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

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Abstract

Research on the Japanese phonology/syntax interface has claimed that the CP phase coincides with a significant intonational boundary and have claimed that prosody is computed phase-by- phase (Ishihara 2003, 2004; Kitagawa 2005; Dobashi 2018; cf. Match Theory, Selkirk 2011 and Ito and Mester 2013). If CP receives a meaningful intonation contour, a natural question that arises is — what about other phases? Within the framework of Distributed Morphology (Halle 1990; Halle and Marantz 1993; Embick and Noyer 2001), the present study proposes that (i) phase-based prosody also holds in the verbal domain; but (ii), in Tokyo Japanese, the phase domain is the sister node of T, not v; and (iii) the pitch-accent in this syntactic domain is modified by phonology and morphology, resulting in superficial complexity.

1 Introduction

Japanese phonology/syntax interface:

1. the CP phase coincides with a significant intonational boundary
2. prosody is computed phase-by-phase (Ishihara 2003, 2004; Kitagawa 2005; cf. Match Theory, Selkirk 2011 and Ito and Mester 2013).

Verbal domains: In Tokyo Japanese, each verbal domain needs to receive a high pitch contour (L stands for the low pitch while H stands for the high pitch):

(1) Four syllable verbs

L	H	H	H	L	
a.	*ra.*	*ta.*	*me.*	*r*	*-u.*
renew					-PRS

'(I) renew (something).'

(2) Three syllable verbs

L	H	H	L	
he.	*da.*	*ta.*	*r*	*-u.*
be distant				-PRS

'(It) is distant (from something).'

This high pitch contour reflects the verbal domain only and is not affected by subsequent C-elements. For example, sentence-final particles such as *-yo* and *-ne* or the quotative particle *-to* never extend the already-created high-pitch region, as illustrated below.[1]

(3) C-elements and high pitch contour

a.

L	H	H	H	L
a.	*ra.*	*ta.*	*me.*	*r-u.*
renew				-PRS

'(I) renew (something).'

b.

L	H	H	H	{L/*H}	L
a.	*ra.*	*ta.*	*me.*	*r-u.*	*-yo*
renew				-PRS	-SFP

'(I) renew (something); YO.'

c.

L	H	H	H	{L/*H}	{L/*H}	L
a.	*ra.*	*ta.*	*me.*	*r-u.*	*-yo*	*-ne*
renew				-PRS	-SFP	-SFP

'(I) renew (something); YO+NE.'

d.

L	H	H	H	{L/*H}	{L/*H}	{L/*H}	L
a.	*ra.*	*ta.*	*me.*	*r-u.*	*-yo*	*-ne*	*-to*
renew				-PRS	-SFP	-SFP	-SFP

'that (I) renew (something); YO+NE.'

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[1] The meaning of the sentence final particles are not relevant for the current discussion. In the gloss, YO and NE are used to refer to their expressive meanings.

Claims:

(4) a. phase-based prosody also holds in the verbal domain

   b. in Tokyo Japanese, the phase domain is the sister node of T, not v

   c. based on this syntactically defined domain, phonology and morphology modify the pitch contour, resulting in superficial complexity

2 Data

2.1 Two pitch-accent patterns

With respect to the position of the falling pitch, Japanese verbs have been traditionally classified into (i) non-accented verbs and (ii) accented verbs (Kubozono 2011; Kawahara 2015).

(5) Disyllabic verbs

a. Non-accented verb

[L	H	H	]	L	L	L
[*ha.*	*re.*	*r-u.*	]	*yo.*	*ne.*	*to.*
become swollen		-PRS		SFP.	SFP.	QUO.

'that (it) becomes swollen; YO + NE.'

b. Accented verb

[L	H	L	]	L	L	L
[*ha.*	*re.*	*r-u.*	]	*yo.*	*ne.*	*to.*
clear up		-PRS		SFP.	SFP.	QUO.

'that (it) clears up; YO + NE.'

(6) Trisyllabic verbs

a. Non-accented verb

[L	H	H	H	]	L	L	L
[*na.*	*ku.*	*na.*	*r-u.*	]	*yo.*	*ne.*	*to.*
pass away			-PRS		SFP.	SFP.	QUO.

'that (he) passes away; YO + NE.'

b. Accented verb

[L	H	H	L	]	L	L	L
[*he.*	*da.*	*ta.*	*r-u.*	]	*yo.*	*ne.*	*to.*
be distant			-PRS		SFP.	SFP.	QUO.

'that (it) is distant; YO + NE.'

(7) Four syllable verbs

a. Non-accented verb

[L	H	H	H	H	]	L	L	L
[*me.*	*si.*	*a.*	*ga.*	*r-u.*	]	*yo.*	*ne.*	*to.*
eat. HON$_S$				-PRS		SFP.	SFP.	QUO.

'that (he = honorified) eats; YO + NE.'

b. Accented verb

[L	H	H	H	L	]	L	L	L
[*a.*	*ra.*	*ta.*	*me.*	*r-u.*	]	*yo.*	*ne.*	*to.*
renew				-PRS		SFP.	SFP.	QUO.

'that (I) renew; YO + NE.'

The accented verb has a falling pitch before the closing bracket whilst the non-accented verb has a falling pitch after the closing bracket. In the accented verb, the both edges of the bracketed region must be assigned a low pitch accent.

Monosyllabic verbs are exactly the same except for the fact that the accented verb cannot have low pitch accents at both edges — if low pitch accents appear at the both edges, a high pitch accent is never assigned within the verbal domain! — and the left edge is assigned a high pitch accent.

(8) Mono-syllabic verbs

a. Non-accented verb

[L	H	]	L	L	L
[*na.*	*r-u.*	]	*yo.*	*ne.*	*to.*
ring	-PRS		SFP.	SFP.	QUO.

'that (it) rings; YO + NE.'

b. Accented verb

[H	L	]	L	L	L
[*na.*	*r-u.*	]	*yo.*	*ne.*	*to.*
become	-PRS		SFP.	SFP.	QUO.

'that (it) becomes; YO + NE.'

(9) a. *
```
[ L      L      ]  L    L    L
[ na.    r-u.   ]  yo.  ne.  to.
  become -PRS      SFP. SFP. QUO.
```
'that (it) becomes; YO + NE.'

b. *
```
[ L      H      ]  L    L    L
[ na.    r-u.   ]  yo.  ne.  to.
  become -PRS      SFP. SFP. QUO.
```
'that (it) becomes; YO + NE.'

2.2 Research questions

(10) Research questions

   a. Which functional projection is the bracketed region? (e.g., TP? PolP? Asp? *v*P?)

   b. Based on the syntactically-defined domain (= the bracketed region), how do we predict the pitch contour?

2.3 More data 1: Bracketed region = TP?

There are some suffixes (heads of some functional projections) that makes us believe that the bracketed regions are TPs.

2.3.1 Aspectual suffixes

- *hazimer-* 'start/begin,' *tuduker-* 'continue,' and *owar-* 'finish' neutralize the contrast between the non-accented and accented verbs.

(11) Disyllabic verbs

   a. Non-accented verb
```
[ L      H      H    H    H    {L/*H} ]  L    L
[ ha.    re.    ha.  zi.  me.  r-u.   ]  yo.  to.
  become swollen     start      -PRS     SFP. QUO.
```
'that (it) starts becoming swollen; YO .'

   b. Accented verb
```
[ L      H    H    H    H    {L/*H} ]  L    L
[ ha.    re.  ha.  zi.  me.  r-u.   ]  yo.  to.
  clear up    start        -PRS       SFP. QUO.
```
'that (it) starts clearing up; YO .'

(12) Monosyllabic verbs

   a. Non-accented verb
```
[ L      H    H    H    H    {L/*H}]  L    L
[ na.    ri.  ha.  zi.  me.  r-u.  ]  yo.  to.
  ring        start          -PRS     SFP. QUO.
```
'that (it) starts ringing; YO .'

   b. Accented verb
```
[ L      H    H    H    H    {L/*H}]  L    L
[ na.    ri.  ha.  zi.  me.  r-u.  ]  yo.  to.
  clear up    start          -PRS     SFP. QUO.
```
'that (it) starts becoming; YO.'

2.3.2 Addressee-honorific markers

- The addressee-honorific marker *-mas* appears also in the *v*P-periphery (cf. Belletti 2004) and triggers the neutralization.

(13) Disyllabic verbs

   a. Non-accented verb
```
[ L      H      H    {L/*H} ]  L    L
[ ha.    re.    ma.  s-u.   ]  yo.  to.
  become swollen HON_A -PRS     SFP. QUO.
```
'that (it) becomes swollen; YO; polite.'

   b. Accented verb
```
[ L      H    H    {L/*H} ]  L    L
[ ha.    re.  ma.  s-u.   ]  yo.  to.
  clear up    HON_A -PRS     SFP. QUO.
```
'that (it) clears up; YO ; polite.'

(14) Monosyllabic verbs

    a. Non-accented verb

[L	H	H	{L/*H}	]	L	L
[*na.*	*ri.*	***ma.***	***s-u.***	]	*yo.*	*to.*
ring		A-HON	-PRS		SFP.	QUO.

'that (it) rings; YO; polite.'

    b. Accented verb

[L	H	H	{L/*H}	]	L	L
[*na.*	*ri.*	***ma.***	***s-u.***	]	*yo.*	*to.*
become		A-HON	-PRS		SFP.	QUO.

'that (it) becomes; YO: polite.'

2.3.3 Tense (the present tense)

- What has been called the present tense morpheme *-u* respects the lexical difference.

(15) Disyllabic verbs

    a. Non-accented verb

[L	H	H	]	L	L
[*ha.*	*re.*	***r-u.***	]	*yo.*	*to.*
become swollen		-PRS		SFP..	QUO.

'that (it) becomes swollen; YO.'

    b. Accented verb

[L	H	L	]	L	L
[*ha.*	*re.*	***r-u.***	]	*yo.*	*to.*
clear up		-PRS		SFP.	QUO.

'that (it) clears up; YO.'

2.3.4 Interim summary

(16) Interim summary

    a. Neutralization: elements in the *v*P periphery neutralize the lexical difference

    b. Bracketed region: it looks like a TP ... BUT

2.4 More data 2: Bracketed region = PolP?

Other suffixes (heads of some functional projections) suggest that the bracketed region is the PolP.

2.4.1 Tense (the past tense)

- The past tense suffix does respect the lexical difference but, in the accented verb, the low pitch accent is assigned not only to the last mora but also to the penultimate mora in this domain.

(17) Disyllabic verbs

    a. Non-accented verb

[$_{TP}$ L	H	H	]	L	L
[*ha.*	*re.*	***-ta.***	]	*yo.*	*to.*
become swollen		-PST		SFP.	QUO.

'that (it) became swollen; YO.'

    b. Accented verb

[$_{TP}$ H	L	L	]	L	L
[*ha.*	*re.*	***-ta.***	]	*yo.*	*to.*
become swollen		-PST		SFP.	QUO.

'that (it) cleared up; YO.'

(18) a. *

[$_{TP}$ L	H	L	]	L	L
[*ha.*	*re.*	***-ta.***	]	*yo.*	*to.*
become swollen		-PST		SFP.	QUO.

'that (it) cleared up; YO.'

    b. *

[$_{TP}$ L	H	H	]	L	L
[*ha.*	*re.*	***-ta.***	]	*yo.*	*to.*
become swollen		-PST		SFP.	QUO.

'that (it) cleared up; YO.'

• The same pattern is observed in trisyllabic, four syllable and monosyllabic verbs.

(19) Trisyllabic verbs

   a. Non-accented verb

[L	H	H	H	H	]	L	L
[*na.*	*ku.*	*na.*	*ʔ.*	***-ta.***	]	*yo.*	*to.*
pass away				-PST		SFP.	QUO.

   'that (he) passed away; YO.'

   b. Accented verb

[L	H	H	L	L	]	L	L
[*he.*	*da.*	*ta.*	*ʔ.*	***-ta.***	]	*yo.*	*to.*
be distant				-PST		SFP.	QUO.

   'that (it) was distant; YO.'

(20) Four syllable verbs

   a. Non-accented verb

[L	H	H	H	H	H	]	L	L
[*me.*	*si.*	*a.*	*ga.*	*ʔ.*	***-ta.***	]	*yo.*	*to.*
eat.S-HON					-PST		SFP.	QUO.

   'that (he = honorified) ate; YO.'

   b. Accented verb

[L	H	H	L	L	]	L	L
[*a.*	*ra.*	*ta.*	*me.*	***-ta.***	]	*yo.*	*to.*
renew				-PST		SFP.	QUO.

   'that (I) renewed; YO.'

(21) Monosyllabic verbs

   a. Non-accented verb

[$_{TP}$ L	H	H	]	L	L
[*na.*	*ʔ.*	***-ta.***	]	*yo.*	*to.*
ring		-PST		SFP.	QUO.

   'that (it) rang; YO.'

   b. Accented verb

[$_{TP}$ H	L	L	]	L	L
[*na.*	*ʔ.*	***-ta.***	]	*yo.*	*to.*
become		-PST		SFP.	QUO.

   'that (it) became; YO.'

2.4.2 Negation (present)

• The negation in the present tense shows the same pattern. The accented verb and the non-accented verb differ

(22) Monosyllabic verbs

   a. Non-accented verb

[$_{TP}$ L	H	H	H	]	L	L
[*na.*	*r-a.*	***na.***	***-i.***	]	*yo.*	*to.*
ring	-NEG	-PRS		SFP..	QUO.

   'that (it) does not ring; YO.'

   b. Accented verb

[$_{TP}$ L	H	L	L	]	L	L
[*na.*	*r-a.*	***na.***	***-i.***	]	*yo.*	*to.*
ring	-NEG	-PRS		SFP.	QUO.

   'that (it) does not become; YO.'

Notes: *-i* as a tense morpheme

This view is supported by the following observations:

(23) Exclamatives

   a. [$_{TP}$ [$_{PolP}$ *Ariena*] *-i*] .
      exist-can-NEG-PRS

      '(it) is impossible.'

   b. [$_{PolP}$ *Ari-e-na*] !
      exist-can-NEG

      'Impossible!'

(24) The complement of *soo*

   a. [$_{TP}$ [$_{PolP}$ *Ari-e-na*] *-i*]   *soo-des-u.*
      exist-can-NEG-PRS   hear-COP.HON$_A$-PRS

      'I heard that (it) is impossible.'

   b. [$_{PolP}$ *Ari-e-na*]   *soo-des-u.*
      exist-can-NEG   seem-COP.HON$_A$-PRS

      '(it) seems impossible.'

2.4.3 Negation (past)

- Japanese exhibits the *do*-support (the *be*-support) at T, when there is a negation. The inserted element is *ar* 'be' or one of its allomorphs (e.g., *(k)aʔ*).
- The past tense morpheme *-ta* only falls under the high-pitch region iff there is no *do*-support inserted at T, suggesting a correlation with the post-syntactic Lowering.

(25) Monosyllabic verbs

    a. Non-accented verb

$[_{TP}$ $[_{PolP}$	L	H	H	]	L	L	L	]
[[	*na.*	*r-a.*	*na.*	]	*ka.*	*ʔ.*	*-ta.*	
	ring	-NEG			COP		-PST	

    'that (it) did not ring'

    b. Accented verb

$[_{TP}$ $[_{PolP}$	L	H	L	]	L	L	L	]
[[	*na.*	*r-a.*	*na.*	]	*ka.*	*ʔ.*	*-ta.*	
	become	-NEG			COP		-PST	

    'that (it) did not become; YO + NE.'

- The presence of an addressee-honorific marker causes a morphological change at Pol and T (Yamada 2018a). But the pitch distribution respects the pattern in (25), especially in (25b). The past tense morpheme is 'far away' from the relevant high-pitch region.
- With the addressee-honorific marker, the lexical difference is neutralized.

(26) Monosyllabic verbs

    a. Non-accented verb

$[_{TP}$ $[_{PolP}$	L	H	H	H	L	]	L	L	L	]
[[	*na.*	*ri.*	*-ma.*	*s-e.*	N	]	*de.*	*si.*	*-ta.*	
	ring		-HON$_A$	-NEG			COP.HON$_A$		-PST	

    'that (it) did not ring; polite'

    b. Accented verb

$[_{TP}$ $[_{PolP}$	L	H	H	H	L	]	L	L	L	]
[[	*na.*	*ri.*	*-ma.*	*s-e.*	N	]	*de.*	*si.*	*-ta.*	
	become		-HON$_A$	-NEG			COP.HON$_A$		-PST	

    'that (it) did not become; Polite.'

2.4.4 Interim summary

(27) Interim summary

    a. Neutralization: elements above *v*P periphery respect the lexical difference of the verbs

    b. Bracketed region: it looks like a PolP

(28) $[_{TP}$ $[_{PolP}$ $[_{HonAP}$ $[_{AspP}$ $[_{vP}$

... *v*]	Asp]	Hon]	Pol]	T]
Lexical difference	Neutralized	Neutralized	Not neturalized	

3 Analysis

- From the data given above, the following statement seems uncontroversial; n.b., it is known that this also holds in the other lexical domain (i.e., the nominal domain).

(29) **Hypothesis 1 (Single-pitch contour hypothesis):** In Tokyo Japanese, the verbal prosodic domain must form a single high-pitch region.

3.1 Prosodic domain = PolP

By considering that what is known as the present tense morpheme *-u* is in fact a post-syntactically inserted vowel, we can re-interpret that the bracketed regions in Section 2.3 are all PolPs.

(30) **Hypothesis 2 (Phase = PolP):**: In Tokyo Japanese, the sister node of T is the phase domain, to which the pitch assignment is sensitive.

- One empirical support for the claim that the present tense morpheme *-u* is in fact a post-syntactically inserted vowel comes from the *do*-support. Unlike the past tense morpheme *-ta*, *-u* never triggers the *do*-support. If we assume that the *do*-support is a syntactic operation for the stranded (tense) affix, the lack of *do*-support suggests that *-u* is not a bound morpheme present in the narrow syntax.

(31) Do-support

a. Present (affirmative)

Aruk-u.
walk-PRS
'(I) walk.'

b. Past (affirmative)

Arui-ta.
walk-PST
'(I) walked.'

c. Present (negative)

Aruk-anai.
walk-NEG
'(I) do not walk.'

d. Past (negative)

Aruk-ana   kat-ta.
walk-PST   COP-PST
'(I) did not walk.'

e. **Aruk-ana   kar-u.*
walk-NEG   COP-PRS
'(I) do not walk (intended).'

f. **Aruk-ana-ta.*
walk-NEG-PST
'(I) did not walk (intended).'

- Is there any empirical evidence to support that PolP is the domain relevant for the phonology/syntax interface?

First, in (colloquial) Tokyo Japanese, the target of the ellipsis is the PolP not the *v*P.

(32) Support 1: Ellipsis

Lucia*:*   [TP [PolP   *Iki-mas-en]   desi-ta] -yo-ne?*
go-HONA-NEG   COP.HONA-PST-SFP-SFP

'Did you not go (to the party)?; YO+NE'

James*:*   (i)   **[vP —]   En   desi-ta-ne.*
NEG   COP.HONA-PST-SFP

'He did not [go to the party] (intended); NE.'

(ii)   [PolP —]   *Desi-ta-ne.*
COP.HONA-PST-SFP

'He did [not go to the party]; NE.'

Second, the target of the *soo* replacement is also the PolP.

(33) Support 2: *soo*-replacement

Lucia*:*   [TP [PolP   *Iki-mas-en]   desi-ta] -yo-ne?*
go-HONA-NEG   COP.HONA-PST-SFP-SFP

'Did you not go (to the party)?; YO+NE'

James*:*   (i)   **[vP Soo]   en   desi-ta-ne.*
SO   NEG   COP.HONA-PST-SFP

'He did not [go to the party] (intended); NE.'

(ii)   [PolP *Soo]   desi-ta-ne.*
SO   COP.HONA-PST-SFP

'He did [not go to the party]; NE.'

3.2 Lowering

A remaining problem is the pitch contour for the tense morphemes (*-ta* and *-i*). The pitch assignment in (34a) needs explanation.

(34) Monosyllabic verbs

    a. Non-accented verb

      $[_{TP}$ L   H   H   ] L   L

      [*ha.*   *re.*   ***-ta.***] *yo.* *to.*

      become swollen   -PST   SFP. QUO.

      'that (it) became swollen; YO.'

    b. Accented verb

      $[_{TP}$ H   L   L   ] L   L

      [*ha.*   *re.*   ***-ta.***] *yo.* *to.*

      clear up   -PST   SFP. QUO.

      'that (it) cleared up; YO.'

If the following bracketing is the right one, we wrongly predict that (35a) is the true pitch pattern, not (35b).

(35) a. * $[_{TP} [_{PolP}$ L   H   ]   **L**   ] L

        [[*ha.* *re.*] ***-ta.***] *to.*

        become swollen -PST   QUO.

        'that (it) became swollen; YO + NE.'

    b. $[_{TP} [_{PolP}$ L   H   ]   **H**   ] L

        [[*ha.* *re.*] ***-ta.***] *to.*

        become swollen -PST   QUO.

        'that (it) became swollen; YO + NE.'

- Along with Embick and Noyer (2001), I assume that the Lowering happens post-syntactically, which yeilds the apparent exception in (35b).[2]
- We've seen that the present tense *-u* is not a bound morpheme in the narrow syntax. On the other hand, *-ta* is a bound morpheme present in the narrow syntax, because it is involved with a *do*-support, just like English *-ed*. Without a negation, it is lowered to the neighboring head (Embick and Noyer 2001).

(36) **Hypothesis 3 (Post-syntactic Lowering in Tokyo Japanese):**
    In Tokyo Japanese,

    a. the Lowering comes after the pitch-assignment within the PolP.

    b. the Lowering comes before the pitch-assignment to the elements in the CP.

    c. Lowered elements receive the pitch accent of the host element.

(37) a. $[_{PolP}$] A phase is created and spelled out.

      [*ha.* *re.*]

    b. $[_{PolP}$ L   H   ] Based on this syntactic domain, the pitch accent is assigned.

      [*ha.* *re.*]

    c. $[_{CP} [_{PolP}$ L   H   ]   ] The next phase domain is created.

      [[*ha.* *re.*] ***-ta.*** *yo.* *ne.* *to.*]

    d. $[_{CP} [_{PolP}$ L   H   ]   ] Post-syntactic lowering.

      [[*ha.* *re.* *-ta.*] *yo.* *ne.* *to.*]

    e. $[_{CP} [_{PolP}$ L   H   H   ]   ] *-ta* receives the same pitch as the adjacent mora,

      [[*ha.* *re.* *-ta.*] *yo.* *ne.* *to.*] to which it attaches

    f. $[_{CP} [_{PolP}$ L   H   H   ] L   L   L   ] The low pitch accent is assigned to the remaining

      [[*ha.* *re.* *-ta.*] *yo.* *ne.* *to.*] elements.

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[2] The assignment is done so that the following principles are satisfied:

(i) in general, the both edges of the prosodic domain receive the low pitch accent; e.g., %[LH … HL]%.

(ii) for lexical verbs, some have a lexical requirement that %[LH … H]%L is respected, which overrides the principle in (i).

(iii) if the prosodic domain only consists in two mora, %[LL]% is not allowed, so the accented verb should receive the high-pitch at the left edge, i.e., %[HL]% .

(iv) for the elements in the *v*P-periphery, %[LH … HL]% must be present, which overrides the principle in (ii).

  For the formal algorithm for the pitch-accent assignment, see the tableau in Appendix.

- The same analysis is applied to the the present tense marker *i* with the negation *(a)na*.
- When we have a do-support in the narrow syntax, the Lowering never happens.

(38) a. [$_{PolP}$]   A phase is created and spelled out.
       [*ha*.   *re*.   na]

    b. [$_{PolP}$ L   H   H]   Based on this syntactic domain, the pitch accent is assigned.
       [*ha*.   *re*.   na]

    c. [$_{CP}$ [$_{PolP}$ L   H   H]   ]   The next phase domain is created.
       [[*ha*.   *re*.   *na*]   ***-ta***.   *yo*.   *ne*.   *to*.]

    d. [$_{CP}$ [$_{PolP}$ L   H   H]   ]   *do*-support.
       [[*ha*.   *re*.   *na*]   *ka*.   ʔ.   ***-ta***.   *yo*.   *ne*.   *to*.]

    e. [$_{CP}$ [$_{PolP}$ L   H   H]   L   L   L   L   L   L]   The low pitch accent is assigned to the remaining
       [[*ha*.   *re*.   *na*]   *ka*.   ʔ.   ***-ta***.   *yo*.   *ne*.   *to*.]   elements.

4   Theoretical implications

- First, the idea of phase-oriented prosodic domain is empirically extended outside the C region. This goes along with the same line of the recent studies on phonology/syntax interface (Ishihara 2003, 2004; Kitagawa 2005; Dobashi 2018).
- Second, the study predicts a typology between v-as-the-phase-head languages and T-as-the-phase-head languages, which should correlate with the prosodic domain formation and the ellipsis/replacement pattern. What counts as a phase is a controversial issue (Chomsky 2000, 2001; Legate 2003, 2014; McGinnis 2005). This analysis hints at the recent movement in the syntax that emphasizes the flexibility of the phaseness, e.g., the dyanmic view to the phase as proposed by Bošković (2014).
- Finally, the phonological operations are applied much earlier than are traditionally assumed, or at least in parallel with morphological processes, contributing to a growing body of literature with similar conclusions (Trommer 2001; Richards 2010, 2016, 2017; Yamada 2018b; Rolle, manuscript). For example, especially for the problem of the order of post-syntactic operations in DM framework, see the architecture proposed by Arregi and Nevins (2012).

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Appendix

(A) General constraints:
  (i) $[_{\text{phase domain}} ...HL]$
  (ii) $[\ LH...]_{\text{phase domain}}$

(B) Lexical requirement: $[_{\text{phase domain}} ...H]\ L$

	Anti-homophony	Ident-IO	(ii)	(i)		(i) for compounds	(ii) for compounds	Anti-homophony	Ident-IO	(ii)	(i)
[ha.re.r-u] 'become swollen-PRS'		*!	*	*	☞ [ha.re]-ta 'clear up-PST'						*
[ha.re.r-u] 'become swollen-PRS'		*!			[ha.re]-ta 'clear up-PST'			*!		*	
☞ [ha.re.r-u] 'become swollen-PRS'			*		☞ [ha.re -na]-ka.?.-ta 'clear up-NEG-be-PST'						
[ha.re.r-u] 'clear up-PRS'			*	*	[ha.re -na]-ka.?.-ta 'become swollen-NEG-be-PST'						*
☞ [ha.re.r-u] 'clear up-PRS'					☞ [na.ri.o.wa.?.]-ta 'ring/become-finish-PST'†					(*)	
[ha.re.r-u] 'clear up-PRS'	*!		*		[na.ri.o.wa.?.]-ta 'ring/become-finish-PST'	*!			*	(*)	
[ha.re]-ta 'become swollen-PST'		*!		*	☞ [na.ku.na.?.]-ta 'pass away-PST'†						*
☞ [ha.re]-ta 'become swollen-PST' †			*		☞ [he.da.ta.?.]-ta 'become distant-PST'†						

Figure 1: Pitch assignment within the PolP

Lexical difference: An Input-Output Identity constraint (Prince and Smolensky 1993) ensures that roots with lexically assigned accent retain their input accent pattern (for anti-homophony, see, e.g., Ichimura 2006). The lexical contrast in the compound is ignored because of the high priority of the creation of [%LH…HL%] contour in the compound, resulting in the neutralization in (11).

Trisyllabic verbs: As for non-compound trisyllabic verbs, this model predicts, for example, he.da.ta.r-u. (LHHL) 'is distant' (accented) and na.ku.na.r-u. (LHHH) 'passes away' (non-accented), as in (6), which is exactly how they are pronounced.

The past tense: First, pitch is assigned before the lowering and the lowered element receives the same pitch accent. This results in ha.re.(LH).ta (H) 'became swollen,' not *ha.re. (LH) -ta. (L). Second, when we have a negation and thus do-support in the narrow syntax, the lowering does not happen.

The present tense: The present tense does not have a tense morpheme; -*u* is inserted when the mora structure is created within the PolP. So, neither do-support nor lowering take place, resulting in the difference in pitch contour between (5a) and (5b).