

EVIDENCE AGAINST THE USE OF WORD BOUNDARIES
IN TONOLOGICAL RULES: An Autosegmental Approach *
to the Fast Speech of the Tokyo Dialect of Japanese

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I. Introduction

The accentuation systems of tone patterns of Japanese have been studied repeatedly; however most past works have been restricted to the description of such systems with a large set of ad hoc rules (cf. Kindaichi (1958)). Within the framework of generative grammar, McCawley (1968) and Shibatani (1972) attempt to account for the phenomena in terms of segmental phonology. Following Goldsmith (1974, 1976), Haraguchi (1977) demonstrates that Japanese tone patterns are best described in the framework of the autosegmental theory in regard to such phenomena as the preservation of tones on devoiced or deleted vowels (discussed later) and the existence of a contour tone on a short vowel, which segmental phonology cannot explain.

The tone pattern of Japanese, unlike that of a true tone language like Chinese, is predictable given an accent marker (*)² on a word and a set of tonological rules. In the Tokyo dialect, the tone patterns of a minor phrase³ illustrated in (1) are the only possibilities.

- (1) a. ## $\overline{0}$ (0 . . .) ## 0 : a mora
b. ## $\overline{0}$ (0 . . .) $\overline{0}$ (0 . . .) ## () : optional
c. ## $\overline{0}$ (0 . . .) ## . . . : a potentially infinite number of unaccented moras

In other words, within a minor phrase the moras following the first or left most accented mora (where * falls) are all low pitched and the accented mora and all moras preceding it are high pitched except the first which, if not itself the accented mora, will be low pitched. Though the generalization for basic tone patterns is expressed in any of the past analyses, in the following, I will take Haraguchi's analysis as a representative, in view of the explicitness of its rules and descriptive and explanatory adequacy, to illustrate how the tone pattern of the Tokyo dialect is described. Then, I will present two problems which his analysis, or any previous analysis, cannot explain. I will show that the problems are inherent in the analysis crucially using word boundaries (WB). They will be easily solved once the notion of WB's is abandoned. Lastly, the consequence of giving up WB's will be discussed, suggesting the direction of future researches.

II. The Tonological Rules of the Tokyo Dialect: Haraguchi's Analysis

To capture the generalization of the basic tone patterns in (1), Haraguchi sets up HL as the basic tone melody for the Tokyo dialect

and presents the following tone association rule.⁵

(2) Tone Association Rule (TAR) (Haraguchi 1977, p. 10)

- ## Q V

 H
- (i) where Q is the maximal sequence of phonological segments which contains no V.
 (ii) where the dotted line indicates the structural change (SC) of the rule.

The operation of (2) is expressed informally:

(3) (Haraguchi p. 9)

- a. If a string has at least one V, associate the H tone of the basic tone melody with the leftmost V;
 b. If it has no V (i.e., if it is unaccented), associate the H tone of the basic tone melody with the rightmost V.

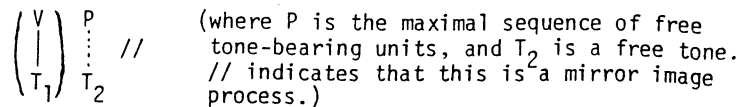
The following examples show how the above association rule works.

- (4) a. /kokoro-made/ b. /miyako-de/ c. /inoti/
 H L H L H L
 'heart-even' 'city-in' 'life'

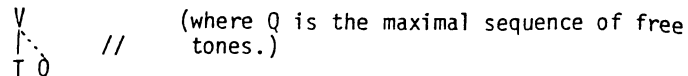
Then, the universal Tone Association Conventions are triggered, which serve as wellformedness conditions for tone association, connecting every tone with at least one of the tone-bearing units and vice versa. The following is presented by Haraguchi (pp. 11-12).⁶

(5) Universal Tone Association Conventions (UTAC)

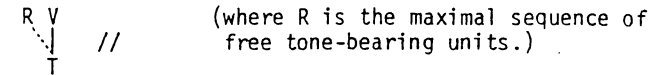
- (i) a. All tones should be associated with at least one tone-bearing unit, and conversely, all tone-bearing units should be associated with at least one tone in the tone melody.
 b. No association lines should cross.
 (ii) To guarantee (i), perform the following processes:
 a. If a domain contains only one free tone, or if it contains only one free tone to the right (or left) of a bound tone, the free tone should be associated with every free tone-bearing unit or every free tone-bearing unit on the same side of the bound tone. I.e.,



- b. If a domain contains no V to the right (or left) of a bound V, and if it contains at least one free tone, the free tone should be associated with the bound tone-bearing unit. I.e.,



- c. If a domain contains at least one V to the right (or left) of a bound tone and if there is no free tone, associate the bound tone with the remaining free tone-bearing units. I.e.,



(5iia) applies to (4a) and (4c), associating the free tone, L, with the tone-bearing units on the right side of the bound tone, H.

(5iib) operates on (4b). This is illustrated in (6):

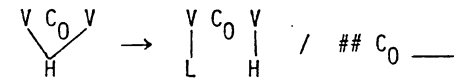
- (6) a. /kokoro-made/ b. /miyako-de/ c. /inoti/
 H L H L H L

(4a) and (4b) are further subject to (5iic) whose operation is explained in (7):

- (7) a. /kokoro-made/ b. /miyako-de/
 H L H L

To derive the correct surface forms described in (1), where the initial mora is low toned (unless it is starred) and no contour tone is exhibited on the last mora, Haraguchi gives the following two rules.

(8) Initial Lowering Rule (ILR) (Haraguchi p. 17)



(9) Tone Simplification Rule (TSR) (Haraguchi p. 18)



These rules change (7a) and (7b) in the following way, deriving the correct surface forms. ((6c) is repeated as (10c))

- (10) a. /kokoro-made/ b. /miyako-de/ c. /inoti/
 L H L L H H L

As shown above, the tone pattern of a minor phrase is described correctly, given the leftmost accent marker (*) and the rules and conventions, applying them in the order of (2), (5), (8), and (9).

The definition of a minor phrase has never been explicitly articulated in any of the past analyses, and Haraguchi's is not an exception. He crucially uses two WB's for tonological rules; however, he never specifies syntactic configurations of strings where two WB's

occur, which is fundamental in the framework of SPE and Selkirk (1975). In view of the fact that Haraguchi is silent about how WB's are placed, I assume that he applies the notion of WB's developed in SPE and Selkirk to Japanese. Thus, a WB is not inserted before or after specifiers and enclitics, such as copulas, auxiliary elements, particles, etc., which do not constitute independent minor phrases. As shown in (2) and (8), Haraguchi makes his tonological rules apply to the phrases which are bounded by two WB's. This is the fundamental assumption of his framework and, as one will see, it inevitably leads him to the difficulties, which I will take up in the third section.

II.1. The Interaction between Tonological Rules and Segmental Rules

As is well-known, Japanese has a phonological process which devoices high vowels. Though the formalization of this process is not so simple in rather slow speech, it is generalized and simplified in a fast speech context, which is something like the following.

(11) High Vowel Devoicing (HVD)

$$[+syll] \rightarrow [-voice] / [-syll] \text{ — } [-syll]$$

In addition, a devoiced high vowel often gets deleted, if the surrounding segments are identical consonants. This process is roughly formalized as (12).

(12) Voiceless Vowel Deletion (VVD)

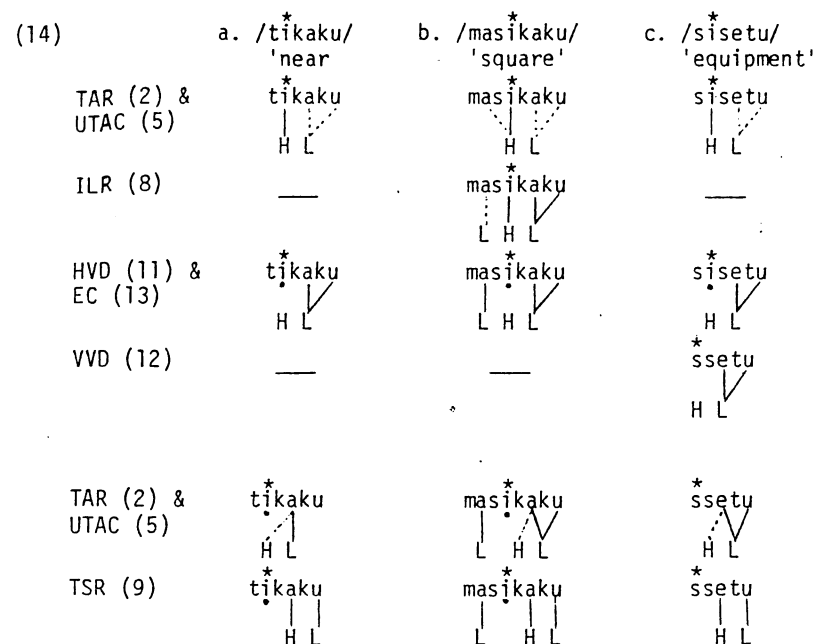
$$[+syll] \rightarrow \emptyset / [-voice] \text{ — } [-voice]$$

These two rules are interesting to the extent that they affect tone patterns. By the definition of a tone-bearing unit, a mora segment which becomes voiceless is no longer capable of bearing a tone. By proposing the following convention, Haraguchi makes this process formal.

(13) Erasure Convention for Association Lines (EC) (Haraguchi p. 36)

If a tone-bearing unit V is turned into an element which cannot carry a tone by some phonological process (such as Devoicing Rules, Deletions, Glide Formation, etc.), then the association line drawn between a tone and the element in question will automatically be erased.

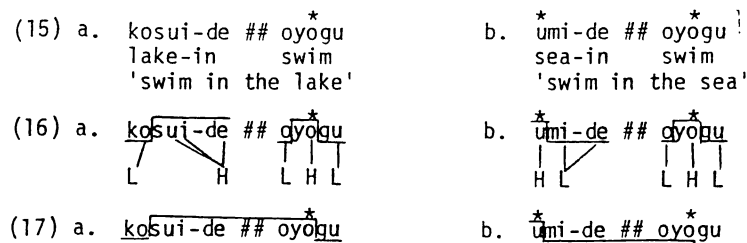
Thus, a tone associated with the vowel which eventually becomes voiceless by (11) or subsequently deleted by (12) will be left unassociated. Whenever a free tone appears, TAC (2) and UTAC (5) are automatically triggered. This process is described in the following (C = [-voice]).



The output of these examples are thus predicted as tikaku, masikaku and ssetu, which are the correct surface tone patterns.

II.2. Tone Patterns across Two Word Boundaries

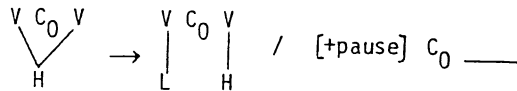
The derivation of the tone pattern on the minor phrase has been discussed so far. In this section, I will discuss some tonological processes which are sensitive to the information beyond two WB's. When (more than) two minor phrases are uttered without a pause in between in a normal or rather fast speech context, certain changes of tone patterns take place. For example, the strings in (15) consist of two minor phrases separated by two WB's. The rules and UTAC introduced above assign the tone patterns as in (16), while the actual surface patterns are those in (17).



To realize (17a), Haraguchi slightly modifies his ILR (8), making it

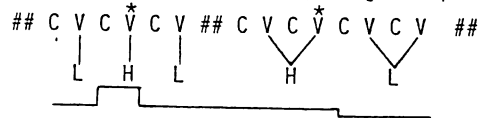
sensitive to the existence of a pause.

(18) Initial Lowering Rule (Revised) (ILRR)



To obtain (17b), Haraguchi sets up the Downtdrift Rule (19) that lowers an H tone to an L tone when its preceding phrase ends with an L, provided that there are no pauses between the phrases. DDR applies after ILRR. He does not formalize DDR but illustrates its effect as follows, using a line to indicate the surface tone pattern.

(19) The Downtdrift Rule (DDR) (Haraguchi p. 30)



Thus, the change of tone patterns with respect to the rate of speech is described, with the help of DDR and the feature [+pause].

III. Problems with Haraguchi's Analysis

In the above section, Haraguchi's analysis is presented in considerable detail. In this section I will show that his analysis cannot escape from at least two serious difficulties, as long as the application of his tonological rules are bounded by two WB's. Firstly, the mechanisms that Haraguchi presents to describe the tone pattern across two WB's, discussed in II.2., are totally ad hoc. To derive the correct tone patterns given in (17), he posits DDR (19) and the feature [+pause]. They are merely needed to describe the tone pattern observed. In terms of the possible combination of minor phrases, with respect to the tone pattern of the phrase, where (18) and/or (19) may operate, there are only four possibilities, which are illustrated in (20). Here, the first line of each group gives a schematic tone pattern and an example with the pattern is presented in the second line.

- (20) a. ILRR & DDR
inulo ## naguru
dog obj. beat-pre. 'beat a dog'
- b. ILRR & DDR
otoko ga ## hataraku
man sub. work-pre. 'a man works.'
- c. ILRR
sakura ga ## saku
cherry blossoms sub. bloom-pre. 'cherry blossoms bloom.'

- d. ILRR
tomodoti ni ## au
friend ind.-obj. meet-pre. 'meet a friend'

When we observe the surface tone patterns exhibited in (20), it is easily noticed that the proposed operations to describe the phenomena seen across two WB's work in such a way that the basic tone patterns (1) are preserved. This means that, in Haraguchi's analysis, the preservation of the basic tone patterns by the ad hoc mechanisms on a string larger than a minor phrase is totally accidental, although it seems to be an important generalization about the tone pattern of the Tokyo dialect, which should be explained somewhere in the grammar. One might propose a conspiracy which controls the well-formedness of surface strings. But I would rather propose to eliminate DDR and the ad hoc feature [+pause] altogether and to expand the domain of tonological rules across two WB's in a fast speech context. Then, it naturally follows that the basic tone patterns are always created in a string irrespective of WB's.

This approach presents further interesting consequences, with respect to the following phrases, each of which consists of two minor phrases.

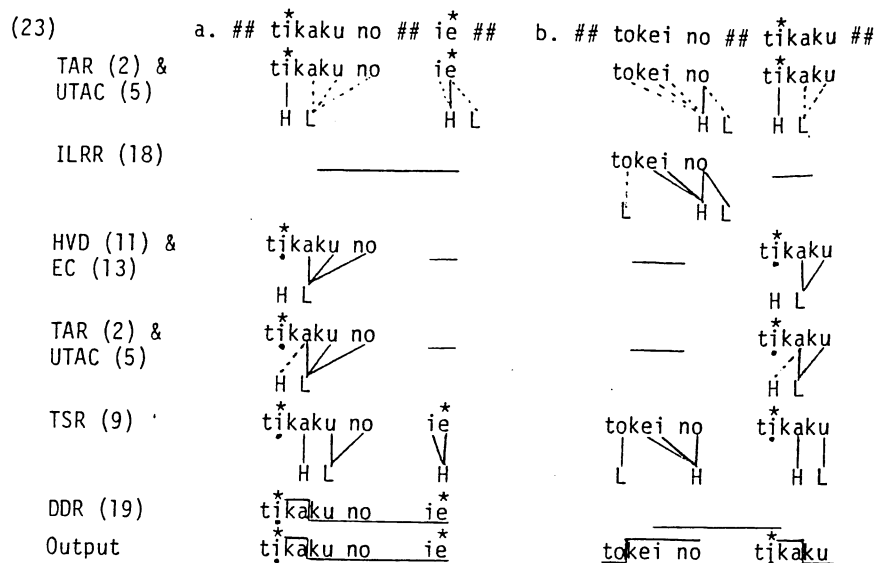
- (21) a.
t̃ikaku no ## iē
near house
'the house near by'
- b.
tokei no ## t̃ikaku
clock near
'near the clock'
- c.
ssetu ga ## rippada
equipment sub. excellent
'the equipment is excellent'
- d.
rippa na ## ssetu
excellent equipment
'excellent equipment'

Within Haraguchi's framework, the two phrases separated by two WB's are independent tonological domains where TAR (2) operates separately. Tone patterns would not change once they are assigned unless the preceding phrase ends with a low tone and no pause falls between the two phrases. Therefore, his analysis predicts the following tone patterns, (22), on the phrases in (21). The detailed derivations, taking (21a) and (21b) as representatives, are given in (23): ((23) is on the following page.)

- (22) a.
t̃ikaku no ## iē
- b.
tokei no ## t̃ikaku
- c.
ssetu ga ## rippada
- d.
rippana ## ssetu

Without a pause intervening the minor phrases above, (21a) and (21c) are subject to DDR (19) and they are correctly realized. On the other hand, Haraguchi's prediction is wrong, regarding (21b) and (21d), where a phrase starting with a devoiced or deleted vowel is following another phrase. The correct surface forms are:

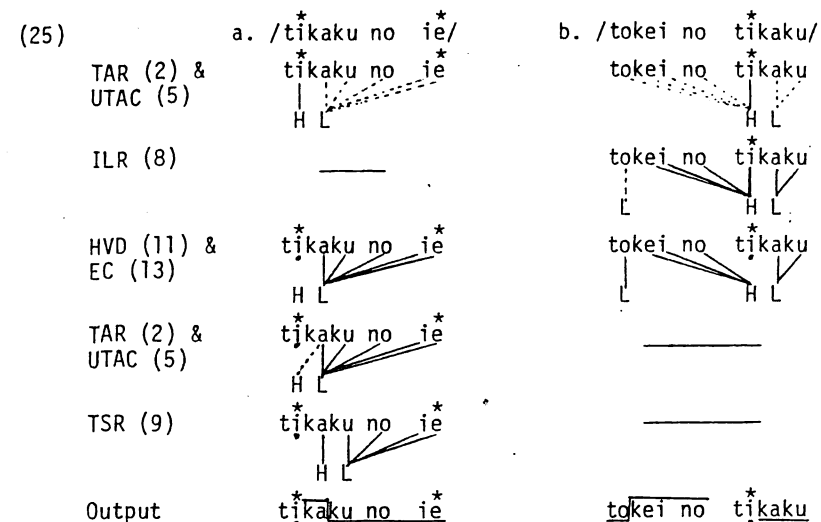
- (24) a.
t̃ikaku no ## iē
- b.
tokei no ## t̃ikaku
- c.
ssetu ga ## rippada
- d.
rippana ## ssetu



To make the point clear, in Haraguchi's framework, the freed high tone at the beginning of a minor phrase has to be reassociated with the following tone-bearing unit, regardless of the position of the phrase in a string relative to other phrases, given the assumption that TAR operates in the area bounded by two WB's. Differing from Haraguchi's prediction, it seems to be the case that an initial high tone freed from the originally associated mora is shifted to the right next mora only when the phrase containing the free tone is the first phrase of the entire string within which no pauses fall and that it is shifted to the left when other phrases are preceding without pauses. Only the former phenomenon is captured in Haraguchi's analysis, while the latter phenomenon is totally mysterious. This is a consequence of his approach where the domain of the tonological rules are sensitive to two WB's.

Let us see how these phenomena are treated in my analysis where the entire strings in (21) are regarded as independent tonological domains. Therefore, TAR applies only once to each string. This is illustrated in the following page, taking (21a) and (21b) as examples, whose derivations are (25a) and (25b), respectively.

What is interesting here is that in (25b) HVD (11) and EC (13) do not trigger TAR (2) and UTAC (5) due to the fact that the high tone, H, associated with the devoiced /i/ is not totally freed after HVD and EC but still attached to other tone bearing units preceding the /i/. In (25a), on the other hand, TAR (2) and UTAC (5) are triggered, connecting the freed H with the right next vowel, because the H is left unassociated after HVD and EC. This explains why the high tone associated with the devoiced /i/ appears on the right next vowel when the phrase containing the /i/ is the first phrase of the entire string, and it is preserved on the left when another phrase is preceding. Thus,



my analysis can not only derive the correct surface tone patterns but predict different tone patterns according to the position of the phrase with an initial free tone with respect to other phrases.

IV. Conclusion

To sum up the above discussions, any theory which attempts to describe tone configurations in Japanese in a fast speech context, has to be able to explain at least (i) why an utterance preserves the basic tone pattern for a single word or phrase, and (ii) why a preserved tone after a devoicing or deletion process of vowels appears in different places depending on the structure of an uttered string. None of the theories, to my knowledge, can succeed in doing this, while my analysis can do so without any difficulties. The consequence of adopting my analysis of Japanese fast speech phenomena is that WB's are of no use for the tonological rules of the Tokyo dialect. It is clear that limiting the application of TAR makes Haraguchi's theory unable to explain (i) and (ii) and forces him to postulate ad hoc mechanisms; DDR and the feature [+pause]. Just giving up WB's solves the difficulties.

The residual problem after giving up WB's is how to set up the domain of the tonological rules. The most promising alternative to WB's seems to be sought in the framework that Selkirk (1977, 1978) has been developing. She proposes different levels in prosodic domain rules. Among others, the levels of the phonological phrase (PP) and the intonational phrase (IP) are of most interest to us. Her definition of the constituency of PP is:

(26) (Selkirk 1978, p. 20)

- (i) An item which is the specifier of a syntactic phrase joins with the head of the phrase.

- (ii) An item belonging to a "non-lexical" category (cf. Chomsky 1965), such as Det, Prep, Comp, Verb_{aux}, Conjunction, joins with its sister constituent.

This gives an almost equivalent phrase to what is bounded by two WB's. IP is composed of PP('s), though the choice of combinations is free, except that parentheticals, preposed adverbials, non-restrictive relative clause (in the case of English; for Japanese, parentheticals and right dislocated phrases), etc., must be independent IP's.

Given these two levels, the tonological rules discussed above seem to be most sensitive to IP and the choice as to which phonological phrase(s) may compose an IP seems to be dependent on types of speech; either fast or slow. Therefore, I assume that the domain of the tonological rules are on the level of IP, rewriting (2) as (27) and (8) as (28).

$$(27) \quad \begin{array}{c} \text{I} \quad \text{Q} \quad \text{V} \\ | \\ \text{H} \end{array} \quad \begin{array}{l} \text{(i) the same as (2i).} \\ \text{(ii) the same as (2ii).} \end{array}$$

$$(28) \quad \begin{array}{c} \text{V} \quad \text{C}_0 \quad \text{V} \\ \diagdown \quad \diagup \\ \text{H} \end{array} \rightarrow \begin{array}{c} \text{V} \quad \text{C}_0 \quad \text{V} \\ | \quad \quad | \\ \text{L} \quad \quad \text{H} \end{array} \quad / \quad \text{I} \quad \text{C}_0 \quad \text{---}$$

There may be restrictions on the maximum number of PP's in a single IP or on the choice of PP's; i.e., which PP's are more likely chosen, as opposed to others, as constituents of an IP. Since these questions are outside of the scope of this paper, the answers to them have to await future researches.

Notes

* I would like to thank Ellen Kaisse who read an earlier version of this paper and gave me much helpful advice. Any errors that may remain are, of course, mine. Work on this study was supported by research grant AH-111 from the graduate school of the University of Washington, for which I am greatly indebted.

1. In general, a contour tone is not observed on a short vowel in the Tokyo dialect, though Haraguchi claims that it occurs on certain structures, giving a few examples. In my speech, among other Tokyo dialect speakers, however, a contour tone does not occur in his examples. Note that there are many dialects of Japanese which clearly exhibit a contour tone on a short vowel.
2. Not all of the accent markers are given by the lexicon. Some are supplied by star assigning rules. How an accent marker is assigned is, however, not relevant to the discussion in this paper.
3. What constitutes a tonological minor phrase is discussed later.

4. The actual tone patterns are not so simple as described in (1). For example, when a tone falls or rises, it does not change so abruptly; two adjacent tones do not exhibit clear differences between a high tone and a low tone, but rather a gradual tone change is observed. See also note 10.

5. Note that V or \bar{V} stands for a tone-bearing unit, which is assumed to be a voiced vowel or a syllabic nasal /n/.

6. Haraguchi presents (5) as a first approximation. A more complex version is offered in the later chapter of his book. Since the differences in the two versions do not affect the entire discussion of this paper, I take up the simpler version.

7. Note that these changes in tone patterns give considerable difficulties to segmental analyses of tones. They cannot elegantly explain why an underlying high tone on a devoiced or deleted vowel is preserved, which is the natural consequence within the framework of the autosegmental tonology.

8. Haraguchi's illustration (19) is not accurate enough to describe the phenomena. The number of tone-bearing units and the existence of a star in the second phrase are irrelevant to the phenomena to be taken care of by DDR (19). What is relevant is that the initial phrase ends with a low tone and the second phrase starts with a high tone.

9. This is also a problem for Haraguchi, since he has to specify whether DDR can apply to more than two places in a single utterance or which phrases are subject to DDR if it applies only once in a string where more than two places meet the conditions of DDR.

10. The careful reader may have noticed that there seems to be a lower tone than an ordinary low tone when an IP contains more than one accent marker (see (17a) and (20a)). In general, it is true that a tone which follows a star is lower than the tone on the starred mora. For instance, if a high tone is associated with a starred mora, the following tones are marked as L and if a low tone is associated with a starred mora, the following tones are further lowered. Note that this is not a defect of my analysis, but has to be explained in any other analysis as well, which regards (10a), for example, as a single phrase, where two accent markers occur. Phonetically, the low tone on the moras after the second star are lower than the low tone(s) on and preceding the second starred mora.

(i) (=10a) $## \text{kokoro-made} ##$

The explanation for this phenomenon should be responsible for the tone pattern on (17a) or (20a). The following rule seems to be operating.

$$(ii) \quad \begin{array}{c} \text{C}_0 \quad \bar{V} \quad (\text{C}_0 \text{ V})_1 \quad \text{I} \\ \diagdown \quad \diagup \\ \text{L} \quad \quad \text{LL} \end{array} \rightarrow \begin{array}{c} \text{C}_0 \quad \bar{V} \quad (\text{C}_0 \text{ V})_1 \quad \text{I} \\ | \quad \quad | \\ \text{L} \quad \quad \text{LL} \end{array} \quad \begin{array}{l} \text{L} > \text{LL} \\ > : \text{higher than} \end{array}$$

Bibliography

- Chomsky, Noam and Morris Halle (1968). The Sound Pattern of English
New York: Harper and Row.
- Goldsmith, John (1974). "An Autosegmental Typology of Tone: And How
Japanese Fits in," Papers from the Fifth Annual Meeting North
Eastern Linguistic Society, pp. 172-82.
- ____ (1976). "An Overview of Autosegmental Phonology," Linguistic
Analysis Vol. 2, No. 1, pp. 23-68.
- Haraguchi, Shosuke (1977). The Tone Pattern of Japanese: An Auto-
segmental Theory of Tonology. Tokyo: Kaitakusha Co., Ltd.
- Kindaichi, Haruhiko (1958). Meikai Nippongo Akusento Jiten (Japanese
Accent Dictionary). Tokyo: Sanseido.
- McCawley, James (1968). The Phonological Component of a Grammar of
Japanese. The Hague: Mouton.
- Selkirk, Elisabeth (1974). "French Liaison and the \bar{X} Notation,"
Linguistic Inquiry Vol. 5, No. 4, pp. 573-90.
- ____ (1977). "Prosodic Domains in Phonology: Sanskrit Revisited,"
Unpublished paper.
- ____ (1978). "On Prosodic Structure and its Relation to Syntactic
Structure," Paper presented at Conference on the Mental Re-
presentation of Phonology.
- Shibatani, Masayoshi (1972). "The Non-Cyclic Nature of Japanese
Accentuation," Language Vol. 48, No. 3, pp. 584-95.