(a)*yumeijóyu-no Ogawa Máiko-no shuen-éiga*
famous actress-Gen Ogawa Maiko-Gen movie
'the movie in which Ms Ogawa Maiko, the famous actress, plays a main character '

(b)*yumeibándo-no shonennáifu-no hittoárubamu*
famous band-Gen Shonen Knife-Gen hit album
'the hit album of Shonen Knife, the famous band

Given those two types of three-noun left-branching structures, Kubozono's and Selkirk & Tateishi's model make different predictions with respect to the pitch range associated with the second noun in (10) As shown in Table 1, according to Kubozono, those two left branching structures in (9) and (10) are both mapped into exactly the same left-branching prosodic representations because both of them have exactly the same left-branching syntactic structures As a result, he predicts that there is no pitch range boost at N2 in (9) as well as in (10) because the second noun in both structures does not occupy the left edge of a branching node

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Table 1 Kubozono's Model

(9) [N1 N2] = Restrictive Modification   (10) [N1 N2] = Non-Restrictive Modification

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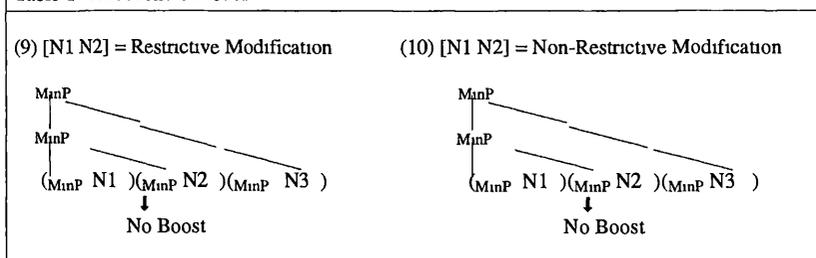
When it comes to Selkirk & Tateishi, those equally left-branching syntactic structures in (9) and (10) are mapped onto two different prosodic representations as shown in Table 2 the one in (9) is mapped onto a ternary branching MajP but the other in (10) is mapped onto two Major Phrases In the left-branching structure with restrictive modification in (9), the second noun N2 does not coincide with the left edge of an NP, and no MajP boundary appears at the left edge of the second noun On the other hand, in the left-branching syntactic structure with non-restrictive modification in (10), the second noun N2 coincides with the left edge of an NP According to the XP-MajP alignment constraint in (6), a MajP boundary appears at the left edge of the second noun in (10) For them, the left edge of a MajP is where pitch range boost takes place As a result, they predict that the pitch range of the second noun in (10) is realized higher than that of the second noun in (9)

Table 2 Selkirk & Tateishi's Model

(9) [N1 N2] = Restrictive Modification   (10) [N1 N2] = Non-Restrictive Modification

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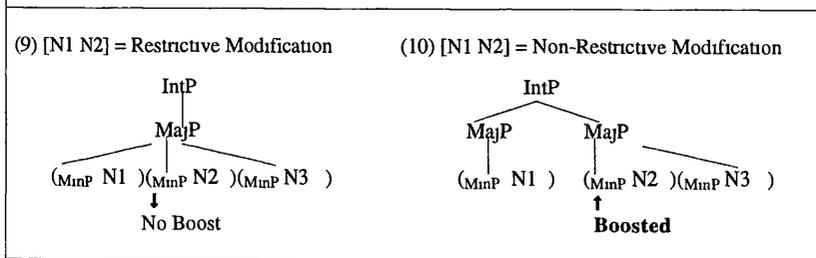
In summary, Kubozono's model predicts that there is no pitch range boost at the second noun of the equally left-branching syntactic structures in (9) and (10), whereas Selkirk & Tateishi's model predicts that the second noun in (10) is realized higher than the one in (9) To examine those two different predictions, a production experiment was carried out

4 The Experiment

The experiment introduced in this section was conducted to examine two different predictions made by Kubozono's and Selkirk & Tateishi's model shown in Section 3

4 1 Methods

Four speakers of Japanese, MK, KK, AT and DI, were recorded in a sound-proof studio in the UMass Phonetics Laboratory Each of them read two kinds of left-branching structures the one with restrictive modification and the other with non-restrictive modification MK and KK and AT produced seven repetitions of (9a) and (10a) and DI produced seven repetitions of (9b) and (10b) Those left branching structures are again shown below
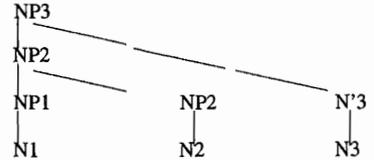
(9) [N1 N2] ---> Restrictive Modification (10) [N1 N2] ---> Non-Restrictive Modification
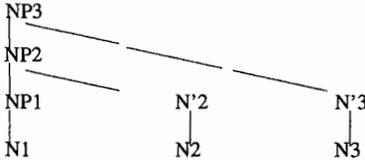
(a) *sumiremóyo-no   handobákku-no   uregúai*
patterns of violet-Gen handbag-Gen   sales

(a)*yumeijóyu-no   Ogawa Máiko-no   shuen-éiga*
famous actress-Gen Ogawa Maiko-Gen movie

(b)*taishojídai-no shonenmánga-no heiseibájon*
Taisho era-Gen boys' comics-Gen Heisei-version

(b)*yumeibándo-no shonennáifu-no hittoárubamu*
famous band-Gen Shonen Knife-Gen hit album

Those three-noun left branching structures are all embedded in a topicalized phrase followed by a topic marker -*wa* or a nominative case marker -*ga* together with a phrase-final particle -*ne* This topic phrase itself is also embedded in a sentence that starts with *tokorode* 'by the way' The phrase-final particle -*ne* is associated with a high Intonational Phrase-final boundary tone, H%, as shown in (11) By adding this phrase-final particle with H%, an unwanted effect of *final lowering* is minimized

(11) [s *tokorode*, [Left Branching Structure] -*wa* (or -*ga*)   -*ne*,   ]
    [s by the way, [Left Branching Structure] -Topic (or -Nominative) -phrase-final particle,   ]
                                                                         H%

All the recorded utterances are digitized at 16,000Hz, using the X-Waves software on the Sun workstation in the UMass Phonetics Laboratory, and their pitch track (F0 contour) was extracted using the same software Then the F0 value for the peak of each word (or Minor Phrase) was measured I will call the F0 peak of the first noun N1 (or the first Minor Phrase) 'Peak 1' and that of the second noun N2 (or the second Minor Phrase) 'Peak 2' as shown in Figure 3
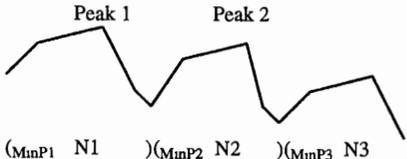

Figure 3 A schematic representation of three accented Minor Phrases and supposed F0 contour associated with them

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The main interest of this experiment is the F0 difference between Peak 1 and Peak 2, which is notated as [Peak1-Peak2]. If Kubozono's model is on the right track, then we expect that there is no evidence to conclude that [Peak1-Peak 2] of the left branching structure with non-restrictive modification in (10) and that of the left branching structure with restrictive modification in (9) are different. On the other hand, if Selkirk & Tateishi's model is right, then 'Peak 2' of the restrictive modification structure in (9) is realized lower than that of the non-restrictive modification structure in (10). If that is the case, then [Peak1-Peak2] of (9) should be larger than [Peak1-Peak2] of (10) as shown schematically below
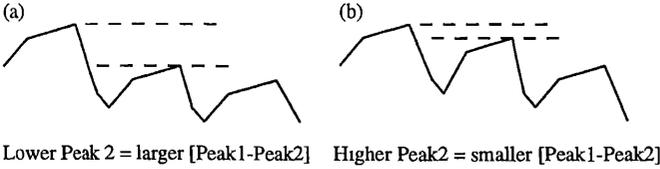
(a)

(b)

Figure 4   A schematic representation of an F0 contour with low Peak 2 in (a), and that of an F0 contour with high Peak 2 in (b)

Lower Peak 2 = larger [Peak1-Peak2]   Higher Peak2 = smaller [Peak1-Peak2]

4 2   Results and Discussion

For each of the speakers, the mean of [Peak1-Peak2] of (10) is significantly smaller than the mean of [Peak1-Peak 2] of (9). That is, the pitch range of the second noun in (10) is realized higher than that in (9). The graphs in Figure 5 show the correspondence between the F0 height of Peak 1 and that of Peak 2 in those two kinds of 3-noun left branching structures (9) and (10). It is obvious from those graphs that Peak 2 of the restrictive left-branching structures in (9) is lower than that of the non-restrictive left-branching structures in (10)
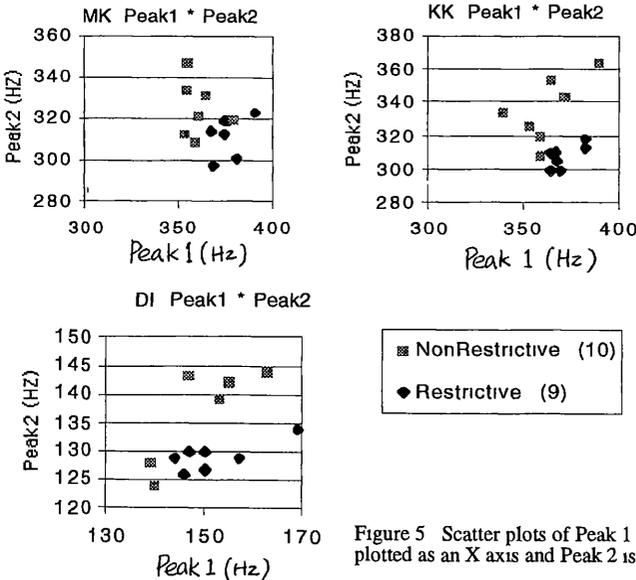

Figure 5   Scatter plots of Peak 1 and Peak 2   Peak 1 is plotted as an X axis and Peak 2 is plotted as Y axis

The sample mean of [Peak1-Peak2] of (9) is consistently larger than that of (10) for all of the speakers As for MK, the sample mean of [Peak1-Peak2] of (9a) is 63Hz and that of (10a) is 36 14Hz The p value of a one-tailed paired t test comparing those two means is 0 008 (< 0 05, the level of significance) The same is true of KK, AT and DI KK's sample mean of [Peak1-Peak2] of (9a) is 62Hz and that of (10a) is 26 57Hz The p value of the t test is 0 0017 (< 0 05) AT's sample mean of [Peak1-Peak2] of (9a) is 38 43Hz and that of (10a) is 20 29Hz The p value of the t test is 0 0013 (< 0 05) DI's sample mean of [Peak1-Peak2] of (9b) is 22 4Hz and that of (10b) is 12 7Hz The p value of the t test is 0 02 (< 0 05) In summary, the mean of [Peak1-Peak2] of (9) is significantly larger than that of (10) for all of the speakers That is, Peak 2 of the restrictive modification structure in (9) is realized lower than that of the non-restrictive modification structure in (10)

The results obtained in this experiment support Selkirk & Tateishi's XP-MajP alignment model That is, the second word N2 in the left branching structure with non-restrictive modification in (10) is realized in a higher pitch range than the one in the left branching structure with restrictive modification in (9) According to Selkirk & Tateishi, it is because there is an XP left edge aligned with the left edge of N2 in the non-restrictive modification structure in (10) and the XP edge calls for a MajP left edge aligned with it, which results in a pitch range boost On the other hand, Kubozono's model wrongly predicts that there is no pitch range boost at N2 in (9) as well as in (10) because N2 is not the left-hand daughter of a branching node in both types of left branching structures

5   Violability of $ALIGN_L(XP,MajP)$

In Section 4, I have concluded that the result of the experiment presented in that section support Selkirk & Tateishi's XP-MajP alignment constraint, i e $ALIGN_L(XP,MajP)$, which is again shown in (12) There are, however, some limited cases where the edge alignment constraint is violated This does not necessarily mean that the edge alignment constraint is invalid Rather, I will argue, within the framework of Optimality Theory developed by Prince & Smolensky (1993), that it is because some conflicting constraints dominate the alignment constraint in (12)

(12) $ALIGN_L(XP,MajP)$
    For each XP, there is a Major Phrase such that the left edge of the XP and that of the Major Phrase coincide

Consider the following two-noun restrictive modification and non-restrictive modification structures in (13) and (14) respectively

(13)　　　　　NP2　　　　　　　　　　(14)　　　　　NP2

　　　　　NP1　　　N'2　　　　　　　　　　　NP1　　　NP2

　　　　　N1　　　　N2　　　　　　　　　　　　N1　　　　N2
　　　taishojídai-no　　*shonenmánga*　　　　　*yumeibándo-no*　　*shonennáifu*
　　　Taisho era -Gen　　boys' comics　　　　　famous band -Gen　　Shonen Knife
　　　"boys' comics in the Taisho era"　　　　　　"Shonen Knife, the famous band"
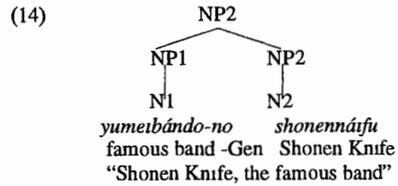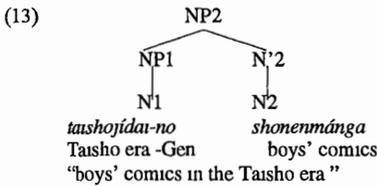
If $\text{ALIGN}_L(\text{XP,MajP})$ is satisfied, then we expect that the pitch range associated with N2 in (14) is realized higher than that associated to N2 in (13), i e [Peak1-Peak2] of (9) is larger than [Peak1-Peak2] of (10) However, the result of an experiment shown in Section 5 1 reveals that it is not the case In Section 5 2, I will argue that the violation of $\text{ALIGN}_L(\text{XP,MajP})$ is possible in those circumstances because it is dominated by another constraint that forbids an Intonational Phrase-final prosodic head

5 1　The Experiment and Its Results

To test the hypothesis that the pitch range of N2 in the two-noun non-restrictive modification structure in (14) is realized higher than that of N2 in the two-noun restrictive modification structure in (13), another production experiment was conducted One speaker, DI, was recorded in this experiment He read the restrictive modification structure in (13) and the non- restrictive modification structure in (14) seven times All the other procedures and methods of this experiment is the same as the ones of the previous experiment introduced in Section 4

The scatterplot in Figure 6 shows the correspondence between Peak 1 and Peak 2 of the 2-noun restrictive modification structure in (13) and the 2-noun non-restrictive modification structure in (14) From the plot, it is obvious that there is almost no difference between Peak 2 of (13) and Peak 2 of (14) Both are realized in the same pitch range The sample mean of [Peak1-Peak2] of (13) is 22 7Hz and that of (14) is 25 1Hz only 2 4Hz difference To examine whether there is any significant difference between the mean of [Peak1-Peak2] of (13) and that of (14), a two-tailed paired t test was carried out. The p value of the test is 0 4 (> 0 05) Given this result, I conclude that there is no evidence to conclude that the mean of [Peak1-Peak2] of (13) and that of (14) are different [1]
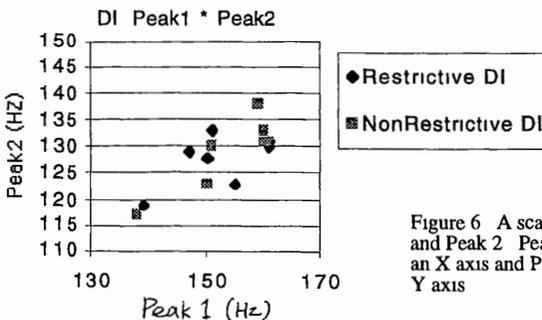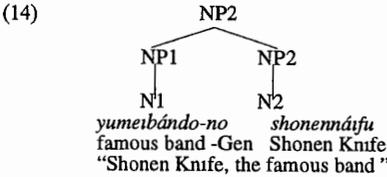
Figure 6　A scatter plot of Peak 1 and Peak 2 Peak 1 is plotted as an X axis and Peak 2 is plotted as Y axis

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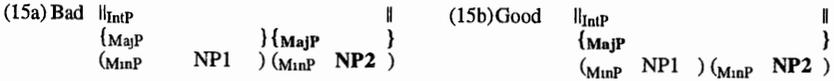[1] Similar results were obtained in another experiment with different speakers in Sugahara (1999)

This is something unexpected if the alignment constraint in (12) is satisfied If it were satisfied, then Peak 2 of (13) would be realized lower than that of (14) the mean of [Peak1-Peak2] of (13) would be larger than that of (14) Because there is no significant difference between those two means, I conclude that ALIGN$_L$(XP,MajP) in (12) is violated in the two-noun non-restrictive modification structure in (14) Under the assumption of Optimality Theory developed by Prince & Smolensky (1993), a constraint is violable if it is dominated by a conflicting constraint In the next section, I will propose that ALIGN$_L$(XP,MajP) is actually dominated by a purely prosodic constraint NONFINALITY
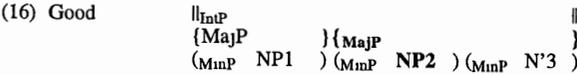
5 2   Prosodic Heads and NONFINALITY

In the last section, we have observed that ALIGN$_L$(XP,MajP) is violable at the left edge of N2 of the two-noun non-restrictive modification structure in (14), which is again shown below I will argue, within the framework of Optimality Theory, that the constraint is dominated by a conflicting constraint whose origin is purely prosodic

(14)

```
                    NP2
               ┌─────┴─────┐
             NP1          NP2
              |            |
             N'1          N2
       yumeibándo-no    shonennáifu
       famous band -Gen  Shonen Knife
       "Shonen Knife, the famous band "
```

In (15a) and (15b), I show two possible prosodic representations for (14) The former is a bad representation but satisfies ALIGN$_L$(XP,MajP) The latter is the preferred representation but it violates ALIGN$_L$(XP,MajP)

(15a) Bad ‖$_{IntP}$ ‖   (15b) Good ‖$_{IntP}$ ‖
           {$_{MajP}$ }{$_{MajP}$ }   {$_{MajP}$ }{$_{MajP}$ }
           ($_{MinP}$ NP1)($_{MinP}$ **NP2**)   ($_{MinP}$ NP1)($_{MinP}$ **NP2**)

ALIGN$_L$(XP,MajP) is not violated at the left edge of NP2 by the preferred representation when NP2 is in (10), a three-noun left-branching structure, as already observed in Section 4 This representation is shown in (16)

(16)   Good   ‖$_{IntP}$ ‖
                   {$_{MajP}$ NP1 }{$_{MajP}$ }
                   ($_{MinP}$ NP1)($_{MinP}$ **NP2**)($_{MinP}$ N'3)

A generalization obtained from the comparison between the representations in (15) and the representation in (16) is that only at the left edge of the rightmost Minor Phrase, ALIGN$_L$(XP,MajP) is violated In the case of the three-noun left-branching structure where nonrestrictive modification relation holds between N1 and N2 as in (10), the Minor Phrase that corresponds to N2, whose left edge coincides with an NP left edge, does not occupy the rightmost position of an Intonational Phrase Rather it is the third Minor Phrase (i e N3) which occupies the rightmost position of the phrase as shown in (16) When it comes to two-noun non-restrictive modification structure in (14), it is the second Minor Phrase (i e N2) whose left edge coincides with the left edge of an NP At the same time the second Minor Phrase occupies the rightmost

position of an Intonational Phrase as shown in (15) If there is a Major Phrase boundary aligned with the left edge of the Intonational Phrase-final Minor Phrase as in (15a), the representation becomes disfavored for some reason

Then, what is special about the IntP-final MinP in (15a)? Before answering this question, we have to consider the relation between a prosodic constituent and its head According to the Prosodic Prominence Hypotheses[2] in (17) proposed by Selkirk (1997), every prosodic constituent must dominate one and only one immediate head

(17) Prosodic Prominence Hypothesis (Selkirk 1997)
Every prosodic constituent is headed by exactly one prosodic constituent one level lower

Given this hypothesis, a Major Phrase must dominate exactly one Head Minor Phrase, which is notated as MinP Also an Intonational Phrase must dominate one and only one Head Major Phrase, which is notated as MajP Then, the IntP-final Minor Phrase in (15a) is an immediate head of a Major Phrase which in turn is an immediate head of an Intonational Phrase In her study of Focus and prosodic phrase formation, Selkirk (1999) proposes that there are constraints that force a MinP to occupy the leftmost position of a MajP and force a MajP to occupy the rightmost position of an IntP ALIGN$_L$(MinP, MajP) and ALIGN$_R$(MajP, IntP)

(18) ALIGN$_L$(MinP, MajP)
For each MinP, there is a MajP such that the left edge of the MinP and that of the MajP coincide

(19) ALIGN$_R$(MajP, IntP)
For each MajP, there is a MajP such that the right edge of the IntP and that of the IntP coincide

I assume that those two constraints are undominated in Japanese Given them, the bad representation in (15a) is rewritten as the one in (15'a) and the preferred representation in (15b) is rewritten as the one in (15'b)

(15'a) Bad ‖$_{\text{IntP1}}$ ‖   (15'b) Good ‖$_{\text{IntP1}}$ ‖
         {$_{\text{MajP}}$ }{$_{\text{MajP1}}$ }   {$_{\text{MajP1}}$ }
         ($_{\text{MinP}}$ NP1   ) ($_{\text{MinP1}}$ NP2)   ($_{\text{MinP1}}$ NP1) ($_{\text{MinP}}$ NP2)

In the bad representation in (15'a), MinP₁, which is the head of the head of an IntP is at the IntP-final position Whereas in the preferred representation, MinP₁ is non-final I propose that IntP-final MinP₁ is fatal because there is a highly ranked constraint that forbids prosodic heads being final, say some kind of a NONFINALITY constraint

A NONFINALITY constraint is first proposed by Prince & Smolensky (1993) to explain word-stress patterns in Latin and some other languages a word-stress tends not to fall on the PWd-final syllable or the PWd-final Their NONFINALITY constraint is presented in (20)

(20) NONFINALITY(PWd)
The head of a PWd must not be at the rightmost position of the PWd

According to Prince & Smolensky, the relationship of headedness is transitive if A is headed by B and B

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[2] It is assumed that Prosodic Prominence is part of GEN That is, all the possible output representations must satisfy this constraint

is headed by C, then A is also headed by C Hence, if a PWd is headed by a Head Foot $\underline{Ft}^1$, and $\underline{Ft}^1$ is headed by a Head Syllable $\underline{\sigma}^1$, then the PWd is also headed by $\underline{\sigma}^1$ Given this constraint, we can explain why a word-stress does not fall on the PWd-final syllable in some languages such as Classical Latin It is because a word stress must fall on the head of the head of a PWd, i e the Head Syllable $\underline{\sigma}^1$, and $\underline{\sigma}^1$ must not be PWd-final according to NONFINALITY(PWd) An example case from Classical Latin is presented in Tableau 1

Tableau 1   NONFINALITY(PWd) » HEAVY σ-PROMINENCE[3]

	/amo /	NONFINALITY(PWd)	HEAVY σ-PROMINENCE
a ☞	[($\acute{\text{a}}$ mo)$_{Ft}$]$_{PWd}$	*$\underline{Ft}$	*
b	[a ($\acute{\text{mó}}$)$_{Ft}$]$_{PWd}$	*$\underline{Ft}$ *$\underline{\sigma}$!	
c	[(a $\underline{\acute{\text{mó}}}$)$_{Ft}$]$_{PWd}$	*$\underline{Ft}$ *$\underline{\sigma}$!	

A more unmarked Head Syllable $\underline{\sigma}$ is a heavy syllable according to HEAVY σ-PROM Nonetheless, the candidate in (a) where a light syllable is the head of a foot is optimal and the one in (b) and (c) where a heavy syllable is the head of a foot are bad representations It is because NONFINALITY(PWd) dominates HEAVY σ-PROMINENCE The light syllable in [a mo]$_{PWd}$ occupies the left edge of the PWd On the other hand, the heavy syllable occupies the PWd-final position If the heavy syllable is a Head Syllable, the representation violates NONFINALITY(PWd) twice one violation by the Head Syllable and the other by the Head Foot that immediately dominates the Head Syllable However, if the light syllable is a Head Syllable, then the representation violates NONFINALITY(PWd) only once a violation by the Head Foot only Though this representation violates HEAVY σ-PROM, it is the optimal representation because the violation of the dominating constraint NONFINALITY(PWd) is kept minimum

I propose that NONFINALITY plays a crucial role not only in PWd phonology but also in phrasal phonology The version of NONFINALITY relevant to Japanese prosodic phrase formation is shown in (19)

(21) NONFINALITY(IntP)
The head of an Intonational Phrase must not be at the rightmost position of the IntP

The NONFINALITY constraint in (21) forbids heads of an IntP being at the rightmost position [4] I, then, propose that this constraint dominates ALIGN$_L$(XP,MajP) This is why ALIGN$_L$(XP,MajP) can be violable at the IntP-final position

Again consider the bad prosodic representation in (15'a), which also appears in (b) of Tableau 2 (next page) This representation satisfies ALIGN$_L$(XP,MajP) because the left edge of an MajP coincides with the left edge of N2, whose left edge coincides with an XP left edge At the same time, the head of an IntP, notated as MajP^1, falls in the IntP-final position dominating only one MinP This only daughter of MajP^1 turns out to be its immediate head, notated as MinP^1, according to the Prosodic Prominence Hypothesis in (17) This representation violates NONFINALITY(IntP) twice one violation by MajP^1 and the other by MinP^1

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[3] The constraint HEAVY σ-PROMINENCE says that a heavy syllable must be the head of a foot

[4] "Heads of an IntP" include not only the immediate head of an IntP but also heads of more than one level lower according to the transitivity relationship of headedness

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On the other hand, the optimal representation in (15'b), which is again shown in (a) of Tableau 2, violates $ALIGN_L(XP,MajP)$ but violates $NONFINALITY(IntP)$ only once In this representation, there is no MajP boundary aligned with the left edge of N2, which coincides with the left edge of an XP As a result, it violates $ALIGN_L(XP,MajP)$ At the same time, $NONFINALITY(IntP)$ is violated once because the immediate head of IntP, i e $MajP^1$, occupies the IntP-final position The immediate head of $MajP^1$, i e $MinP^1$, however, does not occupy the IntP-final position Hence, $MinP^1$ does not violate $NONFINALITY(IntP)$ As far as the violation of $ALIGN_L(XP,MajP)$ minimizes the violation of the dominating constraint $NONFINALITY(IntP)$, the candidate violating the former is chosen to be optimal Ultimately the candidate in (a) of Tableau 2 is preferred to the one in (b) of the same tableau because the former has less violation of $NONFINALITY(IntP)$ than the other

In (c) of Tableau 2, there is a candidate that violates neither $NONFINALITY(IntP)$ nor $ALIGN_L(XP,MajP)$ This candidate, however, is not optimal because it violates the undominated constraint $ALIGN_R(MajP, IntP)$, which forces each MajP to be IntP-final The relevant constraint ranking here is summarized in (22)

(22) $ALIGN_R(MajP, IntP) \gg NONFINALITY(IntP) \gg ALIGN_L(XP,MajP)$

Tableau 2

(14) [$_{NP1}$ N1] [$_{NP2}$ N2]	$ALIGN_R$ (MajP, IntP)	NONFINALITY (IntP)	$ALIGN_L$ (XP, MajP)
a ☞ ‖ { (N1)$_{MinP^1}$ (N2)$_{MinP}$ ‖$_{IntP}$ }$_{MajP^1}$		(*$MajP^1$)	✗
b ‖ { }$_{MajP}$ { (N1)$_{MinP}$ (N2)$_{MinP^1}$ ‖$_{IntP}$ }$_{MajP^1}$		(*$MajP^1$) *$MinP^{11}$	
c ‖ { }$_{MajP^1}$ { (N1)$_{MinP^1}$ (N2)$_{MinP}$ ‖$_{IntP}$ }$_{MajP}$	*!		

In summary, I have proposed that the syntax-prosody mapping constraint $ALIGN_L(XP,MajP)$ proposed by Selkirk & Tateishi (1988, 1991) is dominated by a purely prosodic constraint $NONFINALITY(IntP)$ This is why no MajP boundary appears at the left edge of the rightmost MinP whose left edge coincides with an XP

6   Conclusion

The syntactic information to which Japanese prosodic phrase formation is sensitive is not branchingness of the syntactic representation Rather, it is edges of a certain syntactic projection such as XP Selkirk & Tateishi's (1988, 1991) XP-MajP alignment constraint $ALIGN_L(XP,MajP)$ can make the correct prediction for the pitch range boost of the second noun in a three-noun left branching structure with non-restrictive modification Though the structure is left branching, there is an XP left edge aligned with the left edge of the second noun Hence, their alignment constraint requires a MajP boundary to be aligned with the left edge of the second noun This results in a pitch range boost at the second word On the other hand, whether there is an XP edge or not does not matter in Kubozono's (1992, 1993) model

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He proposes that it is the syntactic branchingness to which prosodic phrase formation looks at, and prosodic structure is a direct reflection of syntactic branchingness His model gives exactly the same prosodic representation to three-noun left branching syntactic structure with restrictive modification and to the one with non-restrictive modification As a result, his model cannot predict different intonational patterns for those two different types of left branching structures Though I have argued for Selkirk & Tateshi's XP-MajP edge alignment constraint, it is violable in certain circumstances It is not, however, counter-evidence against their XP-MajP edge alignment constraint Within the framework of Optimality Theory, I have proposed that it is because the syntax-prosody interface constraint is dominated by a purely prosodic constraint NONFINALITY

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