Variable Syllable Weight and Quantity-Insensitive Allomorphy in Shipibo*

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(A) Shipibo, a Panoan language spoken in Eastern Peru, displays two superficially contradicting facts:

- Quantity-insensitive footing:
  1. Disyllabic feet run throughout the Prosodic Word (PrWd).
  2. Rhythmic allomorphy:
     → The second vowel of the suffix ‘again’ alternates: -ribi ~ -riba. It surfaces as [a] when it is in an odd syllable but as [i] when is in an even syllable (Lauriault 1948, Faust 1973, Loriot 1993).
     → The ergative suffix also alternates. It surfaces as -n when added to a noun with an even number of syllables but as -nin when added to a noun with an odd number of syllables.

- Quantity-sensitive stress:

(B) Rosenthall & van der Hulst’s (1999) and Morén’s (1999, 2000) works within Optimality Theory (P&S 1993) have shown that the weight of closed-syllables can be contextually variable within a single language. The present research extends their work by integrating the role that Grouping Harmony (Prince 1991) plays in accounting for languages like Shipibo.

Closed syllables show contextually variable weight in order to satisfy Grouping Harmony (*(HL)), Weight-to-Stress Principle (WSP), and disyllabicity in feet (FtBin).

Variable Weight of Closed-Syllables in Shipibo

(1) a. CVC.CV → ([L,L])
b. CV.CVC → ([L,H])
c. CVC.CVC → ([L,H])

* I would like to thank Akinbiyi Akinlabi, Birgit Alber, Markus Hiller, Paul de Lacy, Steve Parker, Alan Prince and Bruce Tesar for their comments on key aspects of this analysis. I have also benefited from the questions and comments of the Michigan Linguistic Society 2003 and the Workshop of American Indigenous Languages 2004 audiences. The funds for the Shipibo fieldwork (2002-2003) were provided by Rutgers University (José Camacho and Liliana Sanchez). Any errors are my own.
1 About Shipibo

a) Stress
- Stress is realized as high pitch.
- Secondary stresses are not reported to occur.

b) Phonotactics
- Shipibo has the following segmental inventory:

(2) Consonants: / p, t, k, b, s, j, ʃ, ts, tʃ, r, m, n, w, y, h /
Vowels: / i, i, o, a /

- Long vowels only occur in monosyllabic nouns and in some monosyllabic verbs.
- Onsets and codas are optional. Complex onsets and codas are disallowed.
- Coda Condition: only [s, ʃ, ʃ, n] surface in coda position.
- Although stops cannot surface in coda, stress behaves as if they were present creating metrical opacity. In this talk, I put this issue aside.

2 Quantity-Insensitive Footing
- Panoan languages are characterized by a number of segmental rhythmic-phenomena.
  - Amahuaca (Loos 1999): nasals in the onset of even syllables take on a plosive release.
- In Shipibo, the suffix ‘again’ alternates between -\textit{ribi} \sim -\textit{riba} depending on the metrical structure of the PrWd. It surfaces as -\textit{riba} when the suffix is parsed between two feet but surfaces as -\textit{ribi} when parsed within a single foot. See (3) to (5).

(3) (pi -\textit{ri})(ba -\textit{ki})
  - eat -again -past_tense
  - ‘Ate again’ (Lauriault 1948)
The same alternation is obtained by adding suffixes between a root and the suffix ‘again’. See (6) and (8).

(6) (ka -ri)(ba -ki)
    Go -again -past_tense
    ‘Went again’ (Lauriault 1948)

(7) (ka -ma) (-ri.bi) -ki
    Go -causative -again -past_tense
    ‘Made him/her to go again’ (Elías-Ulloa 2003)

(8) (ka -ya)(ma -ri)(ba -ki)
    Go -negation -again -past_tense
    ‘Do not go again’ (Elías-Ulloa 2003)

The ergative suffix is sensitive to foot structure, too. It surfaces as -n when added to a noun with an even number of syllables and as -nin when added to a noun with an odd number of syllables. See data in (9) and (10).

(9) (ba.ki) ‘Child’
    (ba.ki-n) ‘Child (ergative)’ (Loriot 1993)

(10) (a.ta)pa ‘Hen’
    (a.ta)(pa.-nin) ‘Hen (ergative)’ (Loriot 1993)
Crucially in (11) and (12), closed-syllables do not form their own foot; that is, footing is Quantity-Insensitive.

(11) (a)  (miš.ti)(-ři.bi) -ki
(b)  * (miš)(ti. -ři)(ba. -ki)
Cut_his_hand -again -past tense
‘Cut his hand again’ (Lauriault 1948)

(12) (a)  (mís.ko -n)
(b)  * (mís)(ko.-nin)
‘Cramp (ergative)’ (Loriot 1993)

3 Quantity-Sensitive Stress

Closed syllables attract stress. Stress occurs on the second syllable, if closed; otherwise, on the first syllable.

(13) **Stress on the First Syllable**  |  **Stress on the Second Syllable**
--- | ---
a. ( 'ba.ki) ‘Child’  |  d. (wi.'täš) ‘Leg’
b. ( 'mis.ko) ‘Cramp’  |  e. (tšon.'kiš) ‘(Sp. of) Bird’
c. ( 'sa.pi)ton ‘(Sp. of) Fish’  |  f. (mis.'pan)mis ‘tamale-seller’
(Source: Loriot 1993)

Further evidence for the CVC-heaviness:

(14) a. / baki -n /  → (ba.'kin) ‘Child (ergative)’
b. / misko -n /  → (mis.'kon) ‘Cramp (ergative)’
(Source: Loriot 1993)
4 An Additional Puzzle

- Closed-syllables pattern with light syllables in odd positions. They do not form their own foot. However, syllables with long vowels do form their own foot.

Although most of verbal roots are disyllabic, there are few monosyllabic verbs with the shapes: CV, CVC or CVi. When the suffix ‘again’ is added immediately after those monosyllables, CVi-roots (bimoraic roots) form their own foot while both CVC-roots and CV-roots pattern together in grouping with the following syllable. This indicates that the initial closed syllable in (15) (second column) is not heavy and do not form its own foot.

(15)

<table>
<thead>
<tr>
<th>(i) CVi-root: / ti: /</th>
<th>(ii) CVC-root: / his /</th>
<th>(iii) CV-root: / pi /</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ti:)(-ri.bi)-ki</td>
<td>(his.-ri)(ba.-ki)</td>
<td>(pi.-ri)(ba.-ki)</td>
</tr>
<tr>
<td>* (ti:-ri)(ba.-ki)</td>
<td>* (his)(-ri.bi)-ki</td>
<td>* (pi)(-ri.bi)-ki</td>
</tr>
</tbody>
</table>

Work-again-past      See-again-past      Eat-again-past

(Source: Lauriault 1948, Loriot 1993)

- Furthermore, while two closed syllables group together into a foot (see first column), a CVi-syllable cannot group together with a closed syllable (see second column).

(16)

<table>
<thead>
<tr>
<th>( mis. pan)(-ri.bi)-ki</th>
<th>( ti:)(-ṣon.-ri)(ba.-ki)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* (‘mis)(pan)(-ri.bi)-ki</td>
<td>* ( ti:-ṣon)(-ri.bi)-ki</td>
</tr>
</tbody>
</table>

Cook_tamale-again-past  Work-beneficial-again-past

(Source: Elias-Ulloa 2004)

- Closed-syllables in odd positions beyond the initial foot are not heavy, either. They do not form their own foot.

(17)

<table>
<thead>
<tr>
<th>(his.ma)(-ṣon.-ri)(ba.-ki)</th>
<th>(po.ta)(-ṣon.-ri)(ba.-ki)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* (his.)ma.(-ṣon)(-ri.bi)-ki</td>
<td>* (po.ta)(-ṣon)(-ri.bi)-ki</td>
</tr>
</tbody>
</table>

Show-beneficial-again-past  Throw-beneficial-again-past

(Source: Elias-Ulloa 2004)
5 Solution to the Conundrum

- The conundrum posed by Shipibo comes in two parts: its peculiar quantity-sensitive stress and the relation with the quantity-insensitive phenomenon of rhythmic alternation.

Both puzzles are solved by regarding the weight of closed syllables as positionally variable while respecting the disyllabic size of feet.

- The constraints FtBin, WSP and Grouping Harmony *(HL), when ranked over WBP in a language that allows closed syllables to be heavy (WBP >> DEP-µ), render the weight of closed syllables contextually variable while respecting the quantity-insensitive footing.

- Shipibo Ranking:

(18) *(HL), FtBin, WSP
       /       \
      /        \WBP
    /          \
DEP-µ,     TROCHEE
     /            \
    IAMB

- Constraint Definitions

(19) GROUPING HARMONY *(HL): Do not have a foot in which the size of the first syllable is greater than the size of the second. The syllable size is measured in moras (Prince 1991, Prince and Smolensky 1993).

(20) FOOT-BINARITY (FtBin): Feet are disyllabic (based on P&S 1993).

(21) WSP: If heavy, then stressed. (Prince 1991:2-4, P&S 1993)

(22) WBP: Coda consonants are moraic (Hayes 1989, 1994).

(23) DEP-µ: Output moras have input correspondents (McCarthy & Prince 1999).

(24) TROCHEE: Foot heads are left-aligned (P&S 1993).

(25) IAMB: Foot heads are right-aligned (P&S 1993).
5.1 / CV.CV / → ('L.L)

- Trochaic by default

/baki / → ('ba.ki) ‘child’

<table>
<thead>
<tr>
<th></th>
<th>TROCHEE</th>
<th>IAMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>( 'L.L )</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>( L.'L)</td>
<td>*</td>
</tr>
</tbody>
</table>

5.2 / CV.CVC / → (L.'H)

/witaş / → (wi.'taş) ‘leg’

<table>
<thead>
<tr>
<th></th>
<th>WBP</th>
<th>TROCHEE</th>
<th>DEP-μ</th>
<th>IAMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(L.'H)</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>('L.L)</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

5.3 / CVC.CV / → (‘L.L)

/misko / → (‘mis.ko) ‘cramp’

<table>
<thead>
<tr>
<th></th>
<th>*(HL)</th>
<th>FtBIN</th>
<th>WBP</th>
<th>TROCHEE</th>
<th>DEP-μ</th>
<th>IAMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(L.'L)</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>('H)L</td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c.</td>
<td>('H.L)</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

5.4 / CVC.CVC / → (L.'H)

/tʃonkiʃ / → (tʃon.'kiʃ) ‘(Sp.) bird’

<table>
<thead>
<tr>
<th></th>
<th>WSP</th>
<th>*(HL)</th>
<th>FtBIN</th>
<th>WBP</th>
<th>TROCHEE</th>
<th>DEP-μ</th>
<th>IAMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(L.'H)</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b.</td>
<td>(L.'L)</td>
<td></td>
<td></td>
<td>**!</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c.</td>
<td>('H)L</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d.</td>
<td>('H.L)</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>e.</td>
<td>('H.H)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>
As a result of the ranking in (18), Shipibo shows both Non-Uniformity of Foot-type; that is, it has both trochaic and iambic feet, and Non-Uniformity of Closed-Syllable Weight; that is, closed syllables can vary their weight according to the position where they occur.

Thus, the quantity of closed syllables is adjusted within disyllabic feet. Closed syllables surface heavy if they are stressed and if they do not form part of an (HL) foot; otherwise, they surface light.

As a consequence of the quantity adjustments, closed syllables are forced to be light in odd positions. This gives a straightforward explanation to the puzzle posed by the data in (15) to (17).

A faithfulness constraint, WEIGHT-IDENT-MONOSYLLABLE\(^1\), requiring that the vowel length in monosyllabic verb-roots be preserved in the output, outranks FTBIN. Thus, CV₁-syllables do not undergo quantity adjustments.

Furthermore, WSP and *(HL) must also outrank FTBIN since CV₁-roots do form their own foot. See tableau (30).

<table>
<thead>
<tr>
<th>(30)</th>
<th>/CV₁-CVC…/</th>
<th>WEIGHT-IDENT-MONOSYL</th>
<th>WSP</th>
<th>*(HL)</th>
<th>FTBIN</th>
<th>WBP</th>
<th>DEP-μ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>＊(H)(L…)</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(‘H.L…)</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>(‘H.H…)</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>(‘L.L…)</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) WEIGHT-IDENT-MONOSYLLABLE is an expositional device adopted here while further research is carried out to obtain a better understanding of the underlying factors motivating the behavior of long-vowels in monosyllabic roots.
6 Conclusion

- The account presented connects quite naturally the unusual stress pattern and the segmental foot-based phenomena observed in Shipibo, providing us with a straightforward explanation: both crucially depend on disyllabic feet.

What have we learned from Shipibo?

- Shipibo adjusts the quantity of closed syllables instead of shrinking the size of disyllabic feet.

In accounting for these adjustments is not only important to consider the role of Weight-to Stress Principle (Rosenthall, Sam and Harry van der Hulst (1999) and Morén (1999)) but also the role of Grouping Harmony (Prince 1991).

Shipibo: Quantity is adjusted to accommodate Foot Size

(31) CVC.CV → (L.L), but not *(H)L, it violates FtBin

*(H.L), it violates Grouping Harmony

*(HH), it violates WSP

CV.CVC → (L>H)

CVC.CVC → (L>H), but not *(H)L, it violates FtBin

*(H.L), it violates Grouping Harmony

*(H.H), it violates WSP

*(L.L), it violates WBP twice

Typological Consequences: Quantity-(In)sensitive Footing.

Key to this analysis is the definition of FtBin: Feet are disyllabic (see (20)).

The idea behind the definition of FtBin is that feet aspire to have two syllables. Any divergence from that ideal is penalized. Thus, the (H)-foot, a foot formed by a single heavy syllable, emerges as the optimal solution only when both Heavy Weight constraints (constraints that require or allow heavy syllables, e.g. WBP, Weight-Ident) and Metrical Constraints (e.g. WSP, Grouping-Harmony) outrank FtBin.
Simplified typology for languages which have heavy syllables:

(32) **Type I**: Disyllabic Footing without Quantity Adjustments

\[ \text{FTBIN, HEAVY WEIGHT} \gg \text{METRICAL CONSTRAINTS} \]

*Estonian (Kenstowicz 1994, Hayes 1995)*

a. 'lo.pe.tet.ti:n \(\Rightarrow\) (L.L)(H.H)
b. 'so:.ye.mat.tel \(\Rightarrow\) (H.L)(HH)
c. 'pi.mes.ta.vas.se \(\Rightarrow\) (L.H)(LH)L

(33) **Type II**: Disyllabic Footing with Quantity Adjustments

\[ \text{FTBIN, METRICAL CONSTRAINTS} \gg \text{HEAVY WEIGHT} \]

*Shipibo (Loriot 1993)*

a. 'ba.ki \(\Rightarrow\) (L.L) c. wi.'tas \(\Rightarrow\) (L.H)
b. 'mis.ko \(\Rightarrow\) (L.L) d. t\(\acute{s}\)on.'ki\(\grave{s}\) \(\Rightarrow\) (L.H)

*Yidiny (Dixon 1977, Hayes 1997)*

a. ('wur.gu)'lu\(\acute{n}.gu) \(\Rightarrow\) (L.L)(L.L)
b. (gu.'da)(ga.'ni\(\acute{g}\)) \(\Rightarrow\) (L.H)(L.H)

(34) **Type III**: Quantity-Sensitive Footing: (H)-foot allowed.

\[ \text{HEAVY WEIGHT, METRICAL CONSTRAINTS} \gg \text{FTBIN} \]

*Caïrene Classical Arabic (Prince 1991, Hayes 1995)*

a. ë.a.ja.'ra.tu \(\Rightarrow\) (L.L)(L.L)
b. ?ad.'wi.ya.tu \(\Rightarrow\) (H)(L.L)L
c. ha:.'dâ:.ni \(\Rightarrow\) (H)(H)L
7 Appendix: An Account for the Rhythmic Allomorphy in Shipibo

7.1 The -riba ~ -ribi Allomorphy

- I assume the suffix ‘again’ has two underlying representations: /-riba/ and /-ribi/.
- The grammar selects the right allomorph according to the ranking of constraints.

Constraints:

(35) IDENT-V: Correspondent vowels are identical in features (McCarthy and Prince 1999)

Constraints on Foot Headiness and Sonority (Based on Kenstowicz 1996, De Lacy 2002)

(36) *i/Head >>…>> *a/Head
(37) *a/NonHead >>…>> *i/NonHead

- Ranking (In the tableaux below, the relevant heads are underlined):

(38)

\[
\text{IDENT-V} \\
\text{\underline{*a/NonHD}} \quad \text{\underline{*i/Hd}} \\
\text{\underline{*i/NonHD}} \quad \text{\underline{*a/Hd}}
\]

/ tita/ ‘mother’ (Loriot 1993)

<table>
<thead>
<tr>
<th></th>
<th>/ tita/</th>
<th>IDENT-V</th>
<th>*a/NonHD</th>
<th>*i/NonHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(\text{ti.ta})</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(\text{ti..ti})</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>/ tita/</th>
<th>IDENT-V</th>
<th>*i/Hd</th>
<th>*a/Hd</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(\text{ti.ta})</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(\text{ti..ti})</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

- The alternation -ribi ~ -riba

(yo.no)(-\text{ri.bi})-ki ‘(he) commanded it again’ (Lauriault 1948)

<table>
<thead>
<tr>
<th></th>
<th>(i) / yono -ribi -ki/</th>
<th>IDENT-V</th>
<th>*a/NonHD</th>
<th>*i/NonHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(\text{yo.no})(-\text{ri.bi})-ki</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(\text{yo.no})(-\text{ri.ba})-ki</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(ii) / yono -riba -ki/</th>
<th>IDENT-V</th>
<th>*a/NonHD</th>
<th>*i/NonHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>c.</td>
<td>(\text{yo.no})(-\text{ri.ba})-ki</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>(\text{yo.no})(-\text{ri.bi})-ki</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
(yo.mi)(tso.-ri)(ba -ki) ‘(he) stole it again’ (Lauriault 1948)

<table>
<thead>
<tr>
<th></th>
<th>(i) /yomitso -ribi -ki/</th>
<th>IDENT-V</th>
<th>*i/HD</th>
<th>*a/HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>...(tso.-ri)(bi.-ki)</td>
<td>!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>...(tso.-ri)(ba.-ki)</td>
<td>!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>*(i) /yomitso -riba -ki/</td>
<td>IDENT-V</td>
<td>*i/HD</td>
<td>*a/HD</td>
</tr>
<tr>
<td>d.</td>
<td>...(tso.-ri)(ba.-ki)</td>
<td>!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.2 The Ergative Suffix Allomorphy

- For the ergative suffix, I also assume it has two underlying representations: / -n / and / -nin /. The grammar chooses the correct allomorph.
- Ranking:

(43) \( \text{FTBIN, MAX-SEG, DEP-SEG} \gg \text{PARSE-}\sigma, *\text{CODA} \)

‘(Sp.) Fish’ (Loriot 1993)

<table>
<thead>
<tr>
<th></th>
<th>sapi/ton/</th>
<th>FTBIN</th>
<th>MAX-SEG</th>
<th>DEP-SEG</th>
<th>PARSE-\sigma</th>
<th>*CODA</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>(ʼsapi)ton</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>(ʼsa.pi)(to.ni)</td>
<td></td>
<td>!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>(ʼsa.pi)to</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>(ʼsa.pi)</td>
<td></td>
<td><em>!</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>(ʼsapi)(ton)</td>
<td></td>
<td>!</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

- The alternation -n ~ -nin

(ba.'kin) ‘Child-ergative’ (Loriot 1993)

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<th>baki -n/</th>
<th>MAX-SEG</th>
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<th>PARSE-\sigma</th>
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(‘a.ta)(pa.nin) ‘Hen-ergative’ (Loriot 1993)

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