

Phase-based prosody: evidence from pitch-accent distribution in the Japanese verbal domain*

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1. Introduction

It has been claimed that CP phases in Japanese coincide with a significant intonational boundary and, thus, prosody is computed phase-by-phase (Ishihara 2003; Kitagawa 2005; Dobashi 2018; cf., Match Theory, Selkirk 2011 and Ito and Mester 2013). If a CP receives a meaningful intonation contour, a natural question that arises is whether this conclusion also holds in other domains.

By examining pitch-accent distributions in the Japanese verbal domain, this paper gives an affirmative answer to this question; (i) phase-based prosody also holds in the verbal domain. However, (ii) in Tokyo Japanese, the phase domain is the sister node of T, not *v*. Within the framework of Distributed Morphology (Halle 1990; Halle and Marantz 1993; Embick and Noyer 2001), this paper discusses (iii) how pitch-accent assignments, which are in principle determined and predicted by syntactic units, are modified by phonology and morphology, resulting in superficial complexity.

2. Basic data

In Tokyo Japanese, a single high-pitch intonation contour is assigned around a verbal domain. For example, the verbal phrases in (1) (*aratamer-u* ‘renew-PRS’ and *hedatar-u* ‘be distant-PRS’) both receive a single high-pitch contour, created by a sequence of high-pitch accents (H’s) and the surrounding low-pitch accents (L’s).

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- (1) a. L H H H L b. L H H L
 a. ra. ta. me. r -u. *he. da. ta. r -u.*
 renew -PRS be distant -PRS
 ‘(I) renew (something).’ ‘(It) is distant.’

This pitch accent contour cannot be modified by subsequent C elements. For example, sentence-final particles such as *yo* and *ne* and the quotative particle *to* never extend or modify the already-created high-pitch contour. This is illustrated in (2).

- (2) [L H H H {L/*H}] {L/*H} {L/*H} L
 [*a. ra. ta. me. r-u.*] *yo. ne. to.*
 renew -PRS SFP SFP QUO
 ‘that (I) renew (something); YO+NE.’

The fact that pitch-accent assignment is only sensitive to this limited syntactic region suggests that there exists a particular syntactically-marked prosodic unit, which I take to be a phase domain in this language. The main goal of this paper is to articulate this insight by answering the following research questions. First, which syntactic unit corresponds to this bracketed region? Second, how are the pitch-accents assigned?

3. Data

3.1 Non-accented verbs and accented verbs

In terms of pitch-accent assignment, Japanese verbs are classified into two groups, i.e., (i) non-accented verbs and (ii) accented verbs (Kubozono 2011; Kawahara 2015; among many others). Observe the minimal pair in (3). In both cases, the left edge of the prosodic domain is assigned a low pitch accent. But the falling pitch is assigned to different locations.

- (3) Disyllabic verbs
- | | |
|--|--|
| <p>a. Non-accented verb</p> <p>[L H H] L [<i>ha. re. r-u.</i>] <i>to</i> become swollen -PRS QUO ‘that (it) becomes swollen</p> | <p>b. Accented verb</p> <p>[L H L] L [<i>ha. re. r-u.</i>] <i>to</i> clear up -PRS QUO ‘that (it) clears up</p> |
|--|--|

As schematically shown in (4), the falling pitch of a non-accented verb appears to the right of the closing bracket, while, in an accented verb, it falls to the left of the closing bracket.

- (4) a. [L ... H ...] L (Non-accented verbs)
 b. [L ... H ... L] (Accented verbs)

Basically, the same rule applies to monosyllabic verbs. However, monosyllabic accented verbs are exceptional in that they do not start with a low pitch accent. Observe the

Neutralization. Notice that the aspectual suffix neutralizes the pitch contrast. As we saw in (3), *hare-* ‘become swollen’ and *hare-* ‘clear up’ exhibit different pitch-accent contours. However, the sentences in (6) receive the same pitch contour. The main verb and the aspectual suffix combine to form a single prosodic unit and the left and the right edge of the bracketed region receive the low-pitch accent.²

3.2.2 Data 2: Addressee-honorific markers

Second, the addressee-honorific marker *-mas* is another verbal suffix that appears between the Head, AspP and the Head, Pol(arity)P (Yamada forthcoming). This morpheme also falls within the bracketed region and, just as with aspectual suffixes, it neutralizes the lexical difference between the accented and the non-accented verb.

(7) *Addressee-honorific marker*

| | | | | | | | |
|---|---|------------|------------------|-------------|---|------------|------------|
| [| L | H | H | {L/*H} |] | L | L |
| [| <i>ha.</i> | <i>re.</i> | <i>-ma.</i> | <i>s-u.</i> |] | <i>yo.</i> | <i>to.</i> |
| | become swollen/clear up | | HON _A | -PRS | | SFP | QUO |
| | ‘that (it) becomes swollen; YO; polite.’ or ‘that (it) clears up; YO ; polite.’ | | | | | | |

Aspectual markers can be used with *-mas*; in this case, the high-pitch region extends until it hits the present tense (non past tense) marker *-u*. Observe the following sentence.

| | | | | | | | | | | | |
|-------|---|-------------------------|------------|------------|------------|------------------|-------------|-------------|-----|------------|------------|
| (8) [| L | H | H | H | H | {H/*L} | {L/*H} |] | L | L | |
| | [| <i>ha.</i> | <i>re.</i> | <i>ha.</i> | <i>zi.</i> | <i>me.</i> | <i>-ma.</i> | <i>s-u.</i> |] | <i>yo.</i> | <i>to.</i> |
| | | become swollen/clear up | | start | | HON _A | -PRS | | SFP | QUO | |
| | ‘that (it) starts becoming swollen; YO.’ or ‘that (it) starts clearing up; YO.’ | | | | | | | | | | |

Hypothesis 1 (TP). Having examined Data 1 and Data 2, we might want to hypothesize that TP is the relevant domain for Japanese pitch-accent assignment (hereafter, Hypothesis 1). First, aspectual markers and *-mas* are within the bracketed region.³ Second, in all examples above, the present (non past) tense marker appears within the prosodic domain. Lastly, the C-elements are all outside the region.

²**Hazimer- as a lexical verb:** Note that, just like English *start*, *hazimer-* ‘start’ can be used as a transitive verb in addition to the suffixal use. But, in that case, it is pronounced as a non-accented verb (LHHH). In (6)a, an accented pitch pattern emerges despite the fact that neither of the constituents is an accented verb.

| | | | | | | | | |
|-------|----------------|------------|------------|------------|----------|------------|---|------------|
| (i) [| {L/*H} | H | H | {H/*L} |] | L | | |
| | [| <i>ha.</i> | <i>zi.</i> | <i>me.</i> | <i>r</i> | <i>-u.</i> |] | <i>to.</i> |
| | | start | | -PRS | | QUO | | |
| | ‘(It) starts.’ | | | | | | | |

³**Position for *-mas*:** In some languages (e.g., Korean and Thai), addressee-honorific markers appear in the left-periphery above/around CP. However, Japanese *-mas* is pronounced in a position at least lower than Pol(arity)P, which is, of course, lower than TP. See Yamada (forthcoming: Chapter 3).

3.3 Bracketed region = Sister node of T?

3.3.1 Data 3: Tense (the past tense) in affirmative sentences

However, not all tense-oriented elements uniformly display the same distributional pattern. First, the past tense suffix *-ta* seems to be both inside and outside of the prosodic region. Observe the sentence in (9)a. Here, the non-accented verb is accompanied by *-ta*, and this tense morpheme falls under the high-pitch region. Certainly, this observation supports Hypothesis 1. However, observe the sentence in (9)b.

(9) Past tense

| | |
|-----------------------------|-------------------------|
| a. Non-accented verb | b. Accented verb |
| [TP L H H] L | [TP H L L] L |
| [ha. re. -ta.] to. | [ha. re. -ta.] to. |
| become swollen -PST QUO | clear up -PST QUO |
| ‘that (it) became swollen.’ | ‘that (it) cleared up.’ |

Here, an accented verb is used with the same past tense morpheme. If we adopt Hypothesis 1, we would predict that (10) would be the correct pitch-accent assignment, contrary to the fact. The correct pitch pattern in (9)b begins with a high pitch accent, which reminds us of the monosyllabic accented verb, which we saw in (5)b.

(10) * [TP L H L] L
 [ha. re. -ta.] to.
 clear up -PST QUO
 ‘that (it) cleared up.’

Hypothesis 2 (Sister node of T). What if we tentatively assume that the relevant prosodic unit is the sister node of T, not the TP itself (hereafter Hypothesis 2)? Under this hypothesis, we can explain the pitch-contour assignment of *hare-ta* ‘clear up-PST.’ The relevant bracketed domain is shown in (11)b. This region consists of two morae. Based on the same principles for (5)b, we can predict that an HL pitch contour is assigned to (11)b.

(11) Past tense

| | |
|-------------------------|-----------------------------|
| a. Non-accented verb | b. Accented verb |
| [L H] H L | [H L] L L |
| [ha. re.] -ta. to. | [ha. re.] -ta. to. |
| become swollen -PST QUO | clear up -PST QUO |
| ‘that (it) cleared up.’ | ‘that (it) became swollen.’ |

However, as a drawback, this hypothesis runs into trouble when explaining the pattern of the non-accented verbs in (9)a/(11)a, because it predicts that *-ta* is outside the prosodic region. Thus, it is expected that it receives a low pitch-accent. But this prediction is obviously wrong.

Phase-based prosody

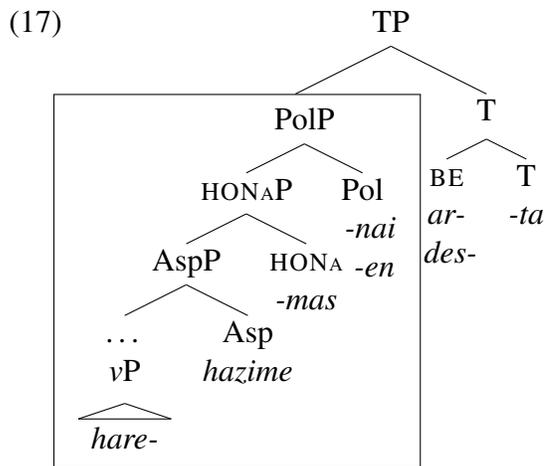
Second, the sentences in (16) illustrate the pitch-accent distribution in polite forms (= with *-mas*). As we have seen, the presence of *-mas* neutralizes the lexical difference. But, again, the past tense marker *-ta* is outside the relevant pitch region.

- (16) a. [TP[L H H H L] L L L]
ha. re. -ma. s -e. N. de. si. -ta.
 become swollen HON_A -NEG be.HON_A -PST
- b. [TP[L H H H L] L L L]
ha. re. -ma. s -e. N. de. si. -ta.
 clear up HON_A -NEG be.HON_A -PST

These data also support Hypothesis 2. If the entire TP is the relevant region (= Hypothesis 1), we would predict that the high-pitch contour extends to *be*-support elements. This prediction is, however, not borne out.

3.4 Interim summary

In this section, we have examined the pitch-accent distribution of the functional projections displayed in (17). First, in all the examples, functional projections as large as the PolP are included in the prosodic domain (= the boxed region in (17)).



Second, the tense markers do not show uniform behavior. The present tense marker appears inside the pitch-domain. When a past tense morpheme is used, the situation is slightly complicated. With a *be*-support element, it is outside the pitch-domain, but without a *be*, the lexical accent becomes influential. The table in (18) summarizes the results.

(18)

| | | | | |
|---------------------------------|------------------------------|---------------|----------------|----------------|
| Present tense marker <i>-u</i> | | <i>inside</i> | (6) - (8) | : A |
| Past tense marker <i>-ta</i> | without a <i>be</i> -support | non-accented | <i>inside</i> | (11)a : B |
| | | accented | <i>outside</i> | (11)b : C |
| | with a <i>be</i> -support | | <i>outside</i> | (15), (16) : D |

4. Analysis

Which domain is relevant for the syntax/phonology interface, the TP (Hypothesis 1) or the sister node of T (Hypothesis 2)? In fact, there are some independent data that support the latter hypothesis (cf., Aelbrecht's analysis on the Dutch modal ellipsis; Aelbrecht 2010: 58; Bošković 2014: 47).

First, this domain is also the target of ELLIPSIS. As in (19), the repeated segment can be omitted if it is the sister node of T. Unlike English, the negation marker may not appear outside the elided region.

(19) Lucia: [TP [PolP *Iki-mas-en*] *desi-ta*] *yo ne?*
 go-HON_A-NEG COP.HON_A-PST SFP SFP
 'Did you not go (to the party)?; the meaning of YO+NE'

James: a. *~~[_{VP} *Iki*]~~ *mas-en* *desi-ta* *ne.*
 go HON_A-NEG COP.HON_A-PST SFP
 b. *~~[_{HON_{AP}} *Iki-mas*]~~ *en* *desi-ta* *ne.*
 go-HON_A NEG COP.HON_A-PST SFP
 c. [_{PolP} *Iki-mas-en*] *desi-ta* *ne.*
 go-HON_A-NEG COP.HON_A-PST SFP
 'He did not; NE.'

Second, *soo*-replacement also targets the same region as illustrated in (20).

(20) Lucia: [*Paul-wa Iki-mas-en*] *desi-ta.*
 Paul-TOP go-HON_A-NEG COP.HON_A-PST
 'Paul did not go.'

James: a. **Elena-mo soo-en desi-ta yo ne.*
 Elena-also so-NEG COP.HON_A-PST SFP SFP
 b. *Elena-mo soo desi-ta yo ne.*
 Elena-also so COP.HON_A-PST SFP SFP
 'Elena did not, either; YO+NE.'

If we assume that elided regions are phase domains (e.g., Bošković 2014), it is reasonable to claim that the sister node of T is a phase domain in Japanese.

4.1 Problem 1: The present tense marker

If the sister node of T is the domain for the syntax-phonology interface, we must explain the two exceptional cases where the tense marker appears inside the prosodic domain; i.e., Cases A and B in (18).

Phase-based prosody

To this end, I assume that this *-u* is not the genuine tense morpheme present in the narrow syntax; it is a vowel inserted post-syntactically .

(21) **Hypothesis 3:** *-u* is a vowel inserted post-syntactically after the narrow syntax.

There are two observations that support this view. First, *-u* can be used to refer to any tense but the past. For instance, in (22)a, this *-u* is used to refer to the state held at the present moment. But in (22)b, it refers to a future state. This elsewhere property is easily explained if we assume that *-u* is inserted post-syntactically for phonological reasons.⁴

(22) *Non-past tense marker -u*

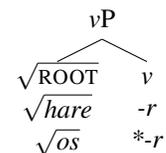
- a. *Reizooko-ni ringo-ga ar-u.*
fridge-LOC apple-NOM be-PRS
‘There is an apple in the fridge.’
- b. *Syuumatu-ni gakkai-ga ar-u.*
weekend-LOC conference-NOM be-PRS
‘There will be a conference on the weekend.’

Second, *-u* and *-ta* differ with respect to the *be*-support. As mentioned above, *-ta* triggers a *be*-support, when there is a negation marker (= (23)c); the sentence without *(k)ar-* ‘be’ is illicit as in (23)b. However, *-u* cannot be used with this *be*-support as in (24)c. When negated, *-u* disappears as in (24)b and no *be*-support is triggered.

- (23) a. *Arui-ta.* b. **Aruk-ana-ta.* c. *Aruk-ana kat-ta.*
walk-PST walk-NEG-PST walk-PST COP-PST
‘(I) walked.’ ‘(I) didn’t walk (intended).’ ‘(I) didn’t walk.’
- (24) a. *Aruk-u.* b. *Aruk-anai.* c. **Aruk-ana kar-u.*
walk-PRS walk-NEG walk-NEG COP-PRS
‘(I) walk.’ ‘(I) don’t walk.’ ‘(I) don’t walk (intended).’

⁴**Verbalizing head -r:** In the non-past tense, verbs that end with a vowel, e.g., *hare-* ‘become swollen/clear up,’ must be accompanied with an *-u* together with a consonant *r*, as shown in (i). I assume that this *-r* is the realization of the verbalizing head, as in (ii). Since *vP* ends with an *r*, *-u* is inserted to create a well-formed mora structure, as in (i)c. If the root ends with a consonant, this *-r* disappears presumably because of the avoidance of *CC; e.g., *os* ‘ $\sqrt{\text{PUSH}}$ ’ + *-r* = *os* ‘push (verb)’. If it is followed by a past tense morpheme *-ta*, this *-r* also disappears, e.g., *hare* ‘ $\sqrt{\text{CLEAR UP}}$ ’ + *-r* + *ta* = *hare-ta* ‘clear up (verb),’ not **haret-ta*. The idea that *-r* is the verbalizing head is also supported by the fact that, when *hare* is used as a noun (‘a sunny day’), this *-r* is never pronounced (e.g., *Kyoo-wa hare da.* today-TOP sunny day COP ‘Today is a sunny day’).

- (i) a. **hare-u.* b. **hare.* c. *hare-r-u.* (ii)
- clear up-PRS clear up clear up-r-PRS
- ‘(it) clears up.’



The data above show that *-u* and *-ta* have a different morpho-syntactic status. If we assume that a *do/be*-support is a remedy for the stranded affix present in the narrow syntax, the lack of a *be*-support for *-u* suggests that it does not exist in the narrow syntax. Such peculiar properties of *-u* are easily explained by the analysis that it is a vowel post-syntactically inserted for a phonological reason, i.e., to make a well-formed mora structure (cf., the *-u* that appears between an adjective and the negation can be seen as another instance of an inserted vowel, e.g., the *-u* in *akak-u nai* ‘red-u NEG’). Although *-u* is pronounced inside the prosodic domain, the presence of *-u* does not indicate that T is in this region. This is the explanation for Case A in (18).

4.2 Problem 2: The past tense marker

The remaining problem for Hypothesis 2 is that non-accented verbs in the past tense appear inside the prosodic domain when there is no *be*-support. I propose that the past tense bound morpheme in Tokyo Japanese undergoes post-syntactic Lowering, as has been assumed for the English *-ed* suffix (Embick and Noyer 2001).

Order of the relevant operations. I assume that the derivation proceeds in the following manner. First, phases are created (= (25)a). This is done in the narrow syntax. Second, pitch accents are assigned to the lower domain, i.e., the sister node of T. This is a phonological operation (= (25)b). Third, the stranded bound morpheme *-ta* undergoes Lowering. This is a post-syntactic morphological operation (= (25)c). Fourth, the lowered *-ta* receives the same pitch accent from the adjacent mora (= (25)d). Finally, the elements in the next phase domain receive low pitch accents (= (25)e). This is also a phonological operation.

(25) *For non-accented verbs*

| | | | | | | |
|----|-----|-------|---------------------|---|--------------------------------|------------------------------|
| a. | [CP | [PolP |] |] | | |
| | [| [| <i>ha. re.</i> |] | -ta. <i>yo. ne. to.</i> | |
| b. | [CP | [PolP | L H |] |] | Pitch-assignment for PolP |
| | [| [| <i>ha. re.</i> |] | -ta. <i>yo. ne. to.</i> | |
| c. | [CP | [PolP | L H |] |] | Lowering |
| | [| [| <i>ha. re. -ta.</i> |] | <i>yo. ne. to.</i> | |
| d. | [CP | [PolP | L H H |] |] | |
| | [| [| <i>ha. re. -ta.</i> |] | <i>yo. ne. to.</i> | |
| e. | [CP | [PolP | L H H |] | L L L | Pitch-assignment for CP |
| | [| [| <i>ha. re. -ta.</i> |] | <i>yo. ne. to.</i> | |

Pitch-accent assignment: As for the step in (25)b, I assume an interaction among several constraints (Trommer 2001; Rolle 2018). In addition to Anti-homophony and Ident-IO (cf., Prince and Smolensky 1993; Ichimura 2006), I assume that (i) Japanese has phase-sensitive phonological constraints and (ii) non-accented verbs have a lexical requirement that the right edge of the phase must end with an H (= (26)). Consider the tableau in (27).

Phase-based prosody

- (26) a. [LH in comp.: An LH pitch accent is at the left edge of the phase in compounds.
 b. LH] in comp.: An HL pitch accent is at the right edge of the phase in compounds.
 c. [LH: An LH pitch accent exists at the left edge of the phase.
 d. LH]: An HL pitch accent exists at the right edge of the phase.

- (27) a. *harer-u* ‘become swollen’ (Non-accented)

| Input: H] | [LH in comp. | HL] in comp. | Anti- hom. | Ident- IO | [LH | HL] |
|--------------------|-----------------|-----------------|---------------|--------------|-----|-----|
| ha.re.r-u. (HLL) | | | | *! | * | * |
| ha.re.r-u. (LHL) | | | | *! | | |
| → ha.re.r-u. (LHH) | | | | | | * |

- b. *harer-u* ‘clear up’ (Accented)

| | [LH in comp. | HL] in comp. | Anti- hom. | Ident- IO | [LH | HL] |
|--------------------|-----------------|-----------------|---------------|--------------|-----|-----|
| → ha.re.r-u. (LHL) | | | | | | |
| ha.re.r-u. (LHH) | | | *! | | | * |

- c. *hare-ta* ‘become swollen-PST’ (Non-accented)

| Input: H] | [LH in comp. | HL] in comp. | Anti- hom. | Ident- IO | [LH | HL] |
|---------------|-----------------|-----------------|---------------|--------------|-----|-----|
| ha.re. (HL) | | | | *! | * | * |
| ha.re. (LL) | | | | *! | * | * |
| → ha.re. (LH) | | | | | | * |

- d. *hare-masi-ta* ‘become swollen-HON_A-PST’ (Non-accented)

| Input: H] | [LH in comp. | HL] in comp. | Anti- hom. | Ident- IO | [LH | HL] |
|-----------------------|-----------------|-----------------|---------------|--------------|-----|-----|
| ha.re.ma.si. (LHHH) | | *! | | | | * |
| → ha.re.ma.si. (LHHL) | | | * | * | | |

First, *harer-u* ‘become swollen’ is given an LHH pitch contour in order to respect Ident-IO (= (27)a). Second, *harer-u* ‘clear up’ is assigned an LHL in order to avoid homophony (= (27)b). Third, *hare* in *hare-ta* ‘become swollen-PST’ receives an LH, due to Ident-IO (= (27)c). Finally, in (27)d, HL] in comp. becomes influential, making an LHHL accent.

Multiple pitch-assignments. In the above analysis, the pitch-accent assignment does not happen at a single moment during the derivation. Each phase has its own pitch-assignment timing. To highlight the importance of this, consider what happens if we assume a single moment for the pitch-accent assignment. First, if we hypothesize that all the pitch-accents are determined before Lowering as in (28)a, we wrongly predict that a non-accented verb receives a LHL intonation contour, as illustrated in (28)b. Second, if we assume that Lowering precedes a single operation of pitch-accent assignment (= (29)a), accent verbs are predicted to have the wrong pitch-accent contour, as in (29)b.

- (28) a. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \text{L} \quad \text{L} \quad \text{L} \quad \text{L} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{-ta.} \quad \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{Pitch-assignment} \\ \text{for PolP}$
- b. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \text{L} \quad \text{L} \quad \text{L} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \right]$
- (29) a. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{-ta.}$
- b. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \text{L} \quad \text{L} \quad \text{L} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \right]$

This is the analysis for Case B in (18), and the same explanation applies to all the other cases. First, accented verbs proceed along the same course of derivation, as illustrated in (30) (Case C in (18)). Second, when *kat-* ‘be’ is inserted, *-ta* cannot be lowered and remains outside the prosodic region, receiving a low pitch accent, as shown in (31) (Case D in (18)).

- (30) a. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \text{-ta.} \quad \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{H} \quad \text{L} \\ \text{ha.} \quad \text{re.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{Pitch-assignment} \\ \text{for PolP}$
- b. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{H} \quad \text{L} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{H} \quad \text{L} \quad \text{L} \\ \text{ha.} \quad \text{re.} \quad \text{-ta.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{Lowering}$
- (31) a. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{H/L} \\ \text{ha.} \quad \text{re.} \quad \text{na.} \end{array} \right] \end{array} \right] \end{array} \right] \text{ka.} \quad \text{-ta.} \quad \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{H/L} \\ \text{ha.} \quad \text{re.} \quad \text{na.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{Pitch-assignment} \\ \text{for PolP}$
- b. $\left[\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{H/L} \\ \text{ha.} \quad \text{re.} \quad \text{na.} \end{array} \right] \end{array} \right] \end{array} \right] \text{L} \quad \text{L} \quad \text{L} \quad \text{L} \quad \text{L} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{H/L} \\ \text{ha.} \quad \text{re.} \quad \text{na.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{ka.} \quad \text{-ta.} \quad \text{yo.} \quad \text{ne.} \quad \text{to.} \quad \left. \vphantom{\begin{array}{c} \text{CP} \\ \left[\begin{array}{c} \text{PolP} \\ \left[\begin{array}{c} \text{L} \quad \text{H} \quad \text{H/L} \\ \text{ha.} \quad \text{re.} \quad \text{na.} \end{array} \right] \end{array} \right] \end{array} \right] \right] \text{Pitch-assignment} \\ \text{for CP}$

5. Conclusion

Examining the pitch-accent distribution, this study has proposed that phase-based phonology holds around the Japanese verbal domain. Important claims are summarized below.

- **Phase-based phonology:** Phase-based phonology is extended outside the C region. Building from the inside-out, lower phase domains are spelled-out and phonologized, but then the output is reinserted back into the derivation (Sande and Jenks 2018).
- **Variation in phase head:** The study predicts a typology between *v*-as-phase-head languages and T-as-phase-head languages, which is detectable from prosodic contours and ellipsis/replacement. Though what counts as a phase is a controversial issue (Chomsky 2000, 2001; Legate 2003, 2014), this analysis hints at the recent movement that highlights the flexibility of phaseness (Bošković 2014).
- **Assumptions in DM:** Assumptions in Distributed Morphology play crucial roles, e.g., Lowering, the timing of *do/be*-support and post-syntactic vowel insertion.

- **Timing of phonological operations:** Phonological operations are applied much earlier than traditionally assumed, or at least in parallel with morphological processes (cf., Trommer 2001; Richards 2010, 2016, 2017; Branan 2018; Yamada 2019a; Rolle 2018; Arregi and Nevins 2012; Sande and Jenks 2018).

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Akitaka Yamada

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