A Comparison of Different Formal Approaches to the Phonology of the Pitch Accent in Japanese

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1 Introduction

1.1 Subject definition

This paper will present a number of theoretical considerations that arise in the course of the phonological treatment of the Japanese pitch–accent.

Classically, the tonal realisation of a mora in Japanese has been represented as either high (H) or low (L). A fundamental question that will be presented in this paper is to what extent this formalism captures the relevant information concerning the tonal pattern of spoken Japanese.

It is clear that native speakers do not restrict themselves to speaking in two pitches, and that especially on the level of an entire utterance many meaningful and perceptible nuances in tonality will be made.

However, we could distinguish between the wish to obtain a *quantitative* model that describes every physical aspect of the speech tonality on the one hand, or to obtain a *qualitative* model that adresses the underlying representations that speakers are likely to have in their minds.

In the latter case, does the formalism capture what matters to speakers, much like differently realised sounds can nevertheless be faithfully represented by a single invariant?

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One of the main issues that will be adressed in this paper is whether our formalism would need both H and L as entities — an *binary* (H,L)–framework —, or whether it could also work on the basis of contrasting H to simply its absence — a *privative* (H,∅)–framework —, or, yet again, could it be formulated as the pitch–fall HL contrasted with its absence — a (HL,∅)–framework?

This question is also related to whether Japanese is a tone– or a stress–language, since a stress–language can be considered a privative framework in which stressed morae or syllables have a feature (typically the H tone) which unstressed ones simply lack.

1.2 Preliminaries

The following discussion will be restricted to the standard dialect of Tokyo Japanese[1]. It will be clear that in this corpus the fundamental unit of tone assignment is the mora, because two morae that make up the same syllable can be assigned different tones[2]. Nevertheless, interestingly, it seems many rules cannot be formulated without referring to the notion of syllable[3].

1.3 Why is Japanese a pitch–accent language?

1.3.1 Comparison with tonal languages

Like in tonal languages, certain Japanese words that consist of the same phoneme sequence are distinguished only by their tonal realisation, as illustrated in table 1.

However, contrary to most tone languages, not all imaginable tone combinations are found.[4] For instance, no bisyllabic word is found with tonal realisation LL or HH.

Notice that the tonal patterns of (1.b) and (1.c) are identical (and hence their complete phonetic realisation). The difference between the two consists only in the tone that the nominative particle "–ga" would receive when suffixed to them in (1.e) and (1.f), respectively.

[1] Many of the interesting features of other, greatly differing dialects are found in the wonderfully clear presentation of Haraguchi[2]

[2] cf. table 8.d

[3] For instance, the rule of initial lowering, table 5

[4] It is known that various African tone languages do not admit the HLH tone sequence. Interestingly, this is also the case in Japanese.

Table 1: Kaki tonal patterns

H L	L H	L H
ka ki	ka ki	ka ki
牡蠣	堵	柿
a. “oyster”	b. “fence”	c. “persimmon”

H L L	L H L	L H H
ka ki - ga	ka ki - ga	ka ki - ga
牡蠣が	堵が	柿が
d. “oyster”–nom	e. “fence”–nom	f. “persimmon”–nom

1.3.2 Comparison with stress languages

If we would consider a particular tone, e.g. H, as marking its mora as accented, then we are faced with the absurd situation in which a single word has multiple accented syllables, for instance as in (1.f).

It seems therefore more natural to identify the mora that bears a H tone and is followed immediately by a mora carrying a L tone as *accented*. As becomes clear from a larger body of data, there are no words in Japanese that have more than one mora that is *accented* according to this definition. However, we then face the problem that a word might not have such an accented mora at all, for instance as in (1.c), thus contradicting an essential characteristic of stress languages[1].

1.3.3 Broader data

In order to be able to find a general pattern, table 2 lists all of the tonal realisations found in words of various lengths, after Haraguchi[4][5].

Because of reasons mentioned in the foregoing discussion, the tone added in subscript is the one that would be associated with a suffixed particle like

[5]It happens only rarely that there are quasi–homophones differentiated only by tonal realisation, such as in table 1. Therefore, the data presented here lists tonal patterns originally associated with possibly varying words of which it is only required that they have the same number of morae.

the nominative "–ga," but only in case there are several possibilities.[6] [7] [8]

Table 2: Observed tonal patterns for various word lengths

n. of morae	tonal patterns	n. of tonal patterns
2	LH_H, LH_L, HL	3
3	LHH_H, LHH_L, HLL, LHL	4
4	$LHHH_H$, $LHHH_L$, HLLL, LHLL, LHHL	5

One sees a pattern emerge, which is described by Haraguchi[4] by saying that an n–mora word has $n + 1$ tonal patterns, which he postulates follow directly from $n + 1$ underlying accentual patterns.

2 Outline of Haraguchi's approach

2.1 "Starred" mora

The point of Haraguchi[2]'s autosegmental explanation is that under the sole assumption that words optionally have a mora that is lexically marked ("starred," as Haraguchi puts it), there is a number of clearly definable rules that can generate the observed tonal pattern on the basis of the location of this "star."

The "starring" or marking of a mora is the formal representation of accentedness. The starred morae will also occasionally be referred to as "accented."[9]

A word without a starred mora is henceforth called "unaccented."

Clearly, the $n + 1$ observed accentual patterns are now explained as corresponding to the possibilities of choosing or not one among n elements.[10]

The procedure of tonal association happens along the following lines:[11]

[6] These subscript tones are not floating tones for Haraguchi, who specifies in the Universal Tone Association Conventions[4](25) that "[a]ll tones should be associated with at least one tone–bearing unit."

[7] It is important to note that given a certain word, the tone "–ga" will take is completely determined. The ambiguity addressed here is that different words with the same surface tonal pattern can nevertheless yield different tones for "–ga."

[8] It is ignored here that due to initial lowering (cf. 5) words can also have the H^n pattern in case their first syllable is heavy

[9] cf. section 3.1

[10] This is Haraguchi's counterpart of Garde[1]'s *free stress placement*.

[11] The order in which these rules apply is not necessarily as below. Haraguchi[2](75)'s detailed discussion will be omitted here.

- A rule (HLA) that assigns the tone pair HL representing the pitch fall to a particular mora depending on where, if at all, the *starred* mora is found.
- A number of tonal rules specific to Japanese (e.g. TS, IL) apply.
- A number of language–universal tonal rules (Ua–Uc) apply. These will make sure that the following *Universal Tone Association Conventions* are satisfied[2](25):
  - all mora have at least one tone associated with them,
  - all tones are anchored to a mora, and
  - association lines do not cross.

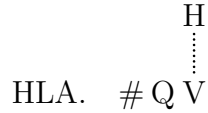
We consider a word as represented by a string of sounds, and in general Q could be any such string. The variables V for vowel and C for consonant are used. The vowel of the starred mora is written as V^*. The association lines a rule introduces are marked by dashing. Also, following the Obligatory Contour Principle in autosegmental theory, adjacent tonal entities will be assumed to differ.

Now the rules above will be discussed in more detail, based on [2](75).

2.2 HL Basic tone melody

A tone pair HL is introduced, whose H is associated to the V following the longest sequence Q without V^*.

Table 3: HL Association



2.3 Universal Tone Association Convention

The language–universal rules introduced in table 4 are mirror image processes, meaning they have horizontally mirrored counterparts.

P represents the longest sequence of free tone–bearing units. T_1 and T_2 are tones, T_2 being free. Q represents the longest sequence of free tones. $\emptyset$ represents the fact that no free tone or free syllable occurs on that side.

The rule paraphrasings are introduced by the author for the purpose of this article's discussion only.

Table 4: Universal Tone Association Rules

Ua. "Free tone anchoring"	
Ub. "Free tone contouring"	
Uc. "Anchored tone spreading"	

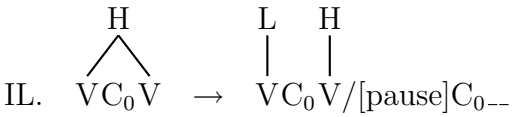
One can remark here that the binary H/L–framework requires in particular the rules Ua and Ub, whereas the privative H/∅–framework could do without, and in the latter, crucially, Uc would not be a mirror image process.

2.4 Japanese–specific rules

2.4.1 Initial lowering

An initial non–accented mora receives a low tone unless belonging to a heavy syllable.

Table 5: Initial Lowering



2.4.2 Tone Simplification

The rule in table 6 is meant to eliminate certain word–final contour tones. Some speakers seem to keep them [2](74) when the mora is accented, for which an alternative formulation is introduced (where V^- marks that the rule applies to unstarred morae only).

Table 6: Tone Simplification

TS.	Original	$L \rightarrow \emptyset / \overset{\text{H}}{\diagup}\ \text{V}$
	Adapted	$L \rightarrow \emptyset / \overset{\text{H}}{\diagup}\ \text{V}^{-}$

Haraguchi[2](34) remarks that this rule can equivalently be formulated as removing the L tone with its association line altogether.

2.5 Example derivations

Table 7 is meant to illustrate how the rules work in practice on examples from table 1[2](34).

3 Commentary on Haraguchi

3.1 Which mora is accented?

Interestingly, many studies seem to point in the direction that the "accented" mora is not necessarily more prominent than other morae in the word (Sato[9] and Haraguchi[3](125)). Therefore, one will only be able to infer the location of the accent on the basis of the location of a pitch drop, if present, in the original word and taking account behaviour under affixing. The question arises why, then, we would call this mora, and not others also, *accented*.

Also, it is interesting to note that the majority (approximately 55%) of words in Tokyo Japanese is "unaccented"[4](7). Also, Haraguchi notes the "accent" cannot appear in arbitrary locations in the word. In particular, it never falls on the second mora of a heavy syllable[2](45).

The following reasons are pointed out in favour of designating the mora identified by the star as "accented."

3.1.1 Economy

The general pattern observed in table 2 is a "plateau" of H tones. The only variable concerning this plateau is up to and including which mora it propagates, so there seems no other way to explain its extent without

Table 7: Example derivations

	1.a	1.b	1.e	1.c	1.f
Underlying	ka*ki	kaki*	kaki*-ga	ka ki	ka ki-ga
HLA	H L | ka*ki	H L | kaki*	H L | kaki*-ga	H L | ka ki	H L | ka ki-ga
U(a,b,c)	H L | | ka*ki	H L /\ kaki*	H L / | kaki*-ga	H L /\ ka ki	H L /\ ka ki-ga
IL	—	L H L | /\ kaki*	L H L | | | kaki*-ga	L H L | /\ ka ki	L H L | /\ ka ki-ga
TS	—	L H | | kaki*	—	L H | | ka ki	L H | / ka ki-ga
Surface	H L | | ka ki	L H | | ka ki	L H L | | | ka ki-ga	L H | | ka ki	L H | / ka ki-ga

viewing the last mora in its range as carrying the accent[1](55). The rest of the plateau is considered an "echo" of the accent.

3.1.2 Native speaker's intuition

Native speakers seem to intuitively agree with the "starred" mora being accented[11](159). However, this could be an intuition rooted only in the fact that dictionaries used to mark those syllables.[12]

Also many cases are known where a contrast perceived by a native speaker did not seem to correspond to an acoustically observable distinction[8]. However, this clearly poses a theoretical problem only if one postulates that the structure is in the observed data and not in underlying representations.

[12]e.g. *Shin Meikai Nihongo Akusento Jiten* or *NHK Nihongo Hatsuon Akusento Jiten* provide normative accentual information.

3.1.3 Intralinguistic indications

There exist native terms for accent–related phenomena, in particular 平板式(*heiban-shiki*, "flat expression") for unaccented words and 起伏式(*kihuku-shiki*, "undulation expression") for accented words[5](174) of which speakers agree they apply precisely to those words that, according to Haraguchi, have no "starred" mora and to those that do, respectively. This could imply that there was a pre–theoretic awareness of the difference between accented and unaccented morae.

However, inquiry with a number of linguists revealed that this terminology is of fairly recent origin, which makes it plausible that they have been introduced only to suit the theory.

3.1.4 Trace

In particular cases there appears to be a trace of a feature that distinguished the starred mora from others.

Firstly, the alternative formulation of the Tone Simplification rule, applying to certain speakers, retains a contour tone in final–accented words, which distinguishes them even on the surface from unaccented words.

Another example of such a trace could be that accented morae are pronounced slightly longer than unaccented ones, but, interestingly, this difference is not perceptible by the human ear[3](125).

3.2 Initial lowering

It is interesting to notice that the rule of initial lowering does not take into account directly the location, if present, of the "starred" mora. Its applicability to uniquely non–accented morae is ensured by the fact that an accented mora will be followed by an L–mora.

Pierrehumbert and Beckman[6](10) note that it might have a delimitative function for phrases, which otherwise could be uninterrupted plateaus of high tones. But they remark also that even in the absence of initial lowering (for instance with the second word in 豚を飼う(*buta-o ka*u*, "to raise pigs"), because it is initial–accented), they are still perceived as two distinct accentual phrases. Poser[7] proposes there is a pitch rise also in these words, such as would have been created by initial lowering, but that it appears earlier[6](10).

However, one can object that phonologically it remains unclear why IL would not apply to heavy initial syllables.

3.3 Tone Simplification

One might wonder why not simply unassociate L, leaving the tone itself there, floating. The reason is that this contradicts the Universal Tone Association Convention[13]. But a point remains: during the tonal derivation, we are first associating the L (by Ub) and then eliminating it (by TS).

Secondly, one could ask why the theory needs to refer to the "starredness" of a mora again in this rule. All of the other rules have been manipulating strings of sounds and tones only.

Also, what is the status of this "null"–tone left after we remove the low tone, or of "void"–association line? This contradicts a privative framework in which L is already the "unmarked", default case. In particular the existence of (final) contour tones constitutes direct evidence against it.

3.4 Basic tone melody association

3.4.1 Is HL the basic tone melody?

HL has been posited as the basic tone melody also for unaccented words, even though in that case clearly there will never actually appear a pitch drop on the surface.[14]

Haraguchi defends this position by referring to two examples, which are illustrated in table 8[2](36),[4](8). It is important to note that Haraguchi implicitly distinguishes two kinds of affixes: *neutral*[15] suffixes that do not cause a change in the location or presence of the star in the word they are fixed onto, e.g. が("–ga") as in table 9.B, and *manipulative* ones that can in certain cases manipulate the location or presence of a star, as in table 9.A. The two examples mentioned below are manipulative, and in particular through their adding or removing a star, they can cause a word that otherwise would have an H melody to exhibit an HL melody, e.g. を("o–") below, or the other way around, e.g. の("–no").

Firstly, the prefix を("o–") in women's speech invokes a pitch drop after the following mora even in words that, without this prefix, are unaccented. In Haraguchi's paradigm, the only way to evoke a pitch drop on the surface level is to postulate that the prefix adds a star to some mora. However, given an unaccented word and the naive assumption that every unaccented

[13] cf. section 2.1

[14] It may be interesting to note here that the common feature of otherwise highly differing dialects occurring across China is precisely the HL contour tone[10]. In a way, it is not unplausible that the pitch fall that is the subject of this paper, although spread out over two syllables, is intimately related to this contour tone.

[15] This naming is introduced by the author of this paper.

word has an H melody, then together with the prefix "o–" one will observe a pitch–fall. Therefore one would need an extra rule to replace the H melody by HL.

Secondly, the genitive suffix の("–no") appears to remove a pitch drop on or after the final[16] syllable in words of at least two syllables. The point here is symmetric: if a word like 8.f that is originally accented, has its star removed by "–no," then the word is left "unaccented" and if one assumes in general that unaccented words have a simple H melody, one needs to explain what happened to the HL melody it supposedly had before suffixing.

Table 8: o– and –no affix behaviour

a.	b.	c.	d.	e.	f.
L H	L H H	L H	H L	L H L	L H L
fu ro*	te ga mi	kawa*	kyo* o	u chi*wa	ni ho* n
風呂	手紙	川	今日	団扇	日本
bath	letter	river	today	fan	Japan
L H L	L H L L	L H H	H L L	L H L L	L H H H
o– fu* ro	o– te* ga mi	ka wa–no	kyo* o –no	u chi*wa–no	ni ho n –no
お風呂	お手紙	川の	今日の	団扇の	日本の
bath	letter	river–gen	today–gen	fan–gen	Japan–gen

3.4.2 Objections to HL basic melody

However, it would seem objections can be made.

Firstly, in the case of speakers who leave a contour tone only when the word is final–accented (as discussed in section 3.1.4), one is at a loss understanding why this contour tone would not also appear in unaccented words, which have the same autosegmental structure.

Secondly, the argument presupposes that the melody accompanying a word is carried over when a suffix is added, and that this suffix does not contribute a melody, or melodic operations, of its own. If we would assume that melody association occurs after affixing then the arguments in section 3.4.1 do not hold.

[16]The pitch drop after the final syllable would normally not be observed, but only appear when a suffix is added, as in table 1.e. Therefore, saying that "–no" removes the star is not as strong an empirical given as it might seem.

Also, Haraguchi's argument seems to rely on a close bond between the underlying level and the basic melody. It presupposes that the basic melody is already there, underlyingly, but simply not yet assigned as long as the star is not fixed.[17] This is illustrated in table 9, where the fact that a word already carries a melody is indicated by the HL in parentheses.

However, one could ask what it means for a basic melody to come with a word when it is not yet autosegmentally associated. The problem is that if the H of the HL melody was already assigned from the start, then an unaccented and final–accented word become equivalent.[18]

The elegance of Haraguchi's approach is that it abstracted the surface HL pitch drop to the starring of a mora, the only information lexically required, in the same way as one could abstract from a guest to its invitation. The problem about the argument is that Haraguchi presupposes the presence of the guest before there is even an invitation: the idea that a word carries, inherently, information about its tonal realisation other than the positioning of the star.

In a limiting case, one could ask why not to turn the suffix–argument presented in section 3.4.1 around to show that all words also have the H basic melody. The only reason it is more plausible the other way around is that we can shove the L under the word–final carpet through the rule of Tone Simplification. If this holds, then the question rises what we have really shown, other than that the melody HL is more informative than H.

Two alternatives are imaginable. One could propose that in accented words the HL melody is (lexically) "anchored" to a particular mora and in unaccented words it remains floating.[19] Alternatively, one could propose that the basic melody for unaccented and accented words is H and HL, respectively, between which is decided after manipulative affixing is done. Clearly, one can then formulate Tone Simplification without referring to the "starredness."

3.4.3 Correspondence star–location/melody assignment

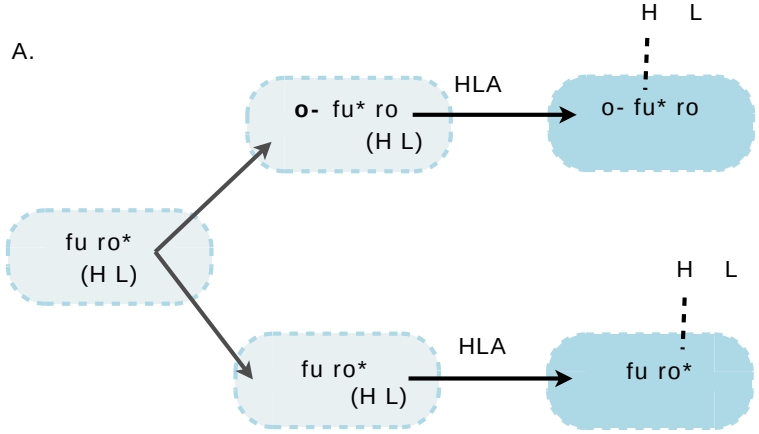
Assuming all words, even the unaccented, have a basic HL melody, we have that not every of the $n + 1$ possible tonal patterns observed corresponds to

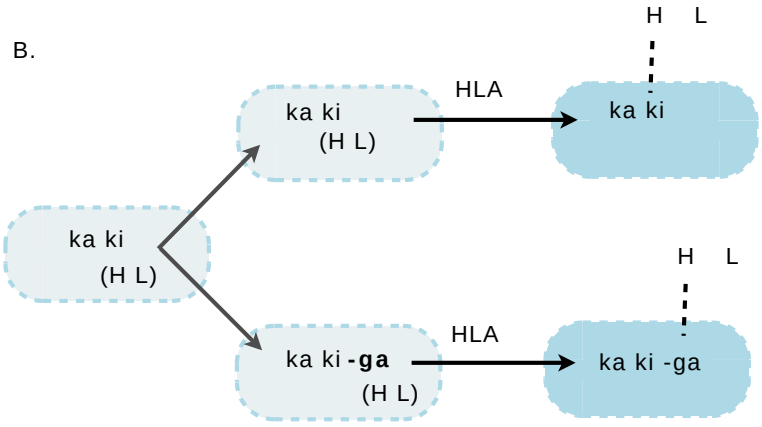
[17] This is because affixes can affect the position or even add or remove a star in a word.

[18] The theory set out to explain the difference in tone of the suffix "–ga" in table 1 (e) and (f)

[19] It is beyond the scope of this paper to give the details of this proposed formalism, but based on the data presented here it would seem clear this is feasible. In particular, the HLA rule would then be restricted to assigning the "floating" HL melody only in the case of unaccented words, since in the other cases it is already assigned.

Table 9: Visualisation of affix influence on starring





a different assignment of the HL melody. Two of these cases, namely the final–accented and unaccented, will result in the same melody assignment. This is why phenomena like the difference in tone of the suffix "–ga" have to be explained by applying differently this HL–association, instead of having two different autosegmental representations acting differently on the suffix.[20]

In particular, contrary to the Initial Lowering rule that could be formulated without referring to the "starredness" of morae, the Tone Simplification rule cannot, for it would then fail to distinguish final–accented and unaccented.

3.5 Tone spreading

3.5.1 Why do default tones spread?

The rule Uc implements a "tone spreading." However, in a privative framework, it seems counterintuitive that the L tone, which is nothing more than the absence of a high tone, could propagate. Can one can ask if we are concerned with "propagation" here, and not rather an "interpolation" low–level filling–in of unspecified tones depending on specified tones in the context?

3.5.2 Pierrehumbert & Beckman 1988

Pierrehumbert and Beckman[6] also make a case against the phenomenon of tone spreading. Their position is that not only the underlying representation, but even the surface level is tonally underspecified. Empirical evidence is presented to the effect that the phenomenon of *downdrift*, the more gradual fall in pitch over the morae following the accented one, is not constant over time, but dependent on the number of morae in the accentual phrase. Therefore, downdrift appears more of an "interpolation" over tonally unspecified morae than a realisation of "spread" tonal instances.

4 Conclusion

4.1 Overview

In this paper is pointed out a number of considerations considering the question how to provide a phonological account of the observed tonal patterns in Tokyo Japanese.

[20] This is illustrated in table 9.

Haraguchi reduces the required lexical information pertaining to tonality to a single given: which mora, if at all, receives a mark ("star") and the observed tonal patterns follow then from a number of mechanical rules.

A number of these rules seem to contradict the privative (H,∅)–framework. For instance, tone spreading seems to indicate the L tone has a symbolic reality of its own, but other evidence seems to call spreading into question. Also, sporadically appearing contour tones appear to rule out a privative framework.

Haraguchi argues that HL is the basic melody of every word. This points at a close relationship between the H and L tones more than simple symbolic opposition, for it implies there can be no H tone without an L. In addition, the (HL,∅) framework is particularly supported by the appearance of word–final contour tones left by certain speakers.

4.2 Future research

Haraguchi's treatment of multi–morae suffixes, though largely omitted in this paper, is exceedingly complex. In particular, it would be interesting to find an explanation why certain affixes influence the tonal realisation (here called "manipulative") and others not ("neutral") and find if this could explain the behaviour of these multi–morae suffixes also.

Another question that was raised in section 3.4.2 is whether the formalism involving the "star" is necessary. The two alternatives could be compared in effectiveness in covering the observations as well as theoretical cleanliness.

The nature of the "star" as a theoretical entity could also be clarified by determining any regularities in its occurence, for instance an explanation why it only occurs on the first mora of a heavy syllable.

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