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The Phonology of Suffixation and Prefixation in Malay

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ABSTRACT

The aim of this paper was to examine the phonology of suffixation and prefixation in Malay, particularly the phonological alternations that are derived due to the morphological process of affixation. It is apparent that the phonological behaviour of suffixation in this language is quite distinct, both in terms of character and degree of generality from prefixation. Rules that are visibly active at the stem-prefix juncture are not permissible at the stem-suffix juncture, and vice versa. This asymmetry has not been satisfactorily accounted for in previous works. The present analysis attempted to account for this irregularity by adopting the theoretical framework of Optimality Theory (Prince & Smolensky, 2004). The apparent irregularity is accounted for as a consequence of a candidate output satisfying more dominant constraints in the hierarchy. The relevant constraints that play significant roles here are the alignment constraints of the prosody-morphology interface, which require that the edge of some grammatical category coincide with the edge of some prosodic category. The prefix-stem boundary is controlled by ALIGN-PREF, requiring that the right edge of a prefix coincides with the right edge of a syllable, while the stem-suffix boundary is governed by ALIGN-SUF, requiring that the left edge of a suffix coincides with the left edge of a syllable, and ALIGN-STEM, requiring that the right edge of a stem coincide with the right edge of a syllable. ALIGN-SUF and ALIGN-STEM are higher ranked than ALIGN-PREF in the hierarchy. This schematic ranking straightforwardly explains the irregularity in the prefixation and suffixation in Malay.

Keywords: Alignment, constraint, grammatical category, prosodic category, ranking

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INTRODUCTION

As commonly observed in many languages, when morphemes combine to form words, some of the neighbouring segments undergo phonological alternations. In the rule-based approach, the generality in the alternation is captured and formalized in terms of input-based rewrite rules. However, current work in phonology, especially with the advent of Optimality Theory (henceforth OT), the phenomena cast under the conventional rule-based approach have now been re-examined and reformulated in terms of output-based well-formedness constraints.

Accordingly, this paper attempts to examine the phonology of Malay, particularly the phonological alternations that are derived due to the morphological processes of prefixation and suffixation. It is observed that the phonology of suffixation and prefixation in this language is quite distinct both in character and degree of generality. Rules such as nasal assimilation and nasal coalescence that are regularly active at the stem-prefix juncture are not permissible at the stem-suffix juncture. These asymmetries have not been satisfactorily accounted for in the previous rule-based works. The present paper offers an account for this irregularity by adopting the theoretical framework of OT (Prince & Smolensky, 2004). The apparent irregularity is accounted for as a consequence of the output candidate that best satisfies the language's constraint hierarchy.

DATA

The Malay data used in the study are prescriptive data as represented in the spelling system. The language has four underlying nasal consonants, namely /m, n, ny, ng/. Generally, a nasal segment which forms the coda of the first syllable is always homorganic, with the following onset obstruent. Underlying non-homorganic nasal-obstruent clusters derived by morphemic concatenation undergo phonological alternations, as follows:

1. Morphemic concatenation at the prefix-stem boundary[1]

   a. /meng+balas/ [mem.ba.las] 'react'

      /meng+datang/ [men.da.tang] 'come'

      /meng+gali/ [meng.ga.li] 'dig'

      /meng+cadang/ [men.ca.dang] 'propose'

      /meng+jilat/ [men.ji.lat] 'lick'

   b. /meng+pasang/ [me.ma.sang] 'set'

      /meng+tiru/ [me.ni.ru] 'copy'

      /meng+kunyah/ [me.ngu.nyah] 'chew'

      /meng+sapu/ [me.nya.pu] 'sweep'

2. Morphemic concatenation at the stem-suffix boundary

   /tanam+kan/ [ta.nam.kan]
   'bury (imperative)'

   /tekan+kan/ [te.kan.kan]
   'press (imperative)'

   /pasang+kan/ [pa.sang.kan]
   'set (imperative)'

The phonological facts displayed above can be summarized as follows: (i) the final nasal of the prefix assimilates to the place of articulation of a following voiced stop and affricate[2] (1a), (ii) the final nasal of the prefix coalesces with the following voiceless obstruents (except for /c/) yielding a homorganic nasal consonant (1b)[3], and (iii) nasal assimilation and coalescence do not apply at the stem-suffix juncture. These generalizations have not been satisfactorily accounted for in the previous rule-based analyses.

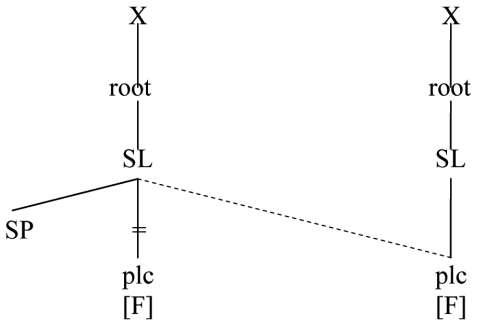
NASAL ASSIMILATION AND COALESCENCE AT THE PREFIX-STEM BOUNDARY

As mentioned, a nasal segment which forms the coda of the first syllable is always homorganic with the following onset obstruent, and this fact is captured in the previous rule-based approach by a very general rule called nasal assimilation (Farid 1980, p. 13; Teoh, 1994, p. 101). In Farid's (1980) analysis, nasal assimilation is formalized as a feature changing rule as in (3), whereas in Teoh's (1994) non-linear analysis, nasal assimilation is interpreted as a process of spreading, that is, the nasal segment gets its specification for place of articulation through linking with the following consonantal segments, as illustrated in (4).

3. Nasal assimilation as feature changing (Farid, 1980, p. 13)

$$[+\text{nasal}] \rightarrow \begin{bmatrix} \alpha\ \text{ant} \\ \beta\ \text{cor} \\ . \\ . \\ . \end{bmatrix} \quad / \quad \underline{\qquad} \quad \begin{bmatrix} \text{C} \\ \alpha\ \text{ant} \\ \beta\ \text{cor} \\ . \\ . \end{bmatrix}$$

4. Nasal assimilation as spreading (Teoh, 1994, p. 101)



Given the formulations of the rules in (3) and (4), we would expect nasal assimilation to apply accordingly at the stem-suffix boundary because its structural description is fully met. This irregularity, however, is not addressed in Teoh (1994). Farid (1980, p. 13), on the other hand, regards this as an exception as he notes, "Nasals always appear on the surface as homorganic to a following consonant, except in cases of reduplication, or if the cluster consists of nasal plus suffix-initial consonant [-kan]".

In an OT account, the irregularity of nasal assimilation at the suffix juncture is explainable. This process does not take place in the optimal output because the candidate in hand is not the candidate best satisfying the constraint hierarchy. In standard OT analysis (McCarthy & Prince, 1993a, 1993b), nasal assimilation in natural languages is triggered by the CODA COND constraint, which is defined in prose as in (5). In a later development, this constraint has been reinterpreted and reformalized in terms of an alignment statement requiring consonants to be left-aligned with a syllable (Ito & Mester, 1994), as formally defined in (6) below.

5. CODA-COND
   A coda consonant is a nasal homorganic to a following stop or affricate.

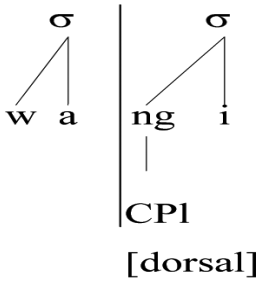
6. CODA COND: Align-Left (C, σ)

The formulation in (6) generally implies that all consonants are ruled out from syllable's final position. In more specific cases, however, the consonantal element 'C' in (6) is often more narrowly circumscribed by referring to Cplace, marked Cplace, major segment types (resonant, obstruents), etc., and in this way, CODA COND (6) is, properly speaking, an alignment scheme that in individual grammars is cashed in for some set of elementary alignment conditions (Ito & Mester, 1994, p. 31). Following Ito and Mester (1994), the CODA COND constraint in Malay is formalized in terms of an alignment statement as in (7) (Zaharani, 2004).

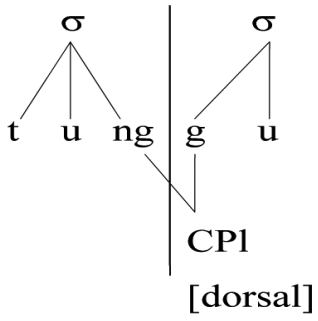
7. CODA COND
   Align-Left (CPlace Nasal, σ)

The constraint in (7) penalises any occurrence of specified CPlace nasal in the coda. As widely known, CODA COND is subject to the Linking Condition (Hayes 1986). Any segment which is doubly-linked to both rhyme and onset is immune to this constraint. Thus, geminates and place-linked clusters are not counted as a violation of CODA COND. Ito and Mester (1994, p. 34) call this 'noncrisp alignment', as opposed to the 'crisp' one. The difference between crisp and noncrisp alignments is as follows:

8. **a. [wa.ngi] 'fragrant'**



b. [tung. gu] 'wait'



The CPlace in (8a) fulfils CODA COND, since it is exclusively linked as a leftmost syllable daughter ('crisp alignment'). The CPlace in (8b) satisfies CODA COND as well because it is linked to the left edge of the second syllable, in spite of the additional link to the preceding syllable ('noncrisp alignment') (Zaharani, 2004).

Before I offer an OT account of nasal assimilation at the prefix-stem juncture, it must be noted that in the previous studies, the C-final prefix in (1) is represented with nasal segment which is not specified for the feature node [Place] (cf. Teoh, 1994; Kroeger, 1988). This consonant gets its [Place] node from the following obstruent through spreading. It has been argued that underspecification is unnecessary in the analysis of OT (Prince & Smolensky, 2004; Ito, Mester & Padgett, 1995). As Ito, Mester and Padgett (1995) pointed out, "since there is no sequential phonological derivation in Optimality Theory, there is no sense in which (parts of) the phonological derivation could be characterized by underspecification." Following this assumption, I construed the nasal-final prefix in Malay as fully specified in the lexical representation, and is represented as a dorsal nasal /ng/, since this segment appears before V-initial stems (i.e. /meng+ubah/ →[mengubah] 'change') (cf. Farid, 1980).

In the rule-based approach, nasal assimilation in (4) basically involves two general procedures. First, the nasal segment loses its specified [Place] node by delinking, and subsequently it obtains a new [Place] node from the following consonant through spreading. The delinking of place node is captured in OT by a formal constraint IDENT-IO[Place] in (9).

9. IDENT-IO[Place]
   The correspondent of the input segment specified as [Place] must be [Place].

It is apparent that CODA COND and IDENT-IO[Place] are in conflict, and therefore, they have to be ranked with respect to each other. The relevant ranking has to be CODA COND >> IDENT-IO in order for the assimilated form to emerge as the optimal output, as the following tableau demonstrates.

10. Nasal assimilation at the prefix-stem juncture

/meng+balas/	CODA COND	IDENT-IO[Place]
a. meng.ba.las	*!	
b. ☞mem.ba.las		*

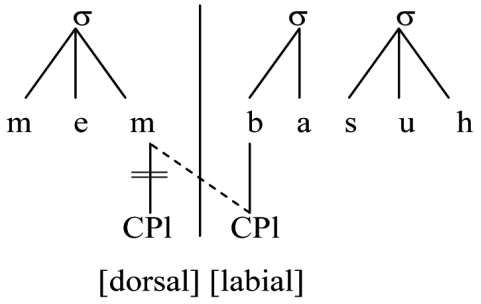
The failed candidate (10a) violates CODA COND since the cluster is not homorganic. By contrast, the optimal candidate (10b) satisfies CODA COND at the expense of violating IDENT-IO[Place]. It must be noted that cross-junctural multiple linking at the prefix boundary has a significant effect on an alignment constraint of the prosody-morphology interface, which requires that the edge of some grammatical category coincides with the corresponding edge of some prosodic categories. The relevant constraint at play here is ALIGN-PREF, which belongs to a family of constraints, called generalized alignment (McCarthy & Prince 1993b).

ALIGN-PREF can be formally defined as follows:

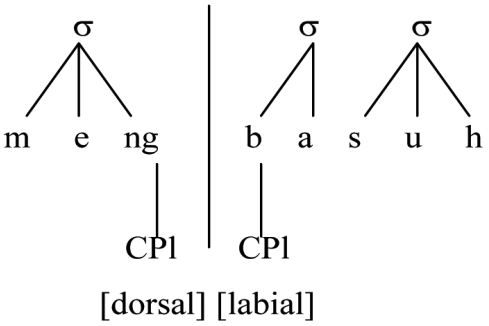
11. ALIGN-PREF
    Align (Prefix, Right, σ, Right)

Constraint (11) states that the right edge of a prefix must coincide with the right edge of a syllable. Following Ito and Mester (1994), ALIGN-PREF is construed in this paper as a 'crisp' alignment constraint, requiring a single linking representation.

12. Nasal assimilation with multiple linking - ALIGN-PREF violation



13. Unhomorganic nasal with a single linking - ALIGN PREF satisfaction



The relevant prefix-edge is marked by a vertical line '|'. As can be seen in (12), the right edge of the prefix coincides with two syllable edges, one on the left and the other on the right. As McCarhty and Prince (1993a, p. 39) state, "ALIGN requires sharply defined morpheme edges, but linking [as in (12)], undoes the desired relation between the morphological and prosodic constituency of a form." Accordingly, multiple linking in a case like (12) does violate ALIGN-PREF.

Although the representation in (13) satisfies ALIGN-PREF, it is not the optimal output in the language. This suggests that ALIGN-PREF must be dominated by CODA COND in the hierarchy, as illustrated in the tableau below.

14. Nasal assimilation: CODA COND >>ALIGN- PREF >>IDENT-IO[Place]

/meng+balas/	CODA COND	ALIGN-PREF	IDENT-IO[Place]
a. meng.ba.las	*!		
b. ☞mem.ba.las		*	*

Other possibilities of eschewing the CODA COND violation are by C-deletion and V-epenthesis. Both strategies involve violations of faithfulness constraints MAX-IO and DEP-IO, respectively. MAX-IO demands that all the input segments must appear on the surface regardless of whether the form has an illicit syllable structure, for instance a syllable with unhomorganic coda. This is to ensure that all underlying segments are parsed. DEP-IO requires that every segment of the output must have a correspondent in the input, and this is to avoid the occurrence of epenthetic element in the output.

It must be pointed out that insertion and deletion of a consonant is permissible

in the language but not a vowel[4]. The generalization that can be deduced from this is that the deletion/insertion of a vowel and the deletion/insertion of a consonant have a very different status in Malay. In OT, this distinction is captured by positing two different and related constraints of MAX-IO and DEP-IO, namely, MAX-IO_{VOW}/ MAX-IO_{CONS} and DEP-IO_{VOW} /DEP-IO_{CONS}. Constraints of these two types are distinct, and therefore, they are separately rankable in the hierarchy. Given the facts of Malay, it is evident that the vowel faithfulness constraints, namely, MAX-IO_{VOW}/ DEP-IO_{VOW} are ranked higher than the consonant faithfulness constraints MAX-IO_{CONS}/ DEP-IO_{CONS}.

With respect to ALIGN-PREF constraint, if epenthesis were to apply, the presence of V-epenthetic segment which is not part of the prefix will shift the syllable edge away from the prefix edge. This causes a misalignment of the leading edges of the syllable and the prefix, an obvious violation of ALIGN-PREF. Equivalently, deleting the final consonant, a MAX-IO_{CONS} violation, as a way to avert a CODA COND violation, can never bring a form into agreement with the syllable-prefix edges alignment. In short, obedience to ALIGN-PREF can only be achieved, if the prefix-final nasal occupies the syllable coda position, as in (13). Putting all the constraints together yields the following set of ranking hierarchy: DEP-IO_{VOW} >> CODA COND >> ALIGN-PREF >> MAX- IO_{CONS} >> IDENT-IO[Place].

15. Nasal assimilation across the prefix-stem juncture

/meng+balas/	DEP-IO_{VOW}	CODA COND	ALIGN-PREF	MAX-IO_{CONS}	IDENT-IO[Place]
a. meng.ba.las		*!			
b. me.nge.ba.las	*!		*		
c. me.ba.las			*	*!	
d. ☞ mem.ba.las			*		*

As can be seen, the ruled out candidate (15a) preserves the underlying nasal, and therefore, it fatally violates CODA COND. Candidate (15b) spares CODA COND because the nasal segment is now syllabified as an onset of the second syllable. It is also ruled out because it is violating a more dominant constraint DEP-IO_{VOW}. Candidates (15c) and (15d) are both violating ALIGN-PREF and satisfying CODA COND equally. Thus, they tie with each other; the next available constraint MAX-IO_{CONS}, which plays a decisive role here, selecting (15d) as the optimal output.

Now, let us move to a process called nasal coalescence, in which the manner of C-final prefix (i.e. [+nasal] feature) and the place of articulation of C-initial stem are both maintained in the output. Traditionally, nasal coalescence is commonly referred to as nasal substitution, which is defined as a process of replacing the initial voiceless obstruent of the stem by a homorganic nasal. This process is common to many Western Austronesian languages (Dempwolff, 1934-1938), as well as in many African languages (Rosenthall, 1989, p. 50).

In Farid (1980) and Teoh (1994), nasal coalescence is treated as two separate, but related rules, which are extrinsically ordered, namely, nasal assimilation (see 3

and 4) and voiceless obstruent deletion (see 16 and 17 below). The rule of voiceless obstruent deletion only applies at the prefix-stem juncture, and not in any other word positions. To prevent voiceless obstruents word-internally and in the suffixed forms from being deleted, the structural description of the rule has to be conditioned by the prefix or stem boundary, as represented in the following rules.

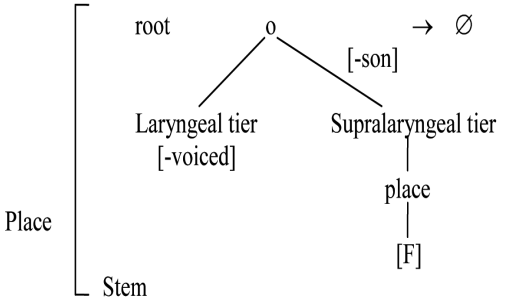
16. Voiceless Obstruent Deletion (Farid, 1980, p. 53)

$$\underset{[-\text{ voice}]}{C} \rightarrow \varnothing \; / \; N \; - \; \underset{[\alpha\, F]}{\underline{\quad}} \; \underset{[\alpha\, F]}{\quad}$$

Where '-' denotes a prefix boundary

17. Voiceless Obstruent Deletion (Teoh, 1994, p. 98)

Voiceless Obstruent Deletion (Teoh, 1994, p. 98)



The autosegmental rule in (17) says that a voiceless obstruent stem-initially with its place node multiply linked to a preceding segment as a result of nasal assimilation will be deleted at the root node. Theoretically, the formalization in this rule poses a serious analytical problem. Treating assimilation as a partly linked structure (Teoh, 1994, p. 104) crucially violates the inalterability and integrity conditions (Hayes 1986), which disallow any segment forming half of a linked structure from undergoing a phonological rule.

Pater (2004) argues that the postulation of the voiceless obstruent deletion rule is not phonologically motivated because there is no attested case, where this rule exists without nasal assimilation. Furthermore, the two-ordered rule analysis also fails to account for other related homorganic cluster phenomena attested in many other languages. Therefore, this phonological alternation is better analyzed as a single process called nasal coalescence, construed as fusion or merger of the nasal and voiceless obstruent driven by a universal and violable constraint *NC (see Pater, 2004), which can be formally defined as in (18).

18. *NC

No nasal/voiceless obstruent sequences

Within the framework of Correspondence Theory (McCarthy & Prince, 1995), the process of merging both the nasal and the voiceless obstruent can be interpreted as a two-to-one mapping from input to output - two input segments stand in correspondence with a single output segment. The correspondence relationship between the input and the output, which is indicated by subscript letters, can be illustrated as below.

19. The representation of nasal coalescence: e.g. /ng+p/ →[m]

The [m] in the output is composed of the features of the two elements of the input, the nasal feature of the /ng/ and the place feature of the /p/. Nasal coalescence cannot be considered to be a MAX-IO_{CONS} violation because pieces of every element of the input are maintained in the output (cf. Lamontagne & Rice, 1995). Although nasal coalescence spares MAX-IO_{CONS} since every input segment has a correspondent in the output, it does incur violations of other constraints. Nasal coalescence violates UNIFORMITY[5], which prohibits two or more input segments from sharing an output correspondent (McCarthy & Prince, 1995, Lamontagne & Rice, 1995; Pater, 2004).

20. UNIFORMITY 'No Coalescence'
No element of the output has multiple correspondents in the input.

The process of nasal coalescence can never bring the right edge of the prefix in coincidence with the right edge of a syllable, an instance violation of ALIGN-PREF. *NC conflicts with ALIGN-PREF and UNIFORMITY, and therefore, they have to be ranked with respect to each other. The relevant ranking to the process of nasal coalescence must be *NC >> ALIGN-PREF >> UNIFORMITY, in order for a coalesced candidate to emerge as an optimal output.

21. Nasal coalescence: *NC >> ALIGN-PREF >> UNIFORMITY

/meng+pasang/	*NC	ALIGN-PREF	UNIFORMITY
a. mem.pa.sang	*!	*	
b.☞me.ma.sang		*	*

Another possibility as a means of achieving structural well-formedness is by C-deletion. This option gives another potential candidate, *[mepasang]. This candidate spares *NC and UNIFORMITY, at the expense of violating MAX-IO_{CONS}. In order to rule out *[mepasang], MAX- IO_{CONS} must be ranked higher than UNIFORMITY in the hierarchy. Resolving *NC by V-epenthesis can never be a better option, since DEP-IO_{VOW} is highly ranked in the language. Considering all the constraints mentioned above, the relevant ranking is as follows: DEP-IO_{VOW} >> *NC >> ALIGN-PREF >> MAX-IO_{CONS} >> UNIFORMITY.

22. Nasal coalescence at the prefix-stem boundary

/meng+pasang/	DEP-IO_{VOW}	*NC	ALIGN-PREF	MAX-IO_{CONS}	UNIFORMITY
a. mem.pa.sang		*!	*		
b. me.pa.sang			*	*!	
c. me.nge.pa.sang	*!		*		
d.☞me.ma.sang			*		*

The failed candidates (22a) and (22c) are ruled out, as they incur fatal violations of high ranked constraints *NC and DEP-$IO_{VOW,}$ respectively. Candidates (22b) and (22d) are spared from this violation, but they both violate ALIGN-PREF resulting

in a tie. However, the next available constraint, MAX- IO_{CONS}, rules out (22b) and pronounces (22d) as the winning candidate. A violation of UNIFORMITY is not significant because the victor has already been determined.

OPACITY OF NASAL ASSIMILATION AND COALESCENCE AT THE SUFFIX BOUNDARY

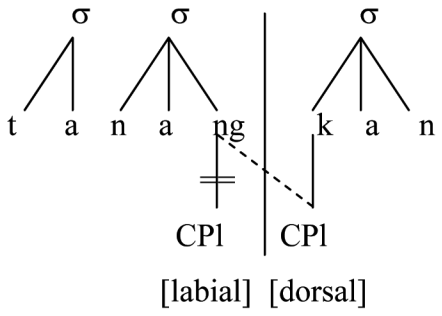
As shown in (2), the final nasal segment of the stem fails to assimilate with the initial obstruent of the suffix /-kan/. Given the formalism formulated in the rule-based analysis, the opacity of nasal assimilation in this particular environment is very difficult, if not impossible to account for. Arguably, this is the main reason why this well-observed phonological fact has been overlooked in Teoh (1994) and treated as an exception in Farid (1980, p. 13).

Given an OT account, the inapplicability of nasal assimilation at the suffix juncture is not merely exceptional but is an explainable phenomenon. Nasal assimilation is blocked as a consequence of a candidate output best satisfying the constraint hierarchy, in accord with the theoretical assumptions of OT. It is apparent that the relevant constraint that plays a central role in deriving the basic generalization at the suffix boundary is a prosody-morphology interface constraint called ALIGN-SUF, which can be formally defined as follows:

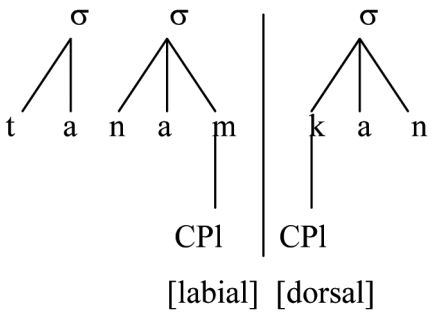
23. ALIGN-SUF
    Align (Suffix, Left, σ, Left)

ALIGN-SUF requires that the left edge of a suffix coincides with the left edge of a syllable. In order for ALIGN-SUF to be fully satisfied, all the feature contents of the input of the C-initial suffix, as well as the root node, must have a correspondent in the output (cf. McCarthy, 1993b; Lombardi 1995). Similarly to ALIGN-PREF, ALIGN-SUF is construed in this paper as a 'crisp' alignment constraint, requiring a single linking representation as proposed by Ito and Mester (1994)[vi].

24. Nasal assimilation with multiple lingking - ALIGN-SUF violation



25. Single linking in unhomorganic nasal – ALIGN-SUF satisfaction



Notice that in (24), if nasal assimilation were to be applied, this would involve delinking and spreading. Delinking of the

[Place] node of the C-final stem incurs a violation of IDENT-IO[Place]. Feature spreading creates multiple linking structure, and as can be seen the left edge of the suffix coincides with two syllable edges, one on the left and the other on the right, an instance violation of ALIGN-SUF. Similar to ALIGN-PREF, ALIGN-SUF requires sharply defined edges, a crisp alignment in Ito and Mester's terms.

The concatenation of nasal-final stems with the suffix /-kan/ forces the alignment constraint ALIGN-SUF to interact with the syllable structure constraint CODA COND. Since nasal assimilation never applies across a stem-suffix boundary, CODA COND has to be violated in this environment as a consequence of respecting a more dominant constraint ALIGN-SUF. If in prefixation CODA COND dominates ALIGN-PREF, inevitably in the case of suffixation ALIGN-SUF must dominate CODA COND. The violation of CODA COND is compelled in order to secure the satisfaction of the high ranked ALIGN-SUF. The following tableau illustrates the points I just made.

26. Nasal assimilation is blocked at the stem-suffix juncture

/tanam+kan/	ALIGN-SUF	CODA COND	IDENT-IO[Place]
a. ta.nang.kan	*!		*
b.☞ta.nam.kan		*	

Other possibilities for eschewing the CODA COND violation without violating the ALIGN SUF constraint are by deleting the final nasal of the stem (i.e. *[ta.na.kan]) and by inserting an epenthetic vowel to the stem (i.e. *[ta.na.me.kan]). Deleting an input consonant violates MAX-IO_{CONS}, and inserting epenthetic vowel violates DEP- IO_{VOW}. Given the schematic ranking established earlier where MAX-IO_{CONS} is a lower ranked constraint, the grammar would predict the form with deletion as more harmonic than the actual surface form, as illustrated in the tableau below.

27. C-deletion at the stem-suffix juncture – incorrect result

/tanam+kan/	DEP-IO_{VOW}	ALIGN-SUF	CODA COND	MAX-IO_{CONS}	IDENT-IO[Place]
a. ta.nang.kan		*!			*
b. ta.na.me.kan	*!				
c. ☞*ta.na.kan				*	
d. ☺ta.nam.kan			*!		

As can be seen, ALIGN-SUF becomes irrelevant when C-deletion or V-epenthesis applies at the stem edge. The candidate (27c) is chosen as the optimal output, as it minimally violates the lower constraint in the hierarchy. Nevertheless, the correct surface form is (27d), which is the candidate marked by '☺'. This suggests that the suboptimal candidate must be violating some other dominant constraints in the language, which brings about its elimination.

Recall the alignment constraint called ALIGN-PREF (11) and ALIGN-SUF (23), which require that a designated edge (i.e. left or right) of a syllable coincide with a designated edge (i.e. left or right) of a morphological constituent (i.e. suffix or prefix). Both constraints prohibit epenthesis or deletion at the edges. To account for the prohibition of stem final epenthesis and deletion, another formal constraint

which closely resembles ALIGN-PREF and ALIGN-SUF is needed, namely, ALIGN-STEM, as formally defined as in (28).

28. ALIGN-STEM
    Align (Stem, Right, σ, Right)

Constraint (28) states that the right edge of a stem must coincide with the right edge of a syllable. In order for ALIGN-STEM to be fully satisfied, the final segment of the input stem cannot be deleted (i.e. underparsed) or syllabified with an epenthetic vowel (i.e. overparsed). Deletion and epenthesis will cause a misalignment of the leading edges of the syllable and the stem. Considering the case under discussion, ALIGN-STEM must be ranked above CODA COND in the hierarchy, so that its satisfaction takes priority whenever a conflict arises. The relevant ranking of all the constraints mentioned is as follows: DEP-IO_{VOW} >> ALIGN-SUF >> ALIGN-STEM >> CODA COND >> MAX- IO_{CONS} >> IDENT-IO[Place].

29. Opacity of nasal assimilation at the stem-suffix juncture

/tanam+kan/	DEP-IO_{VOW}	ALIGN-SUF	ALIGN-STEM	CODA COND	MAX-IO_{CONS}	IDENT-IO[Place]
a. ta.nang.kan		*!				*
b. ta.na.me.kan	*!		*			
c. ta.na.kan			*!		*	
d. ☞ta.nam.kan				*		

As shown, by imposing the constraint ranking in (29), the interaction straightforwardly explains why nasal assimilation is opaque at the stem-suffix boundary. The evaluation reveals that the assimilated candidate is not the one best satisfying the constraint hierarchy. In candidate (29a), the underlying nasal /m/ surfaces as [ng] due to nasal assimilation, which involves delinking and spreading of the Place node. Delinking violates the featural faithfulness constraint IDENT-IO[Place]. A more serious effect of delinking is a fatal violation of ALIGN-SUF. The optimal candidate (25d) is featurally faithful to the input, and thus, it obeys ALIGN-SUF and ALIGN-STEM at the expense of disobeying the CODA COND constraint.

Another significant aspect of the behaviour of the nasal clusters at the suffix boundary that has not been addressed in the literature is the opacity of nasal coalescence. As mentioned, nasal coalescence is construed in this paper as a process of merging a nasal and a voiceless obstruent driven by a universal and violable constraint *NC, which prohibits nasal/voiceless obstruent sequences. Similarly to CODA COND, *NC has to be dominated by ALIGN-STEM and ALIGN-SUF in the hierarchy. As noted earlier, the satisfaction of *NC compels a violation of UNIFORMITY, and the ranking suggests that the latter is dominated by the former in the hierarchy (see 21 & 22). However, a serious consequence of nasal coalescence is that it fatally violates ALIGN-STEM and ALIGN-SUF, respectively.

30. Opacity of nasal coalescence at the stem-suffix juncture

/pasang+kan/	DEP-IO_{VOW}	ALIGN-SUF	ALIGN-STEM	*NC	MAX-IO_{CONS}	UNIFORMITY
a. pa.sa.kan.			*!		*	
b. pa.sa.nge.kan.	*!		*			
c. pa.sa.ngan.		*!	*			*
d.☞ pa.sang.kan.				*		

The failed candidate (30c) undergoes nasal coalescence, that is, the cluster /ngk/ is fused together and becomes a velar nasal /ng/. As can be seen, the consequence of this is that the stem-edge and the suffix-edge do not coincide with a syllable boundary, a fatal violation of ALIGN-STEM and ALIGN-SUF, respectively. In short, the opacity effect of certain regular phonological processes at the suffix boundary is not an irregular phenomenon. The visibly active processes are inapplicable as a consequence of a candidate output to best satisfy the constraint hierarchy.

CONCLUSION

Morpheme boundaries in Malay behave differently with respect to the phonological processes of the language. The prefix-stem boundary allows nasal assimilation and nasal coalescence, but not at the stem-suffix boundary. This asymmetry arises due to the alignment constraints of the prosody-morphology interface, which require that the edge of some grammatical categories coincide with the edge of some prosodic category. The prefix-stem boundary is controlled by ALIGN-PREF, requiring that the right edge of a prefix coincide with the right edge of a syllable, where as the stem-suffix boundary is governed by ALIGN-SUF, requiring that the left edge of a suffix coincides with the left edge of a syllable, and ALIGN-STEM, requiring that the right edge of a stem coincides with the right edge of a syllable.

ALIGN-STEM, ALIGN-SUF and ALIGN-PREF are distinct constraints, and therefore, they are separately ranked in the hierarchy. In their interaction with CODA COND and *NC, the sub-ranking goes as follows: ALIGN-STEM, ALIGN-SUF >> CODA COND, *NC >> ALIGN-PREF. This schematic ranking straightforwardly explains why cross-junctural nasal assimilation and nasal coalescence are transparent in the domain of prefixation, but they are opaque in the domain of suffixation.

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ENDNOTES

[1]/meng-/ and /-kan/ are verb-forming affixes which can be either category-maintaining or category-changing. The former is an active voice marker, where as the latter is a transitive marker.

[2]Nasal assimilation involving voiceless stops occur in a few lexical exceptions (i.e. [menternak] 'rear' and [mengkaji] 'study'), and in borrowed lexical items (i.e. [mempopularkan] 'popular' and [mengkatalog] 'catalogue').

[3]The behaviour of /s/ in connection with nasal coalescence is quite puzzling. The alveolar fricative /s/ is replaced by a palatal /ny/ instead of /n/. Farid (1980:5) regards that /s/ is underlyingly alveorpalatal voiceless fricative, where as Kroeger (1988) suggests that /s/ is better analyzed as a palatal stop /k'/. It is not the purposes of this paper to give an account for this issue.

[4]It must be mentioned that Malay loan phonology demonstrates that borrowed lexical items containing clusters are generally

resolved by schwa epenthesis. For example, English words like *stamp, glass, class, club,* are represented as /setem/, /gelas/, /kelas/ and /kelab/ respectively.

[5]In his analysis, Pater (2004) employs a LINEARITY constraint instead of UNIFORMITY. According to McCarthy and Prince (1995), the former is adopted to rule out metathesis, whereas the latter bans coalescence. In Lamontagne and Rice's (1995) analysis of Navajo Coalescence, they use a constraint called *MULTIPLE CORRESPONDENCE (*MC).

[6]Delilkan (2002, 2005) offers an account which utilizes both a theory of representations and the theory of constraint interaction to account for the distribution of fusion and no-fusion at prefix and suffix junctures. Her analysis suggests that the asymmetry discussed above would fall out as a direct consequence of the prosodic word structure of the language.