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A Reanalysis of Indonesian Stress*

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In *Linguistic Inquiry* 24.372-381, Abigail Cohn (1993) offers an analysis of Indonesian stress. She summarizes her account in the following passage:

> "I argue for ... rhythmic restructuring. Prince (1983) suggests such an account for simplified Hawaian, applying Move X (the Rhythm Rule), motivated by a eurhythmic avoidance of upbeats" (p. 43) and the desire to create "paradigmatic uniformity of initial stress" (p. 51). Following Prince's (1985) insight that destressing is actually Foot Assignment in a feature-changing mode, Kager (1989) proposes a similar analysis for English, creating word-initial stress through *Foot Reassignment*. Such restructuring can only apply if the head of the new foot to be created is a stray syllable. Foot Reassignment in this case serves what Kager terms the *delimitative* property of stress, marking the initial word boundary by making the initial syllable more prominent.
>
> "Following Kager, I propose that the initial dactyls in Indonesian are created through Foot Reassignment. Syllabic trochees are assigned right to left. Then Foot Reassignment applies to create initial dactyls .... In cases where an initial syllable is stressless, a syllabic trochee is reassigned word-initially. (Foot Reassignment is blocked if the foot is the only foot in the domain, the main stress, since it would violate the integrity of the main stress.) ...
>
> " ... Stress patterns in morphologically complex forms are generated by assigning syllabic trochees cyclically, with a single Destressing rule applying postcyclically to account for clashes by cyclic stress assignment. The Foot Reassignment rule applies on the first cycle only, since it affects only monomorphemic words. ...
>
> "This analysis is not radically different from one with two destressing rules; in effect, the first destressing rule has been replaced by Foot Reassignment. But it differs in two important respects. First, it allows us to maintain a strong ban on degenerate feet, predicted by the strong avoidance of content

* *Editors' note*: this paper deals with a problem also discussed in Michael Kenstowicz's paper in this volume. This paper was received in advance of Prof. Kenstowicz's paper, and thus does not respond or reply to it.

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> words consisting of a single syllable in Indonesian. In this sense it is consistent with Hayes's and Kager's goal of eliminating degenerate feet from the foot inventory. Second, the analysis directly captures the insight that stress systems such as that of Indonesian essentially exhibit alternating stress with a slight modification to allow regular initial stress. The creation of such regular initial stresses has the rhythmic advantages of avoiding an upbeat and delimiting the initial word boundary. These rhythmic concerns may explain the prevalence of the initial dactyl effect cross-linguistically." (378-9)

We believe that a simpler and more transparent account is available by taking advantage of the improvements in metrical theory introduced in Idsardi (1992). In particular, as shown below, every example treated by Cohn can be accounted for with the help of five rules: the four generated by the parameter settings in (3) plus rule (5).

Stress patterns for roots of varying lengths are given in (1), which corresponds to Cohn's (2).

1.	a.	óσ	cári	*search for*
	b.	σóσ	bicára	*speak*
	c.	ὸσóσ	bìjaksána	*wise*
	d.	ὸσσóσ	kòntinuási	*continuation*
	e.	ὸσὸσóσ	èrodìnamíka	*aerodynamics*
	f.	ὸσσὸσóσ	àmerikànisási	*Americanization*

Main stress falls uniformly on the penult; that is, the last stress is always more prominent than the rest. However, as this is of no relevance to the matters under discussion here, the distinction between main stress and secondary stress will be disregarded.

As Cohn points out, in monomorphemic words like those in (1) stress falls on the penultimate syllable and on every other syllable preceding the penult, "but words longer than four syllables with an odd number of syllables have an *initial dactyl*" (1f). According to Cohn, Indonesian exhibits "a strong avoidance of content words consisting of a single syllable" (p. 379). However, as shown by the examples in (2), reproduced from Cohn (1989, 170), the language does contain monosyllabic content words, and these are stressed rather than stressless.

2.	a.	cát	*print*
	b.	hák	*rights*

In the theoretical framework developed by Idsardi (1992) these facts are treated by the four rules induced by the parameter settings in (3).

3. *Edge Marking*:
   Place a Right parenthesis to the Left of the Right-most element (RLR)
   i.e. Ø →) / __ * #
   Place a Right parenthesis to the Right of the Left-most element (RRL)
   i.e. Ø →) / # * __

Iterative Constituent Construction (ICC):
Insert a left parenthesis for each pair of free elements iteratively from right to left
i.e. Ø → (/ __ * *

Heads: Right

Iterative Constituent Construction is universally constrained to build constituents composed of at least two elements. In contrast, the *Edge Marking* rules can produce constituents containing only one element. It is important to note that the present theory differs from Halle & Vergnaud (1987) in that it eliminates parenthesis pairing—a single parenthesis can now serve to define a metrical constituent.

The stress assignments generated by the parameter settings in (3) on the examples in (1) are shown in (4).

4.

	*	*	* *	* *
	*)	*)*	*)*)*	*)(* *)*
a.	cát	b. cári	c. bicára	d. bì jaksána
	* *	* * *	* * *	
	*) *(**)*	*)(* *(* *) *	*)*(* *(* *)*	
e.	kòn tinuási	f. è rodìnamí ka	g. àmerikànisási	

The examples in (4a,b) are too short for *Iterative Constituent Construction* to apply, thus only *Edge Marking* is relevant in these forms. It is obvious that in monosyllabic words, the two *Edge Marking* parameters would each supply a parenthesis to the lone mark: Edge:RRL → *), and Edge:RLR →)*. In Idsardi (forthcoming) evidence is presented showing that vacuous parentheses (those parentheses not grouping stressable elements) are eliminated by universal convention. This convention eliminates the parenthesis in the sequence)* because the parenthesis does not group any stressable elements, as there are no elements to the left of the parenthesis. The net effect is that monosyllabic forms only show evidence of Edge:RRL, and comprise a constituent of a single element.

In bi-syllabic words the two *Edge Marking* rules will each place a parenthesis between the two marks, generating the sequence *))*. The vacuous

parenthesis convention of the preceding paragraph eliminates the second of these, since it does not group any stressable elements, and we get the constituency and stress assignment shown in (4a,b).

Turning now to the examples in (4c-g) we note that with the exception of trisyllabic words, (4c), the parameter settings in (3) generate the correct stress distributions. In particular, they ensure that words longer than four syllables with an odd number of syllables begin with a dactylic pattern, as in (4e,g). The dactylic pattern is not formally modelled by a dactyl (i.e. left-headed three element constituent), rather the second element does not belong to any constituent. This analysis is inconsistent with the proposal that forms are parsed exhaustively. This conclusion has also been drawn by Hayes (1991), McCarthy and Prince (1993) and others.

To account for the stress pattern of the trisyllabic stem (4c), we postulate (like Cohn) a rule of deletion "under clash." In the present theory clash can be defined in terms of the metrical constituents, so that the rule of clash resolution alters the metrical constituency itself, deleting a right parenthesis before a sequence of a single element and another right parenthesis. We state the rule more formally in (5).

5. $) \rightarrow \emptyset \; / \; \_\_ \; * \;)$

The rule in (5) thus has the effect of merging a degenerate constituent with the constituent to its left.

Interestingly, the stress patterns of Garawa (Furby (1974)) are nearly identical to those of the Indonesian monomorphemic words, with the exception that three syllable words have initial rather than penultimate stress, i.e., they also exhibit an initial dactylic pattern. One way of generating the Garawa stress patterns is to use the same settings in (3), but to delete the other parenthesis in clash, that is to substitute (6) for (5).

6. $) \rightarrow \emptyset \; / \;) \; * \; \_\_$

However, there are also other ways within the present theory to generate the stress patterns of Garawa, see Idsardi (1992).

In polymorphemic words in Indonesian, the stems preserve their stress patterns only partially, as illustrated in (7), cf. Cohn's (5) (the stems are marked in square brackets)

7.	a.	mən-[cat]-kán-ña	*paint it*
	b.	mən-[carí]-kan	*search for*
	c.	məm-[càɪi]-kán-ña	*search for it*
	d.	kə-[bìjaksaná]-an	*regulations*
	e.	məm-[bicará]-kan	*speak about*

f. məm-[bicàra]-kán-ña *speak about it*

As noted by Cohn, schwas (/ə/) are incapable of bearing stress in Indonesian. This is formally expressed in the theory by not allowing such syllable heads to be projected onto the grid. As a consequence, like other non-stressable elements of the string, such as consonants, schwas are invisible to the principles and parameters assigning metrical structure.

To account for the stress assignments in (7), a distinction must be made between monomorphemic and polymorphemic words. In Indonesian, stress is assigned in two stages: first to the root by itself, and then to the entire word. Formally, this is accomplished by dividing the phonological rules (and, in particular, rules of stress assignment) into two strata: cyclic and noncyclic (or post-cyclic), as proposed in Halle & Vergnaud (1987). Cyclic rules apply to each nested morphological constituent in turn; noncyclic rules apply only once to each word, after all cyclic constituents have passed through the cyclic rules. Furthermore, noncyclic stress assignment respects the cyclically assigned metrical structure. For other examples of languages with both cyclic and noncyclic stress assignment see Halle & Kenstowicz (1991).

We assume that in Indonesian, the stems are the only cyclic morphemes, and that all affixes are noncyclic. Further, we will assume that *Edge Marking* and *Iterative Constituent Construction* apply both cyclically and noncyclically, and that (5) applies noncyclically. Thus, in affixed words the cyclically assigned metrical structure will serve as input for yet another pass through the stress rules. This will generate the correct results, as shown in (8) (recall that schwas do not project onto the grid).

8. Form		Cyclic Edge/ICC	Non-Cyclic Edge/ICC	Clash/Head
a.	mən-[cat]-kán-ña	*)	*)*)*)	* *)*
b.	mən-[carí]-kan	*)*	*)*)*	* *) *
c.	məm-[càri]-kán-ña	*)*	*)(* *)*	* * *)(* *)*
d.	kə-[bìjaksaná]-an	*)(* *)*	*)(* *)*)*	* * *)(* * *)*
e.	məm-[bicará]-kan	*)*)*	*)*)*)*	* * *)*
f.	məm-[bicàra]-kán-ña	*)*)*	*)*)(* *)*	* *)(* *)*

As the derivations in (8) illustrate, the parameter settings in (3) and the rule in (5), which are independently motivated for stem stress assignment, account also for the assignment of stress to suffixed forms, provided that account is taken of the distinction between cyclic and non-cyclic rules and of their different manners of application. Rule (5) must apply simultaneously or iteratively from left to right, as (8e) shows.

The forms in (8) all involve prefixes containing schwa, and because schwas do not project onto the grid these prefixes never bear stress. Cohn 1989 notes that there is only one prefix containing a vowel other than schwa, the verbal passive marker /di-/. This prefix also never receives stress, but this is due to the application of (5), as shown in (9).

9. Form	Cyclic Edge/ICC	Non-Cyclic Edge/ICC	Clash/Head
a. di-[cat]-kán-ña *printed by someone*	*)	*) *) *) *	* * *) *
b. di-[koréksi] *corrected*	*) *) *	*) *) *) *	* * *) *

Notice that if (5) applied cyclically, the form in (9b) would incorrectly be predicted to have prefixal stress, as the cyclic application of (5) would bleed its application to the prefix. Because (5) must be ordered before *Head Projection*, it is possible for otherwise unexpected lapses to arise from the deletion of several sequential unary constituents, as shown by (8e) and (9a,b)[1].

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[1]The form *dòckumentasí-an* 'to document' provides an especially telling test for our proposal. The verb clearly derives fromt eh stem noun *dòkumentási* 'documentation' whose stress contour is derived in exactly the same manner as that of other five-syllable nouns (see, e.g *kòntinuasi* in (4e)) At the beginning of the noncyclic stratum we therefore have the grid structure:

```
 *) *  (*  *)  *  *
do ku menta  si -an
```

Application of *Edge Marking* in the noncyclic stratum yields

```
*) *  (*  *)  *) *
```

The deletion of the penultimate parenthesis by rule 5 and *Head marking*, the produce the correct stress contour:

```
*          *
*) *  (*   *  *) *
doku men  ta si-an
```

Exactly the same effect was observed in Diyari stress by Poser (1989). Diyari also has a similar morphological conditioning of stress, in Poser's analysis, "binary quantity-insensitive left-dominant feet are constructed from left to right, with a left-dominant word tree, together with some proviso for preventing stress on an odd-numbered final syllable, such as defooting of degenerate feet. ... Each morpheme is stressed word-internally just as if it stood alone..." Examples of some Diyari words are shown in (10).

10.	a	1	yá	*and*
	b.	2	káṇa	*man*
	c	3	mánkaṛa	*girl*
	d.	4	ŋándawàlka	*to close*
	e.	2+1	káṇa-ṇi	*man-loc*
	f.	2+2	káṇa-wàra	*man-pl.*
	g.	2+4	táyi-yàtimàyi	*to eat-opt*
	h	3+1	púḻuru-ṇi	*mud-loc.*
	i.	3+2	pînadu-wàṛa	*old man-pl.*
	j.	4+2	ŋándawàlka-tàdi	*to close-pass.*
	k.	3+1+2	púḻuru-ṇi-màta	*mud-loc.-ident.*
	l.	3+2+2+1	yákalka-yìrpa-màli-na	*ask-ben.-recip-part.*

As (10a) shows, the one monosyllabic word in Diyari does receive stress, like the monosyllabic words in Indonesian. To account for the Diyari stress system, we will assume that all morphemes are cyclic, that in Diyari cyclic stress assignment also respects previously assigned structure, and that the Diyari parameter settings are those in (11).

(11) ***Cyclic***:

Edge: Place a Right parenthesis to the Right of the Right-most element (RRR)

i.e. Ø →) / * __ #

ICC: Insert a right parenthesis for each pair of free elements iteratively from left to right

i.e. Ø →) / * * __

Noncyclic:

Clash Resolution:

) → Ø / __ *) (= (5))

Heads: Left

The assignment of *Edge Marking* and ICC to the cyclic stratum ensures that every morpheme ends a metrical foot, and that the binary pattern generated by the

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which differs from an unsuffixed word of six-syllables such as *èrodìnamíka* (cf. (4f)). <We thank Michael Kenstowicz for supplying to us the new data discussed in this note.>

ICC is calculated as if on each morpheme separately. In the non-cyclic stratum any unary constituent is merged with the one to its left, as Diyari also employs (5). Derivations are shown in (12).

12.		Cycle 1	Cycle 2	Non-Cyclic
a.	yá	*)		* *)
b.	mánkaṛa	* *)*)		* * * *)
c.	ŋándawàlka	* *)* *)		* * *)* *)
d.	púḷuru-ṇi	* *)*)	* *)*)*)	* * * * *)

Although monosyllabic morphemes are unary constituents, they will not be affected by (5) because such words comprise only a single constituent, and thus there is no constituent to the left to be merged with. This correctly predicts that such monosyllabic words are stressed, in both Indonesian and Diyari.

It should be noted, however, that languages can lack rules such as (5); that is, clash is not universally resolved. For example, in Tauya (MacDonald 1990 p. 84) "[p]rimary stress falls on the final syllable in a word, with secondary stress on preceding alternate syllables. The initial syllable in a word is never without stress; if a word is polysyllabic, the initial syllable always receives secondary stress, *even if this results in adjacent stressed syllables*." [emphasis added].

The present account of Indonesian stress contains only one rule of *Clash Resolution*, in contrast to the analyses considered by Cohn, which involve either two Destressing rules or a *Destressing rule* and a rule of *Foot Reassignment*. In addition, under her analysis, *Foot Reassignment* cannot apply generally; instead it must be constrained to operate only on the *first* cycle. Further, some stipulation must be made to abrogate the ban on degenerate feet in the case of monosyllabic words. Rule (5), in comparison, applies across the board, just prior to the projection of heads onto the next line of the grid, and correctly accounts for monosyllabic words. Thus, the account given here is strictly bottom-up, and entirely straight-forward. The lowest line of the grid is calculated in its entirety before the next line is projected. No appeal is made to higher prosodic levels, nor to such functional considerations as maintaining the "paradigmatic uniformity" of initial or main stresses.

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