



CO-PHONOLOGY VS. INDEXED CONSTRAINT THEORY: A CASE STUDY OF PERAK DIALECT PARTIAL REDUPLICATION

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Abstract

This paper presents co-phonologies and indexed constraint theory developed within Optimality theory (Prince and Smolensky, 1993) to account for partial reduplication in Perak dialect of Malay. It is found that the dialect has two patterns of reduplicative morphemes, i.e. light and heavy reduplication. In the co-phonology developed by Orgun (1996), Antilla (2002), Inkelas and Zoll (2005, 2007) and many others, each morphological construction is associated with a different phonological grammar, and the idea of ‘Markedness Reversal’, where a markedness constraint can be re-ranked in different morphological constructions in the same language, is used to account for morphologically conditioned phonology. In indexed constraint theory on the other hand, one constraint ranking is used to define the grammar of the entire language (cf. Alderete, 1999, 2001; Itô and Mester, 1999, 2003). Unlike co-phonology, this theory handles morphologically-conditioned phonology cases by splitting the phonology constraints into a particular morphological context, which results in different indexed versions, such as MAX-C_{ROOT}, MAX-C_{AFFIX} and so forth (Ibid.). In the analysis, I will demonstrate how the ideas proposed in both theories can handle light and heavy reduplication. The results of the analysis favour co-phonology rather than indexed constraint theory, as the former offers a better account of morphologically conditioned phonology.

Keywords: reduplication; phonology; optimality theory.

ISO 639-3 Language codes: zlm

1. Introduction

It has widely been observed that Cə is the pattern of reduplicative morphemes which is found in Standard Malay (henceforth SM) (e.g. Omar, 1986, 1993, 1974; Othman, 1976, 1981, 1985; Che Kob, 1981; Karim et al., 1994; Karim, 1995). Below, I exemplify some relevant examples:

(1). Partial reduplication in SM

/bo.la/ ‘ball’ (round object)	[bə-bola] RED-ball ‘ball’ (foods, e.g. fishball)
/taŋ.ga/ ‘stairs’	[tə-taŋgə] RED-stairs ‘neighbours’
/ka.ʃaŋ/ ‘bean’	[kə-kaʃaŋ] RED-bean ‘beans’
/po.hon/ ‘tree’	[pə-pohon] RED-tree ‘trees’
/kun.ʃi/ ‘key’/ ‘lock’	[kə-kunʃi] RED-key ‘password’

Observe that reduplicative morphemes in SM consist of Cə elements or light reduplicative morphemes. In the above data we see that the C element in the reduplicative morpheme is copied from the initial consonant of the base, while the V element is a specific vowel, schwa, regardless of what the vowel in the base is.

It should be mentioned that there is another pattern of reduplicative morphemes in Malay partial reduplication, as well as Cə. This other pattern is the CəC reduplicative morphemes that can be found in one of the Malay dialects, i.e. in the Perak dialect. In this dialect, as well as CəC, Cə is a pattern of reduplicative morphemes, too. Those patterns are referred to in this analysis as light (for Cə) and heavy (for CəC) reduplicative morphemes, as illustrated in (a) and (b), respectively:

(2). Partial reduplication in Perak dialect (from Ahmad, 1991)

(a) Light reduplicative morphemes

(i)	/budak/ 'child'	[budaʔ]	[bə-budaʔ] RED-child 'all kinds of children'
(ii)	/cərita/ 'story'	[cərita]	[cə-cərita] RED-story 'all kinds of stories'
(iii)	/kadʒi/ 'to study'	[kadʒi]	[kə-kadʒi] RED-to study 'to study repeatedly'
(iv)	/kira/ 'to estimate'	[kɛrɛ]	[kə-kɛrɛ] RED-estimate 'by my estimate'
(v)	/dulu/ 'long ago'	[dulu]	[də-dulu] RED-long ago 'very long ago'

(b) Heavy reduplicative morphemes

(i)	/pətaŋ/ 'evening'	[pətaŋ]	[pəm-pətaŋ] RED-evening 'every evening'
(ii)	/dʒaraŋ/ 'seldom'	[dʒaʁaŋ]	[dʒəŋ-dʒaʁaŋ] RED-seldom 'very seldom'
(iii)	/baraŋ/ 'thing'	[baʁaŋ]	[bəm-baʁaŋ] RED-thing 'all kinds of things'
(iv)	/sikit/ 'a little'	[siket]	[səʔ-siket] RED-a little 'very little'
(v)	/gəlap/ 'dark'	[gəlap]	[gəʔ-gəlap] RED-dark 'very dark'
(vi)	/budak/ 'child'	[budaʔ]	[bəʔ-budaʔ] RED-child 'all kinds of children'
(vii)	/daun/ 'leaf'	[daon]	[dən-daon] RED-leaf 'leaves'

Observe that there are two types of reduplicative morphemes in partial reduplication in the Perak dialect of Malay: (1) Light reduplicative morphemes, as in (2a), and (2) heavy reduplicative morphemes, as exemplified in (2b). For light reduplicative morphemes, the copying process is exactly the same as in SM, where the C element in the reduplicative morpheme is copied from the initial consonant of the base, while the V element is schwa specific.

Notice that in heavy reduplicative morphemes, as shown in (2b), the reduplicative morphemes are constructed of CəC elements. The first Cə follows the same process as in SM, where the initial consonant in the reduplicative morpheme is copied from the initial consonant of the base, while the ə segment is also schwa specific. From where does the final C in the reduplicative morpheme gets its phonological material? The final C in the reduplicative morpheme is copied from the final consonant of the base. It can be said that the pattern of the reduplicative morpheme is determined by the base. If the base ends with a consonant, then the reduplicative morpheme will consist of CəC elements or a heavy reduplicative morpheme, while Cə elements or a light reduplicative morpheme are constructed when the base ends with no consonant.

Observe that there are two types of final consonant in the base that are involved in the process of reduplication in the Perak dialect, as presented in (2b). There are (1) nasal segments, like /n/ and /ŋ/, and (2) consonant stops, like /t/, /p/ and /k/. These two final consonants then undergo certain phonological processes when the process of copying occurs. These phonological processes are debuccalisation and nasal assimilation. Debuccalisation converts consonant stops /t/, /p/ and /k/ into [ʔ] when the consonants are copied into the final C in the reduplicative morpheme in the syllable coda. The nasal assimilation process occurs when the nasal consonant is copied into the coda syllable in place of the final C of the CəC reduplicative morpheme. The nasal consonant assimilates to the following onset consonant in the second syllable.

In what follows, I am going to show how those light and heavy reduplicative morphemes in the Perak dialect are accounted for in both indexed constraint theory and co-phonology analysis. The discussion begins with co-phonology analysis, which is then followed by co-indexed constraint theory, as presented in Sections 2 and 3, respectively. At the end of this discussion, we will then be able to see which approach offers a better account for the case in hand.

2. Co-phonologies: Markedness Reversal

An important point highlighted in the co-phonology developed by Orgun (1996), Antilla (1997), Inkelas (1998) and other subsequent works is that a language can have co-existing distinct phonological systems, either small or large, determined by, for example, social register, lexical stratum (e.g. native vs. foreign) or morphological category (e.g. reduplicant vs. base, root vs. affix) (cited in Inkelas and Zoll, 2007). In co-phonologies, such distinction, as mentioned above, is captured by associating morphological constructions with different phonological grammars (ibid.) in different constraint rankings. In this theory, all constraints are completely general, e.g. MAX-C[onsonant], which bans any deletion of consonants.

Scholars who have applied co-phonology analysis to analyse reduplication (e.g.: McCarthy and Prince, 1995; Myer and Carleton, 1996; and many others) claim that in morphological construction, specifically the Faithfulness constraint for example, Faith-BR can be interleaved into a fixed ranking of markedness constraints (cf. Downing, 2008). This allows some constructions to have a more or less marked structure in the output than others (ibid.).

By applying co-phonology to account for Malay partial reduplication, the heavy reduplicative morpheme is explained by the tendency of prosodic constituents to be of maximal size, while the light reduplicative morpheme is explained by the opposing tendency of some prosodic morphemes to have unmarked structure and be distinctly ranked. These opposing tendencies can be accounted for by proposing that heavy and light reduplicative morphemes are associated with distinct constraint rankings, i.e. co-phonology. In the analysis, reduplicative morphemes in both light and heavy reduplication are considered as affixes. They must, therefore, obey MORPHEME SYLLABLE CORRELATION, as defined below:

(3). MORPHEME SYLLABLE CORRELATION

(adapted from Russell, 1997: 121, cited in Downing, 2006: 120)

Each morpheme prefix and root contains exactly one syllable.

As proposed in co-phonology, light reduplication is explained by the tendency for some prosodic morphemes to have an unmarked structure. Language typology and the widespread occurrence of processes which avoid codas suggest that the unmarked structure is for syllables not to have codas (cf. Kager, 1999). This unmarked structure is set out in the following well-formedness constraint, named NOCODA:

(4). NOCODA (syllables are open) (Kager, 1999).

*C]_σ

The next constraint which is crucial to accounting for the data is REDUCE. As we observed, a vowel in the two patterns of reduplicative morphemes is a fixed vowel, which is schwa, regardless of what the vowel in the base is.

(5). REDUCE

Vowels lack quality.

The two constraints just discussed, i.e. NOCODA and REDUCE, are both markedness constraints which play important roles. We shall now discuss the relevant faithfulness constraints to account for the data. Recall that heavy reduplication is explained by the tendency for prosodic constituents to be of maximal size. The maximal size of prosodic constituents is stated in the MAXIMALITY CONDITION, below:

(6). MAXIMALITY CONDITION (Prince, 1985)

Units are of maximal size within the other constraints of their form.

As stated in Downing (2006: 12), this MAXIMALITY CONDITION optimizes the largest reduplicative syllable, which is formalised by the faithfulness constraint, MAX-BR.

(7). **MAX-BR**

All segments of the base are contained in the reduplicative morpheme (there is no partial reduplication).

The faithfulness constraint, MAX-BR, requires that every element in the base to have a correspondent in the reduplicative morpheme. This means that this constraint is violated more for light reduplicative morphemes, as only a few segments of the base are copied into the reduplicative morpheme. As discussed earlier, the light reduplicative morpheme is a case of an unmarked syllable structure. It is an open syllable, omitting any coda consonant. If [ŋ] in the first syllable from the base [taŋ.ge] was copied into the reduplicative morpheme, it would be syllabified as a coda syllable, from which the output would be *[təŋ-təŋge]. In this case, the faithfulness constraint, MAX-BR, must be ranked beneath the markedness constraint, NOCODA, in the constraint ranking of light reduplicative morphemes – NOCODA >> MAX-BR. The interaction of these two constraints is illustrated in the following tableau:

(8). The interaction of NOCODA >> MAX-BR in light reduplicative morphemes

/Light RED-taŋ.ge/	NO CODA	MAX-BR
a. [☞] tə-taŋ.ge		****
b. taŋ-taŋ.ge	*!	**

But when then is a marked structure allowed in the reduplicative morpheme? A marked syllable structure occurs in heavy reduplicative morphemes. Thus, in order to get marked syllable structure in the reduplicative morpheme, MAX-BR must outrank NOCODA: MAX-BR >> NOCODA, as the following tableau illustrates:

(9). The interaction of MAX-BR >> NOCODA in heavy reduplicative morphemes

/Heavy RED-bu.dak/	MAX-BR	NO CODA
a. bə-bu.daʔ	****!	
b. [☞] bəʔ-bu.daʔ	***	*

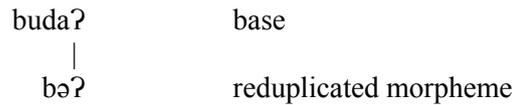
It ought to be mentioned that the heavy reduplicative morphemes which occur in the Perak dialect poses a challenge to the language. They do not meet the requirements of the phonology and morphology of Malay. In the language, it is necessary for a nasal segment occupying the coda position of a syllable to assimilate to the following onset consonant, which must be a voiced obstruent. No voiceless obstruents are allowed after nasal segments. The clusters of nasal and voiceless obstruents in the reduplicated words do not undergo the regular process, nasal substitution, e.g. [pəm-pətaŋ] – *[pəm-ətaŋ] and [kəŋ-kawan] – *[kəŋ-awan]. This process, which is invisibly active in the environment of the reduplicative morpheme, has posed a challenge to linguists writing about the grammar of Malay. It should be borne in mind that nasal and voiceless obstruent clusters are not permitted in the language. Therefore, this sequence undergoes nasal substitution whereby a voiceless obstruent is deleted, leaving its place of articulation to a nasal (Kager, 1999: 59). In this analysis, the undeleted voiceless obstruent after the nasal segment, as in 2(b), can be accounted for by proposing a constraint called ANCHORING. As the coda consonant in the reduplicative morpheme is determined by the final consonant of the base, the relevant ANCHORING constraint which plays a crucial role here is RIGHT ANCHOR-BR. It can be formally defined as follows:

(10). **RIGHT ANCHOR-BR** (Kager, 1999: 251)

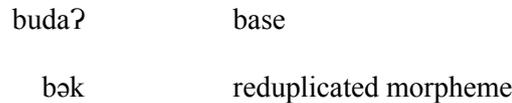
Any element at the designated periphery of S₁ has a correspondent at the designated periphery of S₁

This constraint requires the right peripheral edge of the base to coincide with the right peripheral edge of the reduplicative morpheme. As a final consonant of the base will be copied into the coda position in the reduplicative morpheme, so RIGHT ANCHOR-BR is ranked higher in the hierarchy. This constraint is, however, ranked lower in light reduplication, because the right edge of the reduplicative morpheme does not coincide with the right edge of the base. I demonstrate with the following correspondence diagrams for violation and obedience of RIGHT ANCHOR-BR:

(11). Correspondence diagram for obedience of RIGHT ANCHOR-BR.



(12). Correspondence diagram for violation of RIGHT ANCHOR-BR



As already mentioned, co-phonology is used in this study to analyse the two reduplicative morphemes. I now establish the following co-phonology rankings for Malay.

(13). Co-phonology rankings for Malay.

(a) Light reduplicative morpheme co-phonology:

NOCODA >> REDUCE >> MAX-BR >> RIGHT ANCHOR-BR

(b) Heavy reduplicative morpheme co-phonology:

RIGHT ANCHOR-BR >> REDUCE >> MAX-BR >> NOCODA

Here I present an analysis of light and heavy reduplication, in the following tableaux, by considering all the constraints discussed above:

(14). Light reduplication.

/Light RED-budak/	MORPH-SYLL	NO CODA	REDUCE	MAX-BR	RIGHT ANCHOR-BR
a. bu-bu.daʔ	*		*!	***	*
b. [☞] bə-bu.daʔ	*			****	*
c. bud- bu.daʔ	*	*!	*	**	*
d. bu.daʔ-bu.daʔ	**!	*	*		
e. bəʔ-bu.daʔ	*	*!		***	

As discussed earlier, the unmarked syllable structure for light reduplicative morphemes is obtained by ranking the relevant markedness constraint, in this case NOCODA, above the faithfulness constraint, MAX-BR. Thus, candidates (c), (d) and (e) are ruled out. The remaining candidates in the hierarchy are now (a) and (b). Since REDUCE is high-ranked in the constraint ranking, candidate (a) is ruled out as the vowel in the reduplicative morpheme is a high vowel. Candidate (b) thus emerges as the optimal output.

(15). Heavy reduplication.

/Heavy RED-budak/	MORPH-SYLL	RIGHT ANCHOR-BR	REDUCE	MAX-BR	NO CODA
a. bu-bu.daʔ	*	*!	*	***	
b. bə-bu.daʔ	*	*!		****	
c. bud-bu.daʔ	*	*!	*	**	*
d. bu.daʔ-bu.daʔ	**!		**		*
e. [☞] bəʔ-bu.daʔ	*			***	*
f. bək-bu.daʔ	*	*!		***	*

As shown in (15), when RIGHT ANCHOR-BR ranks high in the hierarchy, it is optimal for the reduplicative morpheme to copy the rightmost segment of the base. As a glottal stop is the rightmost segment in the base, it must be present in the rightmost position of the reduplicative morpheme. Therefore, candidates

(a), (b) and (c) are ruled out. Likewise candidate (f) which the glottal stop in the rightmost position of the base is not copied into the reduplicative morpheme. In this candidate, the glottal stop has been replaced by [k]. This candidate therefore is ruled out, too as it violates RIGHT ANCHOR-BR. Next, candidate (d), with total reduplication, is ruled out by the markedness constraint, REDUCE, because the vowels [u] and [a] are not reduced to a schwa. The remaining candidate is (e), which does not violate the highest constraint, RIGHT ANCHOR-BR, so REDUCE emerges as the optimal output. Since this candidate is not a total reduplication, it violates MAX-BR three times. These violations are however not significant as the optimal output has already been determined.

The data /budak/ we analyse in the above tableaux, (14) and (15), end with a glottal stop. As we observed, two types of final consonant in the base are involved in heavy reduplication: (1) stop consonants and (2) nasal consonants (see (2b) – heavy reduplication data in PD). Stop consonants have already been discussed above. Now, we turn to analyse other data for heavy reduplication, where the base ends with a nasal consonant. With the same constraint ranking that I established in (15) above, for heavy reduplicative morphemes, I now demonstrate how a base ending with a nasal consonant copies the nasal consonant into the coda position in the reduplicative morpheme.

(16).

/Heavy RED-pətaŋ/	MORPH-SYLL	RIGHT ANCHOR -BR	REDUCE	MAX-BR	NO CODA
a. pə-pə.taŋ	*	*!	*	***	
b. pət-pə.taŋ	*	*!		****	*
c. pə.taŋ-pə.taŋ	**!		**		*
d. pəm-pə.taŋ	*			***	*

As shown in the above tableau, the final consonant of the base is a nasal consonant /ŋ/. This consonant is copied into the heavy reduplicative morpheme and is syllabified as a coda consonant. When occupying the coda position of the reduplicative morpheme syllable, the velar nasal /ŋ/ assimilates to the following onset consonant [p]. The velar nasal then becomes [m] after the assimilation process, while [p] remains in the onset syllable of the base. Nasal substitution, as mentioned above, is invisibly active in the environment of reduplicative morphemes. This situation is captured under the identity faithfulness constraint, which is RIGHT ANCHOR-BR. Since the optimal output in (d) is not ill-anchored, it is chosen as the winner. As we can see in the above tableau (16), RIGHT ANCHOR-BR is also crucial in ruling out other non-optimal candidates, hence it must be highly ranked.

As has been shown, the analysis of co-phonology can account well for the two reduplicative morphemes with identical categories, though they show different patterns of markedness reduction. In co-phonology, these different patterns are accounted for by reversing the markedness constraint in the ranking. This can be done by ranking the relevant markedness constraint above the faithfulness constraint in light reduplication, while in heavy reduplication the markedness constraint is ranked below the faithfulness constraint. This application is called ‘Markedness Reversal’, and is allowed in co-phonology. As demonstrated in the above tableaux, in (14), (15) and (16), the syllable markedness constraint NOCODA can only be satisfied in light reduplication, not in heavy reduplication. Therefore, this syllable markedness constraint should be ranked higher in light reduplication to ensure the reduplicative morpheme contains no coda. In contrast to light reduplication, NOCODA is ranked lower in the heavy one, since the reduplicative ends with a consonant. Therefore, by ranking NOCODA lower, a second consonant, which occupies the coda position of the reduplicative morpheme, is allowed to be present.

3. Indexed constraint theory: fixed ranking

This subsection will discuss how light and heavy reduplicative morphemes can be accounted for in indexed constraint theory. This theory, which was developed by Benua (1997a, b), Alderete (1999, 2000) and Itô and Mester (1999), uses a single fixed constraint ranking to define the grammar of the entire language. Constraints within this single fixed ranking are indexed to individual morphological contexts in which the constraints are split into many different indexed versions, such as MAX-C_{ROOT}, MAX-C_{AFFIX}, MAX-C_{BR} and so forth (cf. Inkelas and Zoll, 2007: 134). Later in this subsection, we will see that the many different indexed versions of this constraint cannot adequately account for the case of morphologically conditioned phonology in Malay reduplication.

In what follows, we see how indexed constraint theory handles light and heavy reduplicative morphemes. In work such as that of Alderete et al. (1999), McCarthy and Prince (1994a, 1999) and Steriade (1988), it is said that reduplicative morphemes always illustrate an unmarked structure, or what we call the

Emergence of the Unmarked (TETU) (cited in Downing, 2006: 41). Those previous works claim that a marked structure is optimal in the base output, and is non-optimal in reduplicative morphemes. As we observe in the data presented in (2), the reduplicative morphemes in both groups are monosyllabic in size. The reduplicative morphemes in (2a) contain no coda consonant, while the reduplicative morphemes in (2b) do. In Malay, a light syllable (i.e. Cə) is claimed to be a less marked syllable structure than a heavy one (i.e. CəC) (Teoh, 1994; Ahmad, 2005). It is worth mentioning that both marked (i.e. heavy syllables) and unmarked (i.e. light syllables) structures are patterns of reduplicative morphemes in Malay, as presented in (2). The two patterns of reduplicative morphemes show that the same morphological category has different patterns of markedness.

Before we see how the situation of markedness distinction in Malay reduplication is handled in indexed ranking, let us consider a well-known instance from Ilokano, which also has two reduplication patterns, i.e. light and heavy:

(17). Ilokano light and heavy reduplication (Hayes and Abad, 1989: 357, cited in Downing, 2006: 11)

(a) Heavy reduplication

kaldín ‘goat’	<u>kal</u> -kaldín ‘goats’
púsa ‘cat’	<u>pus</u> -púsa ‘cats’
sájit ‘to cry’	?ag- <u>san</u> -sájit ‘is crying’
trabáho ‘to work’	?ag- <u>trab</u> -trabáho ‘is working’

(b) Light reduplication:

bunéŋ ‘kind of knife’	si- <u>bu</u> - bunéŋ ‘carrying a <i>bunéŋ</i> ’
sájit ‘to cry’	?agin- <u>sa</u> -sájit ‘pretend to cry’
pandilín ‘skirt’	si- <u>pa</u> -pandilín ‘wearing a skirt’
trabáho ‘to work’	?agin- <u>tra</u> -trabáho ‘pretend to work’

The markedness distinction in Ilokano reduplication, as exemplified above, has been accounted for by analysing the light reduplicative morpheme as an affix, and the heavy reduplicative morpheme as a root (see Downing, 2006: 243). This is done by assuming that the relative markedness and the morphological category have a direct correlation between them (ibid.). The following tableau demonstrates the analysis:

(18). Indexed ranking for Ilokano light and heavy reduplication (from Downing, 2006: 244)

/RED _{AFFIX} -trabaho/	MAX-IO	MORPH-SYLL	MAX-BR-ROOT	NO CODA	MAX-BR-AFFIX
a. tra-trabaho		*			****
b. trabaho-trabaho		*!*			
c. trab-trabaho		*!		*!	***
d. trab-trab	*!*			**	
/RED _{ROOT} -trabaho/	MAX-IO	MORPH-SYLL	MAX-BR-ROOT	NO CODA	MAX-BR-AFFIX
e. trab-trabaho		*	***	*	
f. trabaho-trabaho		*!*			
g. tra-trabaho		*	****!		

As can clearly be seen in the above tableau, light and heavy reduplicative morphemes are labelled as affix and root, respectively, and they are analysed in a single fixed constraint ranking. Observe that the faithfulness constraint MAX-BR is split into two indexed versions of constraints, i.e. MAX-BR-ROOT and MAX-BR-AFFIX.

The analysis of single indexed constraint ranking on the two patterns of Ilokano reduplication seems to work well as the correct optimal outputs are obtained. The analysis does however pose a problem to the canonical morpheme shape of the language. In Ilokano, roots are claimed to be canonically disyllabic (Rubino, 2005). As Rubino (ibid.) shows, there are also disyllabic reduplicative morphemes in Ilokano, as well as monosyllabic. If the heavy reduplicative morphemes are labelled as roots, as proposed in the analysis

above, then one might have difficulty in distinguishing between them as the roots (as in the heavy reduplicative morphemes above) are smaller than the disyllabic reduplicative morphemes (cited in Downing, 2006). Thus, labelling a heavy reduplicative morpheme as a root is not the best way to account for the two patterns of reduplicative morphemes in Ilokano. Therefore, this case has been put forward for a more plausible solution, and co-phonology analysis has been used to handle it. In Section 2, we have seen how co-phonology solves the problems more adequately.

Now, let us see how indexed constraint ranking accounts for Malay data. As was mentioned, a heavy syllable is the marked structure in Malay. It is not preferred as a pattern of reduplicative morphemes, therefore it is non-optimal. This syllable structure only becomes optimal in the base output. Because of this, a heavy reduplicative morpheme in Malay is labelled as a root. In contrast, a light syllable, which is optimal to be the pattern of reduplicative morphemes, is analysed as an affix. The following tableaux demonstrate the situation just mentioned:

(19). Indexed ranking for light and heavy reduplicative morphemes in Malay

/RED _{AFFIX} -budak/	MORPH-SYLL	REDUCE	MAX-BR-ROOT	NO CODA	MAX-BR-AFFIX
a. bu-bu.daʔ	*	*!			***
b. [☞] bə-bu.daʔ	*				****
c. bud-bu.daʔ	*	*!		*	
d. bu.daʔ-bu.daʔ	**!			*	
e. bəʔ-bu.daʔ	*			*!	***
/RED _{ROOT} -budaʔ/	MORPH-SYLL	REDUCE	MAX-BR-ROOT	NOCOD A	MAX-BR-AFFIX
a. bu-bu.daʔ	*	*!	***		
b. bə-bu.daʔ	*		****!		
c. bud-bu.daʔ	*	*!	**	*	
d. bu.daʔ-bu.daʔ	**!	*		*	
e. [☞] bəʔ-bu.daʔ	*		***	*	

In the above tableau analysis, the same constraint ranking correctly optimizes the candidates, [bə-bu.daʔ] and [bəʔ-bu.daʔ], both for light and heavy reduplication, respectively. However, the above analysis becomes problematic if we consider another pattern of heavy reduplication (see the data in (2), presented above). In the above tableau, we analyse that a base ends with a consonant stop, i.e. /k/. Now, we shall consider the other type, which ends with a nasal segment, such as /baraŋ/ → [bəm-baŋ], /pətaŋ/ → [pəm-pətaŋ], and so forth. I establish the following tableau for the case just mentioned:

(20). Indexed ranking for a heavy reduplicative morpheme which ends with a nasal segment

/RED _{ROOT} -pətaŋ/	MORPH-SYLL	REDUCE	MAX-BR-ROOT	NOCODA	MAX-BR-AFFIX
a. pə-pə.taŋ	*		***!		
b. [☞] pət-pə.taŋ	*		**	*	
c. pə.taŋ-pə.taŋ	**!	*		*	
d. [☞] pəm-pə.taŋ	*		***!	*	

It is clear from the above tableau that a fixed constraint ranking, as proposed in co-indexed constraint analysis, poses a problem in accounting for Malay partial reduplication, particularly its heavy reduplication. The constraint ranking wrongly optimizes a coda consonant, [t], in CəC reduplicative morphemes, as in *[pət-pə.taŋ].

As well as the problem mentioned above, the heavy reduplicative morpheme, which is labelled as a root, poses a problem to Malay grammar. If this type of reduplicative morpheme is considered a root, we might have a problem differentiating between a root word and a reduplicative root (as in the heavy reduplicative morpheme above). This analysis is thus not the best way to analyse the two patterns of partial reduplication in Malay, whereby heavy reduplication contains two different types of reduplicative morphemes.

4. Conclusion

The analysis above clearly shows that the two patterns of reduplicative morphemes, i.e. light and heavy in Malay, can be adequately treated by applying co-phonology analysis. The idea of ‘Markedness Reversals’, as proposed in the theory, plays an important role in accounting for morphologically conditioned phonology cases such as this one. As claimed by Downing (2008), co-phonology is a sophisticated theory, as it assumes there is interaction between hierarchical morphological structure and phonological constraints. Along with the idea of markedness reversal, Cə and CəC patterns can be re-ranked in the constraint rankings of Malay, as every morphological construction is associated with its own phonological system, i.e. constraint ranking.

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