

Anti-faithfulness in Compounds*

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This paper argues that morpho-phonological alternations specific to compounds such as Rendaku in Japanese and gemination in Malayalam be accounted for in terms of transderivational anti-faithfulness developed by Alderete (1999, 2001). In the proposed analysis, compound-specific floating morphemes can be dispensed with by directly encoding the morpho-phonological alternations in the constraints that require a violation of faithfulness between morphologically related words and as a result, several problems that have been involved with those floating morphemes can be resolved.

Key words: anti-faithfulness, compound, Rendaku, gemination, floating morphemes

1. Introduction

In this paper, I propose that phonological alternations that occur in compounds be dealt with in terms of transderivational anti-faithfulness. Transderivational anti-faithfulness, which has been developed by Alderete (1999, 2000) to account for various phonological alternations exhibited in derivation or inflection, requires an alternation in morphologically related words. By extending transderivational anti-faithfulness to compounds, phonological alternations in compounds can be accounted for without compound-specific floating denominal adjective morphemes, which involve several problems. A dissimilarity between morphologically related words can be directly encoded in anti-faithfulness constraints. This implies that the constraints that enforce the overt realization of a morphemic unit can be dispensed with.

The paper is organized as follows. Section 2 summarizes segmental alternations that take place in Japanese and Malayalam compounds, that

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is, Rendaku voicing in Japanese and gemination in Malayalam. In Section 3, I introduce the theory of transderivational anti-faithfulness proposed by Alderete (1999, 2001). In Section 4, I show that the phonological alternations in Japanese and Malayalam compounds can be given a better analysis in terms of transderivational anti-faithfulness. Section 5 concludes the paper.

2. Segmental Alternations in Compounds

There are languages in which certain segmental alternations occur specifically in compounds. Voicing (also known as Rendaku) in Japanese and gemination in Malayalam can be taken as typical examples of the segmental alternation in compounds. What is also common in these phenomena is that they apply in the compounds with the semantic relation of modifier + head (sub-compounds), but not in the compounds with the semantic structure of head + head (co-compounds).

As is well-known, Rendaku in Japanese refers to the phenomenon by which the initial obstruent of the second constituent of a sub-compound becomes voiced (Ito & Mester, 1986; Vance, 1987; Han, 1994; Kim, 2001).¹⁾

(1) Rendaku in Japanese

iro + kami → irogami
 'color' 'paper' 'colored paper'
 take + sao → takezao
 'bamboo' 'pole' 'bamboo pole'
 ike + hana → ikebana
 'arrange' 'flower' 'flower arrangement'
 yama + tera → yamadera
 'mountain' 'temple' 'mountain temple'

Kim (2001) follows Ito and Mester (1986) and Fukuzawa and Kitahara (2001) in assuming that a denominal adjective morpheme which consists of the feature [voice] is inserted in sub-compounds of Japanese.

1) Rendaku applies only to native (Yamato) vocabulary. There are also several conditions on the application of the phenomenon which I will not mention in this paper. For further conditions on Rendaku, refer to Haraguchi (2001).

(2) Denominal adjective morpheme in Japanese (ρ) (Kim, 2001, p. 321)

$$\begin{array}{c} \rho \\ | \\ \text{[voice]} \end{array}$$

e.g. [[iro]_N + ρ]_A + [kami]_N → [irogami]_N ‘colored paper’

$$\begin{array}{c} | \\ \text{[voice]} \end{array}$$

According to Kim (2001), the denominal adjective morpheme in (2) is attached to the first constituent of a compound and converts its category from a noun into an adjective and then it voices the initial obstruent of the second constituent. In contrast, the denominal adjective morpheme is not inserted in co-compounds and hence there is no Rendaku in co-compounds (e.g. yomi + kaki → [yomikaki] (*[yomigaki]) ‘reading and writing’).

The application of Rendaku, however, is systematically blocked when the second constituent of a compound contains a voiced obstruent. This is shown in the following examples.

- (3) No Rendaku in sub-compounds
 kami + kaze → kamikaze (*kamigaze)
 ‘god’ ‘wind’ ‘divine wind’
 onna + kotoba → onnakotoba (*onnagotoba)
 ‘woman’ ‘word’ ‘feminine speech’

The blocking of Rendaku has traditionally been referred to as Lyman’s Law and Ito and Mester (1986) account for it with the following rule triggered by OCP.

- (4) Lyman’s Law (Ito and Mester, 1986, p. 60)

$$\begin{array}{c} \text{[+voi]} \rightarrow \emptyset / \quad \underline{\quad} \text{[+voi]} \\ | \\ \rho \end{array}$$

Kim (2001) accounts for voice alternation in Japanese compounds using the following constraints.

- (5) a. Realize-Morpheme (RM): Morphemes must be realized in the output.
- b. *Lar: No voiced, tensed, or aspirated obstruents are allowed.
- c. Ident[voice]: The value of the feature [voice] of the input and output segments must be identical.
- d. *[voi]&[voi]: Adjacent [voi] features are not allowed.
- e. Uniformity[voi]: The [voice] feature of the output cannot have two correspondents in the input.

As demonstrated in (6), the constraints in (5) produce the desired outputs.

(6) iro + kami → irogami ‘colored paper’ (Kim, 2001, p. 327)

iro + ρ + kami [voice]	RM	Ident[voice]	*Lar
a. iro + kami [voice]	*!		
b. iro + kami ↖ [voice]		*	*

(7) is an example in which Rendaku is blocked due to the presence of a voiced obstruent in the second constituent.²⁾

(7) kami + kaze → kamikaze (*kamigaze) (Kim, 2001, p. 327)

kami+ρ+kaze [voi] _i [voi] _j	*[voi]&[voi]	Uniformity	RM	Ident[voice]
a. kami + kaze ↖ [voi] _i [voi] _j			*	
b. kami + gaze / [voi] _i [voi] _j	*!			*
c. kami + kaze [voi] _i		*!		*

2) As pointed out by two of the reviewers, (7a) and (7c) are phonetically non-distinct.

Since RM is ranked lower than *[voi]&[voi] and Uniformity, the candidate in which the feature [voice] is not realized, i.e. (7a), turns out to be optimal.

Let us now turn to gemination in Malayalam compounds. There are stem-final and stem-initial gemination of stops in Dravidian stems of Malayalam sub-compounds (Mohan, 1982, 1986). Examples of gemination are given in (8).³⁾⁴⁾

(8) Stem-initial gemination

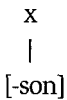
- tii + kaṭṭa → **ṭiikk**ṭa
- ‘fire’ ‘lump’ ‘lump of fire’
- peṭṭi + paṭṭaayam → peṭṭi**pp**ṭaayaṅṅala
- ‘box’ ‘grain bin’ ‘grain bins used as boxes’

(9) Stem-final gemination⁵⁾

- kaaṭ + aana → kaaṭṭaana
- ‘forest’ ‘elephant’ ‘untamed elephant’
- cawar + koṭṭa → cawar**tt**koṭṭa
- ‘trash’ ‘basket’ ‘trash can’

Kim (2001) analyzes gemination in Malayalam sub-compounds in a way analogous to Japanese Rendaku and proposes that a denominal adjective morpheme is attached to the first constituent of a sub-compound.

(10) Denominal adjective morpheme in Malayalam (Kim, 2001, p. 323)



$$\begin{array}{ccc} \text{e.g. } [[aana]_N + x]_A + [kutira]_N & \rightarrow & [aanakkutira]_N \\ & & | \\ & & [-son] \end{array}$$

‘horse that is like an elephant’

3) Various diacritics are used to represent Malayalam consonants in what follows. A letter with underneath designates a dental sound, and a letter with underneath a retroflex sound. *r* stands for the palatalized alveolar tap. Geminated *rr* becomes *tt* (Mohan, 1986).

4) *-ṅala* in *peṭṭippaṭṭaayaṅṅala* is a plural suffix.

5) In Malayalam, only *m* and *n* are allowed in the word-final position in casual speech and *m*, *n*, *ṅ*, *l*, *l* and *r* can appear word-finally in careful or literary speech. When consonants other than these sonorants appear word-finally or are followed by a consonant-initial word, a *ə* is inserted.

The constraints used to account for gemination are as follows.

(11) *Geminate: No geminates are allowed.

*Sonority Reversal (SR): Sonority reversals are not allowed.

According to Kim (2001), the denominal adjective morpheme which consists of a timing slot with the feature [-son] is filled with an adjacent obstruent and thus becomes a geminate. This is shown in (12).

(12) aana + kutira → aanakkutira ‘a horse that is like an elephant’
(Kim, 2001, p. 328)

aana + x + kutira [-son]	RM	*Gem
a. aana + kutira	*!	
☞ b. aana + kcutira		*

Kim (2001) states that when the initial segment of the second constituent is not an obstruent as in (13), the final segment of the first constituent gets geminated.

(13) kaaṭ + maram → kaaṭṭamaram ‘forest tree’ (Kim, 2001, p. 328)

kaaṭ + x + maram [-son]	RM	*Gem	*SR	Dep-IO
a. kaaṭmaram	*!		*	
☞ b. kaaṭṭamaram		*		**
c. kaaṭṭmaram		*	*!	*

So far, I have summarized Kim's (2001) analysis of segmental alternation in Japanese and Malayalam sub-compounds. Now, I will point out several problems involved in the accounts, including Kim (2001), which postulate floating denominal adjective morphemes to deal with segmental alternations in compounds. The first problem is concerned with the status of the denominal adjective morpheme. Kim proposes that in order to form a sub-compound, the category of the first constituent must be turned into an

adjective and the denominal adjective morpheme serves this purpose. However, the denominal adjective morphemes in the two languages we have examined -- the feature [voice] for Japanese and the timing-slot for Malayalam -- are not used to derive an adjective from a noun in the cases of non-compound words. They are used only for the first constituents of sub-compounds. Thus, there is no independent evidence that the first constituents of all of the sub-compounds are adjectives in their category. The function that the denominal adjective morphemes serve is to distinguish sub-compounds from co-compounds and to ensure that the segmental alternations take place only in sub-compounds.

Second, the analysis summarized above does not specify which of the two constituents of a sub-compound is subject to the alternation. In other words, there is no reason why the floating morpheme [voice] is realized in the second constituent, not the first one and in addition, why the initial obstruent, not any other obstruent, of the second constituent is subject to voicing. The same question applies to Malayalam. Nothing in the analysis ensures which constituent (the first or the second) or which segment (the initial, the final or any other) the gemination affects in Malayalam sub-compounds.

Third, the accounts that postulate floating morphemes will have difficulty dealing with segmental alternation in compounds which involves deletion-type phenomena. Malayalam provides a good example of this type. As shown in (14), stem-final geminate sonorants become degeminated in the first constituent of Malayalam compounds. Like gemination, the degemination of sonorants applies only to sub-compounds.⁶⁾

(14) Sonorant degemination

kall	+	praṭima	→	kalpraṭima
'stone'		'statue'		'stone statue'
peṇṇ	+	warggam	→	peṇwarggam
'woman'		'group'		'female species'

If we attempt to account for the sonorant degemination in Malayalam sub-compounds in a way analogous to that used for Rendaku and gemination, we would be faced with the problem of how to characterize

6) *kall* 'stone' and *peṇṇ* 'woman' are realized with an inserted schwa ([kalla] and [peṇṇə]) when they are used independently.

the denominal adjective morpheme because one of the two moras associated with the stem-final sonorants is deleted. Thus, the cases in which some material is deleted/subtracted cannot easily be treated in a floating-morpheme analysis.

In this paper, I propose that segmental alternations in compounds be given a better analysis, free from the problems I have mentioned in the preceding paragraphs, in terms of transderivational anti-faithfulness developed by Alderete (1999, 2001). I will briefly introduce transderivational anti-faithfulness proposed by Alderete in the next section.

3. Transderivational Anti-faithfulness: Alderete (1999, 2001)

Transderivational anti-faithfulness is a theory of morpho-phonological alternations proposed by Alderete (1999). Alderete motivates transderivational anti-faithfulness when introducing morphologically governed exchange processes which are problematic for both traditional generative phonology and Optimality Theory. The example given by him is the voicing exchange in the Nilotic language Luo. In this language, the underlying [voice] specification of the stem-final obstruent is reversed in the plural.

(15) [voice] exchange in Luo

Singular	Plural	
bat	bed-e	'arm'
luθ	luD-e	'walking stick'
čogo	čok-e	'bone'
luedo	luet-e'	'hand'

The proposal made by Alderete to account for morpho-phonological exchanges is that in addition to markedness and faithfulness, UG contains a set of rankable constraints which actively enforce an alternation in morphologically related words. The transderivational anti-faithfulness constraints induce an alternation by requiring a violation of faithfulness in base-derivative pairs and Alderete gives the following definition of anti-faithfulness.

(16) Anti-faithfulness (Alderete, 1999, p. 132)

Given the Faithfulness constraint F , $\neg F$ is the related Anti-faithfulness constraint which is satisfied in a string S iff S has at least one violation of F .

According to the definition, anti-faithfulness constraints are the negation of the corresponding faithfulness constraints and encourage dissimilarity where faithfulness constraints require similarity. The following are anti-faithfulness constraints corresponding to Max-X, Dep-X and Ident(F), respectively.

- (17) a. \neg Max-X: If there is one, delete (at least) one X in the $S_1 \rightarrow S_2$ mapping.
- b. \neg Dep-X: Insert (at least) one X in S_2 not present in S_1 .
- c. \neg Ident(F): (At least) one pair of correspondent segments must differ in feature F.

Alderete accounts for [voice] exchange in Luo by negating the Ident(voi) constraint and restricting its application to the output-to-output dimension of faithfulness (Burzio, 1996; Kenstowicz, 1996; Benua, 1997).

(18) \neg OO-Ident(voi) (Alderete, 1999, p. 135)

If a pair of words stand in an OO-correspondence relation, at least one pair of correspondent segments must be non-identical for the feature [voice].

The constraint in (18) is operative only in the plural and appertentive since only these categories are lexically specified for this OO-correspondence relation. As illustrated in (19) and (20), the singular forms the base of the plural and ranking \neg OO-Ident(voi) above OO-Ident(voi) yields the effect of the [voice] exchange.

(19) bat \neq bede (Alderete, 1999, p. 135)

Base	/bat+e/	\neg OO-Ident(voi)	OO-Ident(voi)
bat	bet-e	*!	
☞ bat	bed-e		

(20) *čogo* ≠ *čoke* (Alderete, 1999, p. 135)

Base	/čogo+e/	—OO-Ident(voi)	OO-Ident(voi)
čogo	čog-e	*!	
↗ čogo	čok-e		

What the theory of transderivational anti-faithfulness needs to do next is to describe which segment of the string will be affected by the anti-faithfulness constraint. In the case of Luo, both *bed-e* and **pet-e* incur a violation of Ident(voi) and hence satisfy —OO-Ident(voi). But the desired plural form of *bat* is only *bed-e*. To handle this problem, Alderete, noting the target of anti-faithfulness is local in some sense to the triggering morpheme, relies on the non-derivational approach to derived environment effects taken by Lubowicz (1998), employing Local Conjunction of constraints.

(21) Local Conjunction of C_1 and C_2 in Domain D
(Smolensky, 1995)

$C_1 \& C_2$ is violated when there is some domain of type D in which both C_1 and C_2 are violated.

In case of Luo, conjunction of the anti-faithfulness constraint with Anchor(Stem, PrWd, Final) as in (22) correctly predicts the application of the exchange process to the final segment of the stem.

(22) (—OO-Ident(voi) & Anchor(Stem, PrWd, Final))_{Seg}
≡ —OO-Ident(voi)_{Fin Seg}

In morphologically related words, attachment of an affix must be accompanied by a violation of Ident(voi) in the stem-final segment.

The attachment of a plural suffix induces a violation of Stem-PrWd anchoring and hence activates the anti-faithfulness constraint in the stem-final segment. (23) shows the enforcement of the locality effect.

(23)

Base	/bat+e/	—OO-Ident(voi) _{Fin Seg}	Ident(voi) _{IO}
bat	pet-e	*!	*
bat	ped-e		**!
bat	bed-e		*

In (23), all of the candidates of the plural form violate the anchoring constraint because of the presence of the plural suffix but only the last two satisfy the anti-faithfulness constraint by changing the [voice] value of the stem-final segment. Between the two candidates, *ped-e* is ruled out since it incurs one more violation of low-ranking faithfulness constraint than *bed-e*.

Alderete (1999, 2001) applies the theory of anti-faithfulness to derivation and inflection mainly to account for the phenomena of affix-controlled accent in various languages. In the next section, I show that the theory of anti-faithfulness can analyze morpho-phonological alternation in compounding equally well, resolving the problems which the floating-morpheme accounts are faced with.

4. Transderivational Anti-faithfulness in Compounds

4.1. Rendaku in Japanese Compounds

In this section, I put forth the analysis of Japanese Rendaku on the basis of the theory of transderivational anti-faithfulness as introduced in the preceding section. Viewed in terms of anti-faithfulness, there is no specific (denominal or whatever) morpheme needed to treat the voicing phenomenon which takes place in sub-compounds. Thus, we can dispense with the denominal adjective morpheme characterized by a floating [voice] feature, whose status is quite doubtful. What is responsible for the voicing is an anti-faithfulness constraint which encourages the change of voiceless obstruents into voiced obstruents.

At this point, a difference between Japanese and Luo must be noted. In Luo plural formation, the change is bidirectional, i.e. voiceless segments turn into voiced segments and vice versa. However, in Japanese sub-compounds, the mutation is uni-directional; voiceless obstruents become voiced but voiced obstruents remain intact.

- (24) asa + gohan → asagohan (*asakohan)
 'morning' 'meal' 'breakfast'

This type of uni-directional mutation can be handled by splitting an Ident constraint into two, which make reference to the same feature. In the case of Japanese, Ident(voice) must be divided into Ident(-voi → voi) and Ident(+voi → -voi) and be ranked independently in the constraint hierarchy. The ranking that yields the effect of voicing only (to the exclusion of devoicing) would be as follows.

- (25) The ranking for voicing only
 Ident(+voi) ≫ -OO-Ident(voi) ≫ Ident(-voi)

(26) shows that the interaction of anti-faithfulness and faithfulness correctly derives the voicing effect in compounds.⁷⁾

- (26) iro + kami → irogami 'colored paper'

/iro + kami/ Bases: iro, kami	Ident(+voi)	-OO-Ident(voi)	Ident(-voi)
a. irokami		*!	
☞ b. irogami			*

Unlike derivation or inflection, both morphemes form bases in compounding. By ranking the anti-faithfulness for [voice] above faithfulness for [-voice], the candidate (26b) in which the initial segment of the second constituent becomes voiced is selected as optimal. By comparison, there is no mutation in [voice] in compounds in which the initial segment of the second constituent is already voiced.

- (27) asa + gohan → asagohan 'breakfast'

/asa+gohan/ Bases: asa, gohan	Ident(+voi)	-OO-Ident(voi)	Ident(-voi)
☞ a. asagohan		*	
b. asakohan	*!		

7) [irogami] violates a markedness constraint NoVoiObs, which generally bans voiced obstruents. I will not include this constraint in the following tableaux because it does not affect the result of the evaluation.

Let us now turn to examine what guarantees that the constituent affected by the anti-faithfulness constraint is the head, not the non-head. As exemplified in (28), only the head is subject to voicing.

- (28) a. take + sao → takezao (*tagesao, *dakesao, *tagezao)
 ‘bamboo’ ‘pole’ ‘bamboo pole’
 b. kasa + ire → kasaire (*kazaire, *gasaire)
 ‘umbrella’ ‘case’ ‘umbrella case’

When there is no voiceless obstruent in the head as in (28b), nothing happens. Voiceless obstruents in the non-head never become voiced. This challenges the analysis proposed above since all the ill-formed candidates in (28) -- *tagesao, *dakesao, *kazaire, *gasaire -- have at least one violation of Ident(voi), thus satisfying \neg OO-Ident(voi).

(29)

/take + sao/ Bases: take, sao	Ident(+voi)	\neg OO-Ident(voi)	Ident(-voi)
a. takesao		*!	
☞ b. takezao			*
☞ c. tagesao			*
d. tagezao			**!

Noting that this problem is caused by the fact that there are more than one bases in compounding, unlike derivation or inflection, I propose that an anti-faithfulness constraint can be split into sub-constraints, specified with a particular stem in compounding, e.g. \neg OO-Ident(F)_{stem1} or \neg OO-Ident(F)_{stem2}. While \neg OO-Ident(F) encourages violation of identity in the entire compound, \neg OO-Ident(F)_{stem1} and \neg OO-Ident(F)_{stem2} require violation in the first stem and the second stem, respectively. In Japanese, \neg OO-Ident(voi)_{stem2} is ranked higher and the result is that violation of faithfulness is enforced only in the second stem.

There are two options to treat the constraints involved. One is to employ two specific constraints as shown in (30a) and the other is to employ one specific constraint and one general constraint as in (30b). (30b) is the stringent form of constraints in the sense of de Lacy (2002) and McCarthy (2002).

- (30) a. \neg OO-Ident(voi)_{stem2}, \neg OO-Ident(voi)_{stem1}
 b. \neg OO-Ident(voi)_{stem2}, \neg OO-Ident(voi)

In this paper, I will adopt the second choice, i.e. the stringent form of anti-faithfulness constraints. Either of the options can deal with Japanese Rendaku but employing the stringent type will be crucial in the analysis of Malayalam gemination, as will be discussed shortly.

(31) illustrates the effect of the specific anti-faithfulness constraint \neg OO-Ident(voi)_{stem2} in Rendaku.

- (31) take + sao → takezao ‘bamboo pole’

/take + sao/ Bases: take, sao	\neg OO-Ident(voi) _{stem2}	Ident(-voi)	\neg OO-Ident(voi)
a. takesao	*!		*
☞ b. takezao		*	
c. tagesao	*!	*	
d. tagezao		**!	

(31a) and (31c) are ruled out because they do not satisfy the highest-ranked specific anti-faithfulness constraint. (31d) satisfies the specific anti-faithfulness constraint but it eventually loses out since it violates the faithfulness constraint more than necessary.

As discussed so far, the account proposed in this paper that relies on the theory of transderivational anti-faithfulness constraints does not need a compound-specific denominal adjective morpheme which changes the category of the first stem and then triggers voicing in the second stem. Instead, the proposed analysis directly encodes devoicing in the second stem as a negation of faithfulness constraint between morphologically related independent words. The absence of a compound-specific denominal adjective morpheme implies that we can dispense with constraints forcing the overt realization of a morphemic unit, e.g. Realize Morpheme, Morph-Dis (McCarthy & Prince, 1995) and so on.

The last question to be addressed is how to prevent the voicing from applying to co-compounds. I claim that this can be dealt with by lexically specifying only the class of sub-compounds for the OO-correspondence relation, \neg OO-Ident(voi), that is, \neg OO_{sub}-Ident(voi). This property of specificity to certain morphological operations or classes is expected from

anti-faithfulness since anti-faithfulness is in general morphologically triggered (Alderete, 1999).

4.2. Gemination in Malayalam Compounds

In this section, I put forward an account for gemination in Malayalam compounds based on the transderivational anti-faithfulness in compounds. As described in Section 2, the initial stop of the second stem or the final stop of the first stem is doubled in compounds (Mohanam, 1982, 1986). (8) and (9) are repeated below.

(32) Stem-initial gemination

$\text{t̪i} + \text{kaṭṭa} \rightarrow \text{t̪i} \mathbf{k} \mathbf{k} \mathbf{aṭṭa}$

'fire' 'lump' 'lump of fire'

$\text{pet̪i} + \text{paṭṭaayam} \rightarrow \text{pet̪i} \mathbf{p} \mathbf{p} \mathbf{aṭṭa} \mathbf{a} \mathbf{y} \mathbf{a} \mathbf{m}$

'box' 'grain bin' 'grain bins used as boxes'

(33) Stem-final gemination

$\text{kaaṭ} + \text{aana} \rightarrow \text{kaa} \mathbf{t} \mathbf{t} \mathbf{a} \mathbf{a} \mathbf{n} \mathbf{a}$

'forest' 'elephant' 'untamed elephant'

$\text{cawar} + \text{koṭṭa} \rightarrow \text{caw} \mathbf{a} \mathbf{t} \mathbf{t} \mathbf{a} \mathbf{k} \mathbf{o} \mathbf{ṭ} \mathbf{ṭ} \mathbf{a}$

'trash' 'basket' 'trash can'

The anti-faithfulness constraint that will take care of stop gemination must be a negation of Dep constraint; in this case, $-\text{OO-Dep}(C/[-\text{cont}])$, which encourages at least one stop to be inserted.⁸⁾

(34) $\text{t̪i} + \text{kaṭṭa} \rightarrow \text{t̪i} \mathbf{k} \mathbf{k} \mathbf{aṭṭa}$ 'lump of fire'⁹⁾

$/\text{t̪i} + \text{kaṭṭa}/$ Bases: $\text{t̪i}, \text{kaṭṭa}$	$-\text{OO-Dep}(C/[-\text{cont}])$	Dep(C)
a. $\text{t̪i} \mathbf{k} \mathbf{aṭṭa}$	*!	
☞ b. $\text{t̪i} \mathbf{k} \mathbf{k} \mathbf{aṭṭa}$		*

8) The candidates with geminated stops such as $[\text{t̪i} \mathbf{k} \mathbf{k} \mathbf{aṭṭa}]$ violate a markedness constraint *Geminate, which prohibits geminates. However, the presence of *Geminate does not block gemination because the anti-faithfulness constraint dominates *Geminate.

9) The candidate in which the initial t is geminated is not considered in the evaluation because in that candidate the geminated stop is not local to the triggering environment, that is, the juncture between the two stems.

Since the anti-faithfulness constraint outranks the faithfulness constraint, violation of Dep(C) is mandated when the initial consonant of the second stem is a stop. Stem-final gemination can be treated in the same way.

(35) $kaa\tau + aana \rightarrow kaa\tau\tau aana$ ‘untamed elephant’

/kaa τ + aana/ Bases: kaa τ , aana	–OO-Dep(C/[–cont])	Dep(C)
a. kaa τ aana	*!	
☞ b. kaa $\tau\tau$ aana		*

As demonstrated in (34) and (35), gemination in Malayalam occurs on either the initial stop of the second stem or the final stop of the first stem. In / $\tau\tau i + ka\tau\tau a$ /, /kaa τ + aana/ and /pet $\tau\tau i + pa\tau\tau aayam$ /, either stem-initial or stem-final gemination is able to apply because there is only one stop at the juncture of each compound. Yet, there exist compounds in which a stop is present on both sides of the compound boundary and in these compounds, stem-final gemination preempts stem-initial gemination. Examples of this type are given in (36).

(36) $kaa\tau + k\bar{u}ra\eta' \eta'an \rightarrow kaa\tau\tau\bar{a}k\bar{u}ra\eta' \eta'an$
 ‘forest’ ‘monkey’ ‘wild monkey’
 $cawar + ko\tau\tau a \rightarrow cawatt\bar{a}ko\tau\tau a$
 ‘trash’ ‘basket’ ‘trash can’

The proposal made in the preceding subsection that an anti-faithfulness constraint can be specific to each of the bases can handle the compounds in (36). In Malayalam gemination, anti-faithfulness on the first stem takes precedence over anti-faithfulness on the second stem. Hence, employing anti-faithfulness constraints specified with a particular stem will resolve the conflict. As in Japanese, two options are available; one is to use two specific anti-faithfulness constraints and the other to use one specific and one general constraint.

(37) a. –OO-Dep(C/[–cont])_{stem1}, –OO-Dep(C/[–cont])_{stem2}
 b. –OO-Dep(C/[–cont])_{stem1}, –OO-Dep(C/[–cont])

I will now show that only the stringent form of constraints works for Malayalam.¹⁰⁾

(38) $kaat + k\bar{u}ra\eta'ij'an \rightarrow kaat\bar{t}ak\bar{u}ra\eta'ij'an$ 'wild monkey'

/kaat + k \bar{u} ra η' ij'an/ Bases: kaat, k \bar{u} ra η' ij'an	\neg OO-Dep(C /[\bar{c} ont]) _{stem1}	\neg OO-Dep(C /[\bar{c} ont])	Dep(C)
a. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$	*!	*	
b. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$			*
c. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$	*!		*
d. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$			**!

Since (38a) is faithful to its bases regarding stops, it violates both the specific and the general anti-faithfulness constraint. The remaining three candidates satisfy the general anti-faithfulness constraint because either of the two stems has an inserted stop. However, (38c) is eliminated due to its violation of the anti-faithfulness constraint that requires gemination in the first stem. (38b) fares better than (38d) because it minimally violates the faithfulness constraint.

Now, let us examine what happens when (37a) is adopted.

(39)

/kaat + k \bar{u} ra η' ij'an/ Bases: kaat, k \bar{u} ra η' ij'an	\neg OO-Dep(C /[\bar{c} ont]) _{stem1}	\neg OO-Dep(C /[\bar{c} ont]) _{stem2}	Dep(C)
a. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$	*!	*	
b. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$		*!	*
c. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$	*!		*
d. kaat $\bar{t}ak\bar{u}ra\eta'ij'an$			**

The ranking \neg OO-Dep(C/[\bar{c} ont])_{stem1} \gg \neg OO-Dep(C/[\bar{c} ont])_{stem2} \gg Dep(C) yields a wrong output. Establishing no ranking between \neg OO-Dep(C/[\bar{c} ont])_{stem2} and Dep(C) will not help because in that case, both (39b) and (39d) will become the winners.

Another possibility is to rank Dep(C) between \neg OO-Dep(C/[\bar{c} ont])_{stem1} and \neg OO-Dep(C/[\bar{c} ont])_{stem2} as demonstrated in (40).

10) Though using \neg OO-Dep(C/[\bar{c} ont])_{stem1} is crucial in the analysis of compounds in which both stem-final gemination and stem-initial gemination are applicable, its ranking with other constraints is not motivated. Hence, with only the ranking \neg OO-Dep(C/[\bar{c} ont]) \gg Dep(C) established, \neg OO-Dep(C/[\bar{c} ont])_{stem1} can be ranked anywhere, e.g. above \neg OO-Dep(C/[\bar{c} ont]), below Dep(C), or between them. Thus, the ranking given in (38) is simply one of the possible rankings. I would like to thank one of the reviewers who has made comments on constraint ranking in Malayalam.

(40)

/kaaṭ + kūraṅṅ'an/ Bases: kaaṭ, kūraṅṅ'an	¬OO-Dep(C) /[¬cont]] _{stem1}	Dep(C)	¬OO-Dep(C) /[¬cont]] _{stem2}
a. kaaṭəkūraṅṅ'an	*!		*
☞ b. kaaṭṭəkūraṅṅ'an		*	*
c. kaaṭəkūraṅṅ'an	*!	*	
d. kaaṭṭəkūraṅṅ'an		**!	

(40) shows that making Dep(C) outrank the anti-faithfulness on the second stem produces the desired result. However, the compounds in (32), in which gemination takes place in the second stem, conflict with this ranking.

(41)

/ṭii + kaṭṭa/ Bases: ṭii, kaṭṭa	¬OO-Dep(C) /[¬cont]] _{stem1}	Dep(C)	¬OO-Dep(C) /[¬cont]] _{stem2}
☞ a. ṭiikaṭṭa	*		*
b. ṭiikkaṭṭa	*	*!	

As illustrated in (41), ranking the faithfulness constraint between two specific anti-faithfulness constraints yields an incorrect output.

From the discussion so far, it is clear that employing the stringent form of anti-faithfulness constraints is pivotal in treating gemination in Malayalam compounds. That ranking can deal with not only compounds in (36) but those in (32) and (33). This is shown in (42) and (43).

(42) ṭii + kaṭṭa → ṭiikkaṭṭa 'lump of fire'

/ṭii + kaṭṭa/ Bases: ṭii, kaṭṭa	¬OO-Dep(C) /[¬cont]] _{stem1}	¬OO-Dep(C) /[¬cont]]	Dep(C)
a. ṭiikaṭṭa	*	*!	
☞ b. ṭiikkaṭṭa	*		*

(43) kaaṭ + aana → kaaṭṭaana 'untamed elephant'

/kaaṭ + aana/ Bases: kaaṭ, aana	¬OO-Dep(C) /[¬cont]] _{stem1}	¬OO-Dep(C) /[¬cont]]	Dep(C)
a. kaaṭaana	*!	*	
☞ b. kaaṭṭaana			*

The analysis based on the theory of transderivational anti-faithfulness constraints can treat gemination in Malayalam compounds without a floating denominal adjective morpheme whose status is not well-justified. Instead, constraints which require a dissimilarity between morphologically related words can directly encode the necessary morpho-phonological alternation specific to compounds. Upon eliminating denominal adjective morphemes postulated only for compounding, constraints that guarantee the overt realization of morphemes become unnecessary. The proposed analysis can also successfully account for how stem-final gemination takes precedence over stem-initial gemination when the two types of gemination conflict with each other by allowing anti-faithfulness to specifically refer to each of the bases.

5. Conclusion

In this paper, I have proposed that compound-specific morpho-phonological alternations – Rendaku in Japanese and gemination in Malayalam – be analyzed based on the theory of transderivational anti-faithfulness by Alderete (1999, 2001). I have shown that the proposed analysis can deal with those morpho-phonological alternations without positing denominal adjective morphemes whose existence involves various problems. While dealing with Japanese and Malayalam compounds, I have also proposed that anti-faithfulness be allowed to specifically refer to each of the compound bases and that the stringent form of constraints be crucially employed in the case of Malayalam gemination.

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