Autosegmental Theory and Japanese Tone-Spread

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A very common phenomenon in the history of the accent-systems of the Japanese dialects is initial spread. This term refers to the diachronic process whereby a tone restricted to an initial mora in one dialect will spread onto a maximal initial sequence of moras in its descendants. It spreads at the expense of the next tone in the surface melody, confining it to a single mora.

This paper argues that the autosegmental theory of tone, when applied as by Haraguchi 1977 to the analysis of Japanese accent, yields a very simple and natural account of this phenomenon, in a way that suggests directions to look for further constraints on the theory. It also proposes a new means, within the same restricted theory, to represent initial tones that have not spread and the processes that produce them.

The phenomena so analysed are then shown to play an important role in giving a historical account of the relations between many of the dialects, including that between the two main dialect groups represented by Kyoto and Tokyo.

1. Initial Spread: Examples

(1) Initial Spread:
A tone confined to a single mora[1] at the front of a word tends to spread at the expense of the adjacent tone, confining it to a single mora.

(1) is a surface generalization, reflecting a diachronic tendency. As such, we should not necessarily expect to find it as a synchronic rule in any dialect; and all the examples which follow are based on the comparison of pairs of related dialects.

(1) affects all types of tones. The spread of a non-low tone is particularly clear in Goto's account of the two subdialects of Ogachogamizu (1973), characterizing older and younger speakers respectively. He reports oppositions as in (2):

(2) Older	kiNnedama	Younger	kiNNedama	'mosquito larva'
	hiittawoyeda		hiittawoyeda	'fell dead'
	haarabutyo		haarabutyo	'pregnant woman'

Here the initial mid tone has spread across one or two moras, con-

fining the following low tone to a single mora. (Goto also mentions that the initial mid-tone sequence is higher in the young people's dialect.)

An example of the spread of a low tone can be discerned in Hiroto's 1961 account of two closely related dialects from the Tottori area. Although the data is a little scanty, he quotes oppositions of the two dialects' forms as in (3):

(3)	Ishimi		East Tottori		
	otoko ga		otoko ga	'man'	
	aozora		aozora	'blue sky'	
	suzusii		suzusii	'cool'	

Here the Ishimi forms are exactly the same as in Tokyo, while the East Tottori equivalents show a spread of the initial low tone onto the second mora. It is clear that this spreading extends as far as possible when there is room for it. Compare the East Tottori forms in (4) with their equivalents in Tokyo Japanese, which we may presume to be identical with the Ishimi forms:

(4)	Tokyo		East Tottori		
	iwasi		iwasi	'sardine'	
	iwasi ga		iwasi ga	do.	
	kono otoko ga		kono otoko ga	'this man'	
	kono iwasi ga		kono iwasi ga	'this sardine'	

In these two examples the tone which spread was non-distinctive. But a lexically distictive tone can spread too. Consider the two sub-dialects of Kochi, distinguishing older and younger speakers (as reported in Haraguchi 1977). This precisely mirrors the change which took place in the realization of the low-initial words in the Kyoto dialect during the early eighteenth century (cf. Wenck 1959 , vol. IV, p.396). This is clearest in the treatment of the low-initial, unaccented, nouns, represented in (5):

(5)	Bumoki Kyoto (C17)		Modern Kyoto		
	Old speakers, Kochi		Younger Kochi		
	matu	matu ga	matu	'pine'	
			matu ga	do.	
	usagi	usagi ga	usagi	'rabbit'	
			usagi ga	do.	

Here the initial low tone, which is lexically distinctive in these Kansai dialects, spreads just like the initial tones in Ogachogamizu and Tottori.

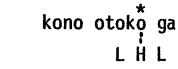
As far as I know, these very similar phenomena have not been viewed before as examples of the same process. Haraguchi's autoseg-

mental representation of Japanese provides the means to unify them.

2. Autosegmental Analysis of Initial Spread's Output

I propose that dialects which have undergone initial spread have simply added a tone to the head of their underlying melody.

Consider for instance the expression kono otoko ga in East Tottori, in (4) above. Since Ishimi, like Tokyo, would be analyzed with an underlying melody HL (high - low), East Tottori will prefix a low tone to this, giving an underlying melody LHL. Tone-association will then proceed as in (6), the prominent tone of the melody being associated with the accented mora. (The dotted line marks the insertion of an association-line.)

(6)


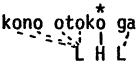
One of Haraguchi's tone-association principles will now apply to give precisely the correct output. The relevant parts of the principle are:

(7) Convention ii a (Haraguchi, p.11)
If a domain contains ... only one free tone to the right (or left) of an assigned tone, the free tone should be associated with ... every free tone-bearer on the same side of the assigned tone.

Schematically, we have (8), applying symmetrically to the right or the left. (Q represents a maximal sequence of tone-bearers.)

(8)


This produces the desired output, as in (9):

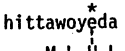
(9)


One problem with (7) is that it seems to recapitulate much of the content of Goldsmith's well-formedness conditions on tone-association (e.g. 1976), conditions which Haraguchi's derivations will have to satisfy anyway. These conditions are stated in (10).

(10) Well-Formedness Conditions (WFC)
a) All tones should be associated with at least one tone-bearer, and conversely, all tone-bearers should be associated with at least one tone .
b) No association-lines should cross.

Moreover, (7) makes no prediction for cases where there is more than one free tone to one side of a tone already assigned; and this situation confronts us in the next dialect to be considered, younger-generation Ogachogamizu.

Our account of initial spread will have the effect of adding one tone to the underlying melody of the older people's dialect. The younger dialect will then have the melody MLHL. Consider the situation after tone-association in (11):

(11)


Principle (7) will assign the final L to da all right: but the two clauses of (10) would have had this effect anyway. And (7) makes no prediction as to how the initial M and L are to be assigned.

However, a very simple innovation will resolve both inadequacies in (7). Replace (7) with (12):

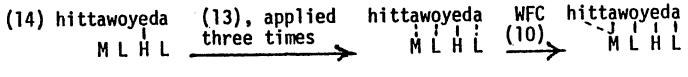
(12) If a domain contains a number of free tones to one side of an assigned tone, assign tones to tone-bearers one-to-one in linear order, working outwards from the tone already assigned.

This amounts to applying the scheme in (13) iteratively, and regardles of whether T_2 is to the right or left of T_1.

(13)


(13) has the effect of removing the ambiguity in (10) without doing its work for it. It also has the advantage over (8) of applying pairwise between tones and tone-bearers: there is no variable Q denoting an indefinite sequence of tone-bearers all simultaneously associated with a given tone. Instead, (13) uses iterativity.

The derivation of (11) will now proceed as follows:

(14)


It would be tedious to give the corresponding treatments of all the other dialects which have undergone initial spread: they are quite straightforward. Note that the device of prefixing a tone to the underlying melody, along with the universal WFC and independently desirable (13), entail the property noted in (1): the tone adjacent to the one that "spreads" is confined to a single mora. No extra rules or principles have been added to get this effect. This goes some way toward explaining why the state following initial spread is a natural one , and a usual result of tonal change.

3. Analysis of the Input State: Tonal Boundaries

But if putting a tone at the head of the underlying melody has the effect of assigning it to a maximal initial segment of the phrase's tone-bearers, how are we to represent the initial tones restricted to the first tone-bearer, which are present in the dialects before initial spread? My answer to this is a tentative one, although the need for some kind of different analysis is clear, if we are to offer a complete analysis of the phenomenon of initial spread as a diachronic process.

There are two main cases to be distinguished. In one, represented by Kochi and Kyoto example (5), the tone which holds the first mora is lexically distinctive, marking off the low-initial words from the high-initial, and as inalienable a part of the word's surface-melody as the position of the accent.

In the other case, which characterizes all the other starting-point dialects I have mentioned, we have to do with a phenomenon which may be called initial dissimilation, stateable as follows:

(15) Initial Dissimilation
If the first two moras in a phrase would bear the same tone, the first of them is dissimilated.

The initial lowering in Tokyo is the best-known example of (15), which is just a generalization about a common sort of rule present in Japanese dialects. There is no evidence that this principle, so stated, is active as a synchronic rule in any dialect: no dialect appears to have both initial lowering and initial raising, despite the fact that Kansai dialects typically possess initial sequences of high and of low moras[3], both of which are suitable for the application of (15).

Dissimilation as such, then, - i.e. in the form of an 'alpha-switching' rule - probably plays no part in any of the dialects' synchronic treatment of the phenomenon: (15) is a cross-dialectal generalization about which tone is added in these circumstances,

a generalization that we can perhaps be content to explain in some sort of functional terms. The formal theory of phonology, on the other hand, must explain why the added tone is manifested in just the way it is: why it is restricted to the first mora.

Initial dissimilation is clearly not to be represented as a property of words in the lexicon. Its conditioning is always quite phonetic, as stated in (15); and it is present in dialects such as Sendai and Uchiko which make no lexical accent distinctions at all (cf. Haraguchi, pp.232ff.). Most cases of it are reported as variable rules (cf. Kawakami 1966 on Tokyo; Goto 1973 on Ogachogamizu; Okuda 1975 on Narada). And in Tokyo at least it clearly applies to the first mora of the accentual phrase rather than of the word (cf. Haraguchi, pp.29ff.).

These two phenomena, initial dissimilation and the lexically-distinctive initial low mora, have one striking property in common. They do not occur when to do so would cause a contour tone to appear on the first mora. So there are no nouns in Kochi with lexical representation as in (16). (M represents an arbitrary mora.)

(16) # $\overset{*}{M}$ M ...
[+ low-initial]

The presence of the accentual star requires a fall of tone to the next mora, while [+ low-initial] requires a low tone at the head of the word. (16) could therefore only be realized as M⌋M ..., with a contour on the first mora. Similarly, the very definition of initial dissimilation in (15) rules out its occurrence in words of the forms in (17):

(17) a. $\overline{M}$⌋M ... b. M⌋$\overline{M}$ ...

To add a dissimilar tone here, per impossibile, would inevitably give M⌋M ... or M⌋M ..., which are not found in dialects which have a rule under the heading of initial dissimilation.

Interestingly, this same property is found in a rule of English sentence intonation discussed in Liberman 1975, pp. 114ff. He notes that the high pre-head which makes (18b) a more lively version of (18a) is not possible in the case of (19).

(18) a. an English sandwich b. an English sandwich
L H L H L H L

(19) a. Lassie brought the cavalry b.* Lassie brought the cavalry
L H L H L H L

This is because the first main stress of the phrase is phrase-initial in (19) and the first low tone must be associated with the first 'beat'. Liberman gets the right results formally by attaching the extra H to the initial boundary of the phrase. Ordinarily, it is obligatorily associated with the first syllable of the phrase:(20a). But since attaching H to Las would violate his constraint on how L is to be attached, it is left unrealized in (20b).

(20) a. # an English sandwich # b. # Lassie brought the cavalry #
H L H L H L H L

Leaving a tone like this, attached only to a boundary, does not violate the WFC (10), since boundaries are considered as tone-bearers.(cf. Goldsmith 1976, fn. 7 for a vague confirmation of this.)

I suggest therefore that both types of initial tone that are restricted to the first mora should be represented as attached to the initial boundary, and not as part of the word or phrase's underlying melody. We then add a general principle, which we can hope will turn out to be universal:

(21) Boundary tones must flop onto the adjacent tone-bearer.

This will be subject to a surface filter such as (22):

(22) * # V
T_1 T_2

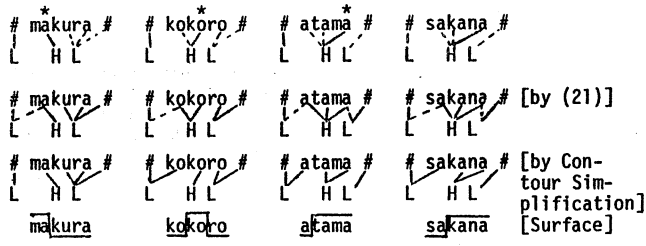
This says in effect that a boundary tone cannot contribute to a contour on the surface. Language- (or dialect-) specific rules will then have to act to simplify any contours which result in the course of a derivation, reducing the configuration in (22) either to (23a) or (23b).

(23) a. # V b. # V
T_1 T_2 T_1 T_2

(In (23a), clause a of the WFC (10) will require that T_2 be attached somewhere else.)

For example, initial lowering in Tokyo will be represented as the insertion of a low tone under the phrase's initial boundary. In the three-mora nouns we should have, after tone-association, the following derivations:

(24)



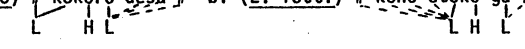
The lexical distinction between high- and low-initial in older Kochi and sixteenth-century Kyoto will be represented as marking whether or not a word's initial word-boundary carries a low tone[4].

All this is intended as a formal analysis of these initial-tone phenomena. The functional question of why particular tones are inserted and not others has not been touched upon.

4. The Interpretation of Initial Spread

It should now be clear what initial spread is: it is a reanalysis of the tone attached to an initial boundary as the initial tone of the underlying melody. A tone which had been attached after the application of the melody to the phrase or word is now attached as part of the process of melodic association: as a result it spreads to fill up the tone-bearers as any other tone would that happened to be on the end of the melody. Synchronically, the forces which make the second L spread in (25a) are precisely what makes the first L spread in (25b) [= (9)].

(25) a.(Tokyo) # kokoro desu # b. (E. Tott.) # kono otoko ga #

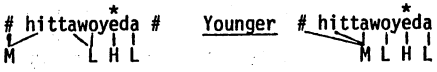


A central prediction of this account is that there will be no intermediate stages in the diachronic spreading process: either a tone will be restricted to the first mora, or else it will occupy a maximal initial segment. We have seen that this is the case in two contemporary examples of the process at work, in Kochi and Ogachogamizu[5].

It is a decided advantage of autosegmental theory that it can so simply represent this diachronic relationship between the restricted and spreading varieties of initial tone[6]. A conven-

tional analysis in terms of Hattori's "corners" , prosodemes which mark changes in the pitch level upwards or downwards, can only represent the facts in terms of an unmotivated slide of the corner over to the right. For instance, the pitch oppositions between the Ogachogamizu dialects, which we represent as in (26), will have to be something like (27).

(26) Older # hittawoyeda # Younger # hittawoyeda #



(27) hiɭttawoʃyelda hittaɭwoʃyelda

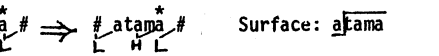
And this theory gives no explanation for the absence of intermediate stages.

5. Implications for Tonology

The main virtue of this analysis formally is that it eliminates all the dialect-specific rules which make reference to indefinitely long sequences of tone-bearers. Universal conventions (10) and (12) alone handle the spreading of tone in the course of a derivation, so that language-specific rules - the only part of a grammar that has to be learned - can be restricted to operations on single tones and tone-association lines, adding or deleting them. This makes the rules simpler, as well as constraining their power. All these benefits are quite independent of whether we accept the suggestion to represent tones restricted to initial moras as attached to a boundary.

If we do accept the suggestion, then it seems that the power of tonal rules can be further constrained. We can suggest that no rule can insert a tone in the course of a derivation except to attach it to a boundary: this has the empirical consequence that tones will not be added in the centre of a fixed melody. Moreover it may be that tone-deletion does not exist as such: all the apparent examples given by Japanese contour simplification can be treated by restricting deletion to the association-lines, and leaving the tone concerned attached solely to a boundary at the end of a derivation. For example, the contour-simplification of atama 'head' in Tokyo Japanese would proceed:

(28) # atama # ⇒ # atama # Surface: a‾tama



Thus the final mora is level high (for most speakers) despite the underlying low tone which shows up, for instance, in a‾tama|ga.

If these suggestions are all accepted, then the autosegmental approach would restrict tonology to tracing the consequences

of language-specific rules which simply add or delete single association-lines.

6. Implications for the History of Japanese

Initial dissimilation and initial spread, considered as diachronic processes, together shed a lot of light on the relations between Japanese dialects.

We can now understand why some dialects with Tokyo-style accentuation (i.e. no lexical distinction between low-initial and high-initial words) have HL as underlying melody (e.g. Tokyo itself - see Haraguchi, chapter 1) , while others have LHL (e.g. Hirosaki - ibid., chapter 3). The LHL dialects are simply dialects that once had HL with an initial dissimilation rule (as in Tokyo today) but which underwent initial spread.

One of the developments in the Kyoto dialect between the period attested in the Ruijumyogisho (twelfth century) and the Bumoki (seventeenth century) also now becomes clear. If we compare the forms for 2-mora, 3-mora and some 4-mora words (data from Okuda 1971, pp. 61ff., and Kawakami 1965) the picture is as in (29).

(29)

	RMS	Bumoki		RMS	Bumoki		RMS	Bumoki
II.1	hana	hana	III.1	iwasi	iwasi	IV.		
2	kami	kami	2	azuki	azuki			
			3	tikara	tikara			
3	hana ga	hana ga	4	atama ga	atama ga	1	tomosibi	tomosibi
4	kasa ga	kasa ga	5	kokoro	kokoro	2	irokudu	irokudu
			6	usagi	usagi			
5	mado ga	mado ga	7	kabuto	kabuto			

The changes here, in II.3, III.4, III.5, IV.1 and IV.2, all affect words which in the RMS begin with two or more low moras. This is precisely the environment for initial dissimilation. If we suppose that a rule was added, affixing a high tone to the initial boundary, precisely as in Ogachogamizu, and that this tone then spread by initial spread, again exactly as is happening in Ogachogamizu today, the advent of the high initial sequences in these cases is exactly predicted. The loss of the final high tones i. II.3, III.4, III.5 and IV.2 will be the result of a reanalysis, whereby the end of the high sequence was taken as the accented syllable and the underlying melody changed from HLH to HL. To take IV.2 as an example, we postulate changes as in

(30) 1. RMS # irokudu # 2. Init. Diss. # irokudu #
L H H L H
3. Init. Spread # irokudu # 4. Bumoki # irokudu #
H L H H L

Finally, the relation of the two major dialect families in Japanese, represented by Tokyo and Kyoto, becomes a little clearer. It is well-known that the position of the accentual star in Tokyo words is systematically one mora further right than in the Kyoto correspondents, except that Kyoto low-initial words all have their star on the first mora in Tokyo. I have nothing new to say about the nature or motivation of the star-shift itself. But let us suppose that the Kyoto system is the older one, and that the star-shift occurred in Tokyo while there was still a distinction between low- and high-initial in the system. At this point, all low-initial words would have an initial string of two or more low moras[7]: again, just the environment for initial dissimilation. When this rule was added, all words in the language would begin with a high tone on the surface. It would be natural for learners to take the underlying melody of the language as HL, eliminating the HL:LHL distinction altogether. The old LHL words would be just the words with a single high mora at the front: and this high tone would be taken to mark the position of the accent. Hence the correlation between Kyoto low-initial and Tokyo initial star. (31) gives an example of two words' passage through the various stages.

(31) 1 Kyoto # karasu # ⇒ 2. Star-Shift ⇒ 3. Init.diss. # karasu #
L H L H L L H L
tayori # # tayori # # tayori
L H L L H L H L L H L

⇒ 4. Tokyo # karasu #
H L
tayori
H L
(before advent of initial lowering)

To sum up, autosegmental theory in a very constrained form provides the means to unify the various instances of initial spread, and of initial dissimilation. These phenomena, when their nature is recognized, provide solutions to a number of problems in the history of the Japanese accent-systems.

Notes

1. Strictly speaking, the word here should be segmental tone-bearer, not mora, since dialects differ as to whether the mora or the syllable fills this role. Kagoshima is one of the few dialects to make the syllable the unit of tone-association.

2. In the theoretical section at the end of his book, Haraguchi (p.325) suggests in a different form what is essentially the same modification of his principle. But he gives no examples to motivate extending it in this way, and still uses the Q-variable (with a positive condition).

3. Two Kansai (i.e Kyoto-style) dialects, Marugame and Takamatsu, have an initial lowering rule in the high-initial class (see Haraguchi, chapter 7). Another dialect with a clear initial dissimilation rule (inserting M at the front of a L sequence is Nakamura (reported in Haraguchi, pp. 208ff.)

4. On this account then, Kochi and 16th-century Kyoto will have only one underlying melody HL, but a lexical distinction as regards the presence or absence of boundary L. In the descendant dialects where spreading has occurred, this distinction is replaced by a distinction between melodies HL and LHL.

5. There are dialects with what appear to be intermediate stages and a little should be said to allay any doubts caused by them. Nagoya, according to Mizutani 1960, lowers the first two syllables if they are of the form CV (V a short vowel). This suggests what is lowered here is the initial foot rather than mora. (For phenomena in English which seem to refer to the same unit, see Liberman and Prince 1977.) The Nagoya data are reproduced in Haraguchi, pp.57ff. Matsue (see Okuda 1975 and Haraguchi 1977) has a form of initial spreading that is partially inhibited by high vowels. I have argued elsewhere for an analysis quite compatible with the claims of this paper, under which the spreading is the result of deleting certain association-lines at a point in the derivation (Ostler 1977).

6. Haraguchi's extensive survey of the dialects from an autosegmental point of view unfortunately missed this generalization. He represents one case of lexical tone speading (Kochi) as the loss of a rule, and one case of an initial-dissimilation tone spreading (Ogachogamizu) as the replacement of an initial raising rule with a rule that simply moves the tone onto a maximal sequence of moras. In both cases, the crucial rule is more powerful than anything we permit outside universal principles (10) and (12).

7. There are no low-initial words with a star on the first mora in Kyoto, as remarked above (see (16)) for Kochi and 16th-century Kyoto. So star-shift would not put any star onto the second mora in low-initials.

References

Goldsmith, John (1976) An overview of autosegmental phonology in Linguistic analysis 2.1

Goto, Kazuhiko (1973) Akusento: Ogachogamizu in Kyushu Hogen Gakkai: Kyushu hogen no kisokuteki kenkyu pp. 489-91. Tokyo.

Haraguchi, Shosuke (1977) The tone-pattern of Japanese (Kaitakusha) Tokyo. (M.I.T. Ph.D. dissertation, 1975)

Hiroto, Atsushi (1961) Tottori-Shimane in T. Misao ed. Hogengaku Koza vol. 3, pp. 290-314

Kawakami, Shin (1965) A change of word-pitch pattern 'low low low' in Bulletin of the Phonetic Society of Japan (BPSJ)#118

(1966) Japanese accent: phenomena vs. conception in BPSJ # 121

Liberman, Mark (1975) The intonational system of English (M.I.T. Ph.D. dissertation)

Liberman, Mark and Prince, Alan (1977) On stress and linguistic rhythm in Linguistic inquiry 8.2

Mizutani, Osamu (1960) Report on one characteristic of accents of the Nagoya dialect in BPSJ ## 102-3.

Okuda, Kunio (1975) Accentual systems in the Japanese dialects (Bunka Hyoronsha) Tokyo. (UCLA Ph.D. dissertation 1971)

Ostler, Nicholas (1977) High-vowel phenomena in two dialects of Japanese ms. M.I.T.

Wenck, Günther (1959) Japanische Phonetik Band IV. Wiesbaden.

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