

Unordered Morphology: The Problem of Axininca Reduplication

Author(s): Cari Spring

Proceedings of the Sixteenth Annual Meeting of the Berkeley Linguistics Society: Special Session on General Topics in American Indian Linguistics (1990), pp. 137-157

Please see “How to cite” in the online sidebar for full citation information.

Please contact BLS regarding any further use of this work. BLS retains copyright for both print and screen forms of the publication. BLS may be contacted via <http://linguistics.berkeley.edu/bls/>.

The Annual Proceedings of the Berkeley Linguistics Society is published online via [eLanguage](#), the Linguistic Society of America's digital publishing platform.

Unordered Morphology:
The Problem of Axininca Reduplication*
Cari Spring
University of Arizona

This paper is primarily concerned with the implications of reduplication in Axininca Campa² for the question of how morphology is organized. The Axininca data show that unordered morphology, for example as assumed in the theory of Lexical Phonology & Morphology (Kiparsky, 1982, 1985; Halle and Mohanan, 1985; Mohanan, 1986), can account for the behavior of the prefix and the verbal stem in reduplication, but cannot explain 'augmentation' in reduplication (or other Axininca morphology). Reduplication is not simply affixation of a constituent (to a base) plus copy and association as is assumed by many researchers since Marantz (1982; eg. Levin, 1983; Broselow and McCarthy, 1984; McCarthy and Prince, 1986, 1989; for alternative views see Clements, 1985; and Steriade, 1988). Reduplication appears to apply cyclically (like phonology), but is morphologically interpreted. This behavioral similarity between phonology and morphology suggests that these two components are not necessarily partitioned in the lexicon.

Section 1 provides preliminary facts about Axininca and 2 gives the reduplication facts in two dialects of Axininca. Section 3 reviews the assumptions of one robust model of morphology, Lexical Morphology and Phonology, and 4 demonstrates the problem of Axininca reduplication for this unordered, partitioned view of morphology. However, it is shown that use of extraprosodicity (Ito, 1986; McCarthy and Prince, 1986, 1989) can resolve the ordering problems in Axininca morphology. Section 5 provides data from 'augmentation' in reduplication and modal morphology, and 6 shows these data are hopelessly problematic to an unordered, partitioned view of morphology. It is concluded that a processual model (eg. Anderson, 1989) provides a theory of morphology in which the Axininca data might be explained.

1. Preliminaries

The syllable template of Axininca is basically CV(V)(N). Onsets are required in all but word initial position; the optional nasal coda surfaces only if a stop or affricate follows, and takes its place of articulation from the following segment.

(1) Axininca syllable structure: CV(V)(N)

| | | | | |
|------|-------------|------------------|------------|--------------|
| CV | sito | 'monkey' | V opaayaa | 'beach' |
| CVV | taanica | 'I don't know' | VV aariiti | 'black bird' |
| | tairi | 'flowering tree' | | |
| CVN | masongi | 'dumb' | VN inkiti | 'sky' |
| CVVN | phiiriinphi | 'palm' | | |

Some person prefixes are given in (2); as shown, the realization of a prefix is dependent upon the initial segment of a following morpheme, and the 3 singular masculine may be realized with no overt marker.

| (2) <u>Person Prefixes</u> | | <u>allomorphy</u> | |
|----------------------------|----------------|-------------------|----------|
| a | no/n 1 (sg) | no / __ C | n / __ V |
| | i/h 3 masc | i / __ C | h / __ V |
| | ∅ 3 masc | | |
| | a 1 pl (excl.) | a / __ C | ∅ / __ V |

Two dialects of Axininca are to be considered here. Data from the first dialect, Axininca 1, is from the published work of Payne (1981). Data from the second dialect, Axininca 2, is from the unpublished fieldnotes of Payne and Spring (1989).

2. Axininca Reduplication

Payne (1981) provides data on Axininca 1 reduplication in the 1 singular future continuative (and the 3 singular masculine, v. section 5); reduplication is glossed as in (3):

(3) Reduplication gloss

n(o) - N- stem+redup -([a]) -wai - t - i
 1st future more and more ([epen])contin-[epen]-future
 "I will continue to ___ more and more" (Payne 1981)

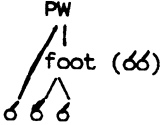
Some forms cited by Payne are given in (4):³

(4) Axininca 1 reduplication (Payne, 1981:144)

| <u>verb</u> | <u>reduplicated forms</u> | <u>gloss</u> |
|-------------|------------------------------|--------------|
| a. koma | no-N-koma-koma-wai-ti | paddle |
| b. kintha | no-N-kintha-kintha-wai-t-i | tell |
| c. thaanki | no-N-thaanki-thaanki-wai-t-i | hurry |
| d. kaawosi | no-N-kaawosi-kaawosi-wai-ti | bathe |
| e. naa | nonaa-nonaa-wai-t-i | chew |
| f. na | nona-nona-wai-t-i | carry |
| g. tho | nontho-nontho-wai-t-i | kiss |
| h. asi | nasi-nasi-wai-t-i | cover |
| i. aasi | naasi-nasii-wai-t-i | meet |
| j. apii | napii-napii-wai-t-i | repeat |

The reduplication template in Axininca 1 is assumed to be the Prosodic Word (Spring, to appear, in progress; for discussion of 'Prosodic Morphology', see McCarthy and Prince, 1986, 1989).

(5) The Prosodic Word Reduplication Template in Axininca

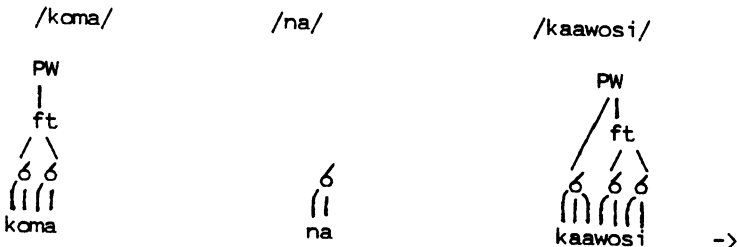


The Prosodic Word (hereafter PW) is assumed to be the template in Axininca reduplication as two or three syllables can reduplicate; cf. (4a-c) with (4d). The PW has a minimal realization, a disyllabic foot, *oo*, i.e. the minimal prosodic word is *oo*, demonstrated by the fact that at least two syllables must reduplicate (all forms). Finally, the person prefix reduplicates only if the stem cannot fulfill a CVCV, that is a *oo*, template; compare (4a-d) with (4e-j). The problem is to explain reduplication of the person prefix: since three syllables can reduplicate, (4d), and since the person prefix can reduplicate, (4e-j), why doesn't a form like /koma/ reduplicate as *[nokoma-nokoma-waitaki]?

To account for the behavior of the prefix in Axininca 1, reduplication must precede person prefixation, (4a-d) and must also follow prefixation (4e-j)--in that order. As demonstrated in (6), a stem in step 1 undergoes syllabification, footing, and PW construction (/na/, center column, cannot supply a PW). Reduplication in step 2 applies before person prefixation in step 3, thus explaining the failure of the prefix reduplication in forms where the verb alone can supply the PW base of reduplication (left and right columns):

(6) Reduplication in Axininca 1

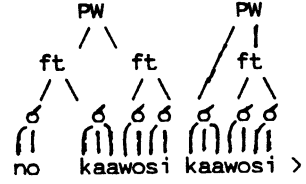
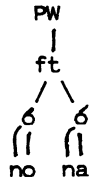
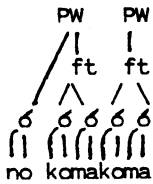
1. stems-- syllabification, footing, PW construction



2. reduplication

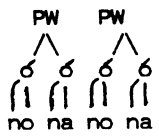


3. person prefixation, syllabification, footing, PW construction



4. reduplication

N/A



N/A

5. [nokomakama]

[nonanona]

[nokaawosikaawosi]

To account for prefix reduplication with a form like /na/, which applies only if the stem alone is not $\sigma\sigma$ or bigger, reduplication (step 4) must follow person prefixation (step 3).

In sum, in Axininca 1, reduplication must first precede reduplication (to explain the failure of the prefix to reduplicate) then must follow prefixation (to explain the reduplication of the person prefix). In other words, reduplication applies as soon as possible, to the stem domain first, and then to the domain consisting of the prefix and stem.

Reduplication in Payne's corpus consists of some twenty verbs with two different subject markings, the 1st person, marked by /no-, and the third person masculine, marked with a null prefix (Payne, 1981:145).⁴ Reduplication data from Axininca 2 is available in the context of several subject markers (Payne and Spring, 1989).

(7) exemplifies reduplication data from Axininca 2; as shown, several surface forms can occur for a single reduplication context. We see that two syllables must always reduplicate (all forms) and if a stem cannot supply two syllables the prefix must reduplicate (7d). Elsewhere, the prefix may or may not reduplicate (7a, b, e, g-i).

(7) Axininca 2 (Payne and Spring, 1989)

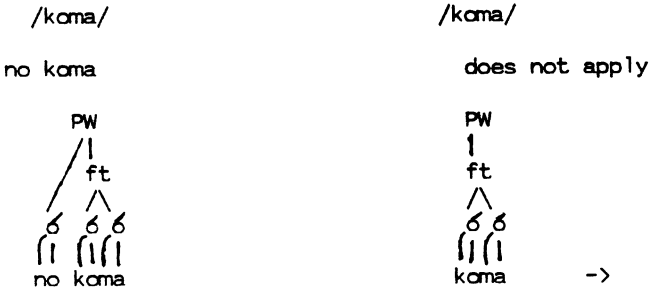
"...more and more"

- | | |
|-------------------------------|-------------------------------|
| a. koma | |
| i. nokomakomawaiḡi | I continue to paddle... |
| ii. nokomanokomawaiḡi | " |
| b. kis | |
| i. nokisakisawaiḡiro | I continue to be angry at her |
| ii. nokisanokisawaiḡiri | I continue to be angry at him |
| c. aasi | |
| haasihaasiwaiḡi | He continues to meet |
| naasinaasiwaiḡi | I continue to meet |
| d. tho | |
| nothonothowaiḡiri | I continue to kiss him |
| e. osampi | |
| i. hosampisampiawaiḡiri | He continues to ask him |
| ii. hosa(m) hosampiawaiḡiri | " |
| iii. hosampihosampiawaiḡiri | " |
| iv. nosampinosampiawaiḡiri | I continue to ask him |
| v. osampi osampiawaiḡi | He continues to ask |
| vi. osampisampiawaiḡi | " |
| f. sirik | |
| asirikasirikatiro | We (incl) will sew it |
| g. kaawosi | |
| i. ikaawosiwosiwaiḡa | He continues to bathe |
| ii. ika(a) ikaawosiwaiḡa | " |
| iii. ikaawosi ikaawosiwaiḡa | " |
| iv. ikaawosikaawosiwaiḡa | " |
| h. tasonk | |
| i. itasonkasonkaiḡiro | He continues to fan her |
| ii. itasonka itasonkawaiḡiro | " |
| i. kinkitha | |
| i. ikinkitha ikinkithawaiḡi | He continues to tell (it) |
| ii. nokinkithanokinkithawaiḡi | I continue to tell (it) |
| iii. nokinkithakinkithawaiḡi | " |

Formalization of reduplication in Axininca 2 follows in (8); I assume that the PW is the template specified by the reduplication operation. The same stem, /koma/ 'paddle', is reduplicated with and without the prefix; the left column assumes a scenario in which the morphological process of person prefixation applies before reduplication, and the right column assumes a scenario where prefixation follows reduplication.

(8) Reduplication in Axininca 2

1. person prefixation -- syllabify, footing, PW constructed



2. reduplicate



3. prefix -- syllabification, footing, PW constructed



4. [nokomanokoma] [nokomakoma]

In step 1 we see that the prefix may or may not concatenate with the stem before reduplication. If the prefix does concatenate, syllabification and PW construction appends the prefix into the PW (left column) and reduplication in step 2 copies the PW, a constituent dominating prefix and stem (left column). If person prefixation does not operate on the stem in step 1 (right column), then after syllabification the PW dominates only the stem; reduplication in step 2 copies the PW, in this case the stem alone (right column). In step 3 the prefix concatenates with the stem after reduplication (right column) and reduplication of the stem alone results in step 2. As person prefixation may optionally precede or follow reduplication in Axininca 2, the variable reduplication of the prefix is explained.

In Axininca 2 a stem like /tho/ cannot reduplicate until a prefix is appended to the stem as the requirements on the base, a PW, are not met until after prefixation. In case the stem cannot supply a PW base, reduplication must follow person prefixation.

Essentially in Axininca 2 reduplication precedes or follows person prefixation; no obligatory ordering between reduplication and person prefixation occurs. In other words, reduplication does not apply as soon as possible. (9) contrasts Axininca 1 and 2:

(9) Axininca Dialects

a. Axininca 1

1st: stem → reduplicate

2nd: prefix + stem → reduplicate

b. Axininca 2

(stem, prefix + stem) → reduplicate

On the phonological side, we see that two syllables must reduplicate and three syllables may reduplicate in both Axininca dialects; on the morphological side, in Axininca 1 the prefix does not reduplicate except to fill the minimal requirement, 66. In Axininca 2 the prefix optionally reduplicates independently of phonological requirements.

In sum, the reduplication template for Axininca 2, like Axininca 1, is a PW; the phonology of reduplication in these two dialects is identical. The point of departure between Axininca 1 and 2 is the ordering of person prefixation and reduplication in the dialects.

3. Unordered Morphology

The theory of Lexical Phonology and Morphology (hereafter LPM; Kiparsky 1982, 1985; Halle and Mohanan, 1985; Mohanan, 1986) holds that the morphology and phonology of a language are arranged into a series of strata, denoted as s1, s2, and sn in (10).

(10) Lexical Phonology and Morphology

| | <u>morphology</u> | | <u>phonology</u> |
|----|-------------------|---|------------------|
| s1 | m1 m2 m3 | → | p1 |
| | | | p2 |
| s2 | m4 m5 m6 | → | p3 |
| | | | : |
| : | | | |
| sn | | | |

The number of strata in a language is determined by the interaction of phonology and morphology in that language: when a subset of morphological forms undergoes a subset of phonological rules, those morphological operations are members of a single

stratum (in (10) m1, m2, m3, etc. stand for morphological operations, p1, p2, etc. for phonological operations).

Kiparsky (1982, 1985) assumes that all lexical strata are cyclic, that is phonology applies after each morphological operation. Other researchers however, have argued that lexical strata are divided into cyclic and non-cyclic strata (that is where phonological operations in non-cyclic lexical strata apply after all morphology has applied; eg. Halle and Mohanan, 1985; Mohanan, 1986). The question of cyclic and noncyclic strata is not here at issue; what is important is that all accounts of LPM assume that morphology within a stratum (cyclic or noncyclic) is unordered. Given m1, m2, m3, where m2 is a stem, and m1 and m3 are morphological operations, m1 can apply to m2 before m3, (11a), or m3 can apply to m2 before m1, (11b):

(11) Unordered Morphology

- a. m1 + m2 -> (m1 + m2) + m3
- b. m2 + m3 -> m1 + (m2 + m3)

Essentially then, LPM assumes that ordering is achieved by stratal organization, not by ordering within strata.

4. Unordered morphology and Axininca reduplication

The interaction of reduplication with person prefixation in Axininca 2 is fully compatible with unordered morphology, exemplified by LPM. In particular, the variable ordering of reduplication and person prefixation in Axininca 2 is consistent with the LPM view of morphology as shown in (12).

(12) Axininca 2 model of the lexicon under LPM

| <u>morphology</u> | | <u>phonology</u> |
|-----------------------------|----|------------------|
| stem, prefix, reduplication | -> | p.rules |
| | <- | |

If reduplication applies to the stem before person prefixation, as shown in (13.1), the stem alone reduplicates. But if person prefixation applies to the stem before reduplication, the prefix, being syllabified and then appended into the PW, reduplicates along with the stem, (13.2).

(13) Reduplication and person prefixation

- | | | | | |
|----------------------------|----|--------------|----|----------|
| 1. a. kama + reduplication | -> | kamakama | -> | p. rules |
| b. prefix | -> | nokamakama | <- | |
| 2. a. prefix + kama | -> | nokama | -> | p. rules |
| b. reduplication | -> | nokamanokama | <- | |

If we assume that morphology is organized into strata as proposed in LPM, reduplication and person prefixation are in the same stratum since the prefix can (and at times, must) reduplicate. The behavior of person prefixation and reduplication in Axininca 2 is unproblematic for, and in fact supports, a view of morphology where morphological processes (within a single stratum) are unordered.⁵

However Axininca 1 is problematic to any theory which assumes that morphology is unordered, as reduplication applies as soon as possible with respect to person prefixation. Assume that Axininca 1 has person prefixation and reduplication in a single stratum (as the prefix reduplicates if the stem alone is not a PW), illustrated in (12). If reduplication applies before person prefixation, the correct forms result, (14.1); but if prefixation applies before reduplication, (14.2), incorrect forms result:

(14) Reduplication and person prefixation in Axininca 1

- | | | | |
|----------------------------|------------------|----|----------|
| 1. a. koma + reduplication | -> komakoma | -> | p. rules |
| b. prefix | -> nokamakoma | <- | |
| 2. a. prefix + koma | -> nokoma | -> | p. rules |
| b. reduplication | -> *nokamanokoma | <- | |

Essentially, the problem is that reduplication appears to apply cyclically in Axininca 1, in the same way that phonological rules apply cyclically: an operation applies whenever its condition is met, i.e. "as soon as possible". Reduplication in Axininca 1 includes the prefix only when the stem alone cannot supply a PW.

Despite this apparent problem, if we wish to maintain the view that morphology is unordered there is a solution: we can assume that the prefix in Axininca 1 is extraprosodic (on morpheme extrametricality, v. for example, Hayes, 1980, 1981; Archangeli, 1984; Everett, 1988).⁶

(15) Prefix extraprosodicity in Axininca 1

| | | |
|-------------------------------|----|------------------|
| <u>morphology</u> | | <u>phonology</u> |
| [prefix], stem, reduplication | -> | p. rules |
| | <- | |

Because the prefix in Axininca 1 is extraprosodic it is not copied in the process of reduplication, as demonstrated in (16).

(16) Prefix extrametricality and LMP in Axininca 1

- | | | | |
|----------------------------|-----------------|----|----------|
| 1. a. koma + reduplication | -> komakoma | -> | p. rules |
| b. prefixation | -> [no]komakoma | <- | |
| 2. a. prefix + koma | -> [no]koma | -> | p. rules |
| b. reduplication | -> [no]komakoma | <- | |

In (16.1), the stem reduplicates and then undergoes person prefixation, resulting in the correct forms. In (16.2), the stem first undergoes person prefixation in (16.2a); since the prefix is extraprosodic it is invisible to syllabification and PW construction. In (16.2b) reduplication applies, copying the stem alone. I assume that prefix extraprosodicity is lost post-lexically.

Note that when a stem is smaller than the requisite base of reduplication, i.e. is smaller than a PW, the prefix reduplicates, (4e-j). A form like /na/ cannot fill a PW; when such a form is prefixed then, prefix extraprosodicity must fail, as prefix extraprosodicity would result in a 'subminimal' domain for the purposes of reduplication. In other words, if extraprosodicity would result in the absence of a requisite domain for reduplication, minimally a σ constituent, extraprosodicity fails. This assumption parallels the behavior of extrametricality found in the literature: when a domain is needed in stress phenomena, extrametricality normally operative in a language fails. For example, in languages with final syllable extrametricality, one syllable words are not extrametrical (v. Hayes, 1980, 1981).

In sum, we have seen that Axininca 1 and 2 each reduplicates a PW, but a difference in morphological ordering between person prefixation and reduplication appears to differentiate the two dialects. While reduplication is unordered with respect to person prefixation in Axininca 2, Axininca 1 appears to have reduplication ordered first before person prefixation then after person prefixation.

This apparent problem for unordered morphology however is resolved by calling upon prefix extraprosodicity in Axininca 1. Essentially, the prefix does not reduplicate in Axininca 1 because it is invisible to the prosodic processes of syllabification, footing and PW construction, and therefore does not copy in reduplication. Extraprosodicity fails if the domain required by reduplication, σ , cannot be met unless the prefix is included as the base of reduplication.

It should be noted that the use of extraprosodicity in Axininca 1 has been invoked in an unconstrained fashion. In the literature 'extrametricality' is used to designate an edge constituent which is invisible to a metrical process (and when morpheme extrametricality is cited elsewhere in the literature, the morpheme

is invisible to a metrical process; v. Archangeli, 1984, and Everett 1988). The notion of 'extraprosodicity' in Ito (1986) is developed to mark an edge segment invisible to the process of syllabification; extraprosodicity is phonologically motivated (see Ito, 1986). The use of extraprosodicity in Axininca 1 targets not a segment, rather a morphological constituent, causing morpheme (prefix) invisibility in a morphological operation (reduplication); no phonological property sanctions this use of extraprosodicity. Essentially then, extraprosodicity in Axininca 1 follows from no principled phenomenon, rather is stipulated to explain ordering within a single stratum.⁷ The alternative then is to assume that Axininca prefixation and reduplication morphology is extrinsically ordered within the same stratum.

5. Augmentation in Axininca Morphology

Data from unprefixated monomoraic or non-moraic stems, C, CV and V stems, with no overt subject prefix shows that extraprosodicity cannot solve the problem of morphological ordering in Axininca.

Monomoraic or non-moraic stems are stems which are not composed of a minimal word. As we have seen, when such forms are adjoined by a subject prefix, the prefix reduplicates to fill in the PW base requirement on reduplication; this phenomenon is explained in Axininca 1 by assuming that extraprosodicity fails if the domain of reduplication, a PW, cannot otherwise be supplied. However, overt prefixes are optional in Axininca. The 3 singular masculine, for example, can be realized with a null prefix; additionally, all verbs can have subject marking via a suffix, in which case the prefix is absent.

Payne's (1981) corpus of unprefixated monomoraic or non-moraic stems in Axininca 1 includes CVV, VCV and CV stems (17.1), while Payne and Spring provide V and C stems as well, (17.1) and (17.2):

(17) Monomoraic or non-moraic stems in Axininca

He has continued to __ (it) more
and more

1. Axininca 1 and 2

| | | |
|---------|-------------------|------------|
| a. naa | naanaawaitaki | chew |
| b. apii | api apiawaitaki | repeat |
| | aasi aasiawaitaki | meet |
| | asi asiawaitaki | cover |
| c. na | natanataawaitaki | carry (it) |

2. Axininca 2

| | | |
|------|----------------|---------------|
| d. i | ita itawaitaki | precede |
| e. h | haahaawaitaki | talk/see/sing |
| | caacaawaitaki | enter |
| p | paapaawaitaki | give |

The point of interest is that in (17.1c) and (17.2.d, e), where the stem is less than two moras, Augmentation supplies the base with a [ta] or [aa] sequence; when a base is two moras or bigger, (17.1a-b) Augmentation does not apply. Augmentation is formalized in (18) as a process of mora insertion until the bimoraic base is realized (and as we will see below, Augmentation occurs in a number of morphological processes, showing that this phonological rule is independent of the morphological process of reduplication). In (18a), a monomoraic stem is augmented by one mora to fulfill the bimoraic base; syllabification inserts an onset (the redundant consonant, [t], is regularly inserted when two vowels come together in the course of a morphological derivation; see Payne, 1981:55, for arguments that [t] and [a] are the epenthetic in Axininca).

(18) Augmentation

| | <u>stem</u> | <u>augment</u> | <u>syllabify</u> |
|----|-------------|----------------|--|
| a. | m | m m | $\begin{array}{c} \delta \quad \delta \\ \quad \\ m \quad m \\ \quad \\ na \quad ta \end{array}$ |
| | | | |
| | na | na | na ta |
| b. | | m m | $\begin{array}{c} \delta \\ \quad \vee \\ m \quad m \\ \quad \vee \\ n \quad a \end{array}$ |
| | h | h | n a |

In (18b), a stem lacking any moras receives two moras to fill out the bimoraic base; I assume that these two moras are segmentally filled by the redundant vowel [a] with a full geminate resulting. In the course of syllabification, the stem consonant and two augmented vowels are associated into a single syllable.

Though Augmentation data on unprefixated C and V stems from Axininca 1 is not available, we can deduce from the more detailed Axininca 2 data that in Axininca (both dialects) Augmentation operates on bases smaller than a bimoraic base to supply as output a bimoraic base. This bimoraic base will be disyllabic if the input is a syllabified CV stem, eg. /na/ -> [nata...], because [t] epenthesis applies between the syllabified vowel of the stem and the unsyllabified, augmented mora. But if the input to Augmentation is a C stem, the output will be a bimoraic, monosyllabic base, eg. /h/ -> [haa...].

What then is the hierarchy of operations used to fulfill the PW base so that reduplication can occur? Person prefixation always precedes Augmentation, as there are no cases of prefixed, augmented forms, *[no-nata-nata...]; augmentation is used as the default process to provide a PW base so that reduplication can apply in the event that neither the stem nor the stem+prefix supplies a PW base.⁸ In both dialects of Axininca then, person prefixation and reduplication must apply before Augmentation and reduplication:

(19) The ordering of Augmentation in reduplication

person prefixation, reduplication (unordered if prefix Ex
 † in Axininca 1)
 reduplication
 Augmentation
 reduplication

Before showing the problem of the Augmentation and reduplication data to models where morphology is unordered, it is interesting to examine the base requirements on other Axininca morphology, as we see that the bimoraic prosodic base is not found solely in the morphological process of reduplication. For example, two cases of 'modal' morphology, /-piro/ 'veracity' and /-wai/ 'continuative' require a bimoraic base.

The base requirement on verbs suffixed with /-piro/, 'veracity', is exemplified in (20). In the left column of (20a) we see that monomoraic or non-moraic stems suffixed with the infinitive do not undergo Augmentation (data are taken from Payne, 1981 and Payne and Spring, 1989; data from C and V stems is taken from Payne and Spring).⁹ But in the right column of (20a) we see that when /-piro/ is suffixed to the stem, Augmentation operates to fill out a bimoraic base (and this stem can subsequently undergo infinitive suffixation). (20c) shows that stems with two moras do not undergo Augmentation when the 'veracity' operation applies; and (20b) shows that prefixed monomoraic stems also do not undergo Augmentation; rather the prefix + stem satisfies the bimoraic requirement on the verb stem.

(20) Piro 'veracity' suffixation, class: manner modal

| | | |
|-------------------------------------|--------------------------------|----------------------|
| a. na-t-aan ^h i | nata-piro-t-aan ^h i | to (really) carry |
| i-t-aan ^h i | ita-piro-t-aan ^h i | to (really) precede |
| h-aan ^h i | haa-piro-t-aan ^h i | to (really) see/talk |
| b. no-na-piro-t-i/*no-nata-piro-t-i | | I will carry it well |
| c. ii-t-aan ^h i | ii-piro-t-aan ^h i | to (really) name |
| koma-t-aan ^h i | koma-piro-t-aan ^h i | to (really) paddle |

Augmentation of the base in some modal morphology then is behaviorally identical to reduplication: bases with fewer than two moras undergo Augmentation, but if an overt prefix is available to fill the moraic requirement of the base, it does; thus person prefixation must precede Augmentation. In the absence of a person prefix, monomoraic or nonmoraic bases undergo Augmentation.

6. The problem of unordered morphology and Augmentation

What do we know about Axininca morphology and Augmentation? We know that 1) in a stratal view of morphology, reduplication is in

the same stratum as person prefixation since the prefix can reduplicate; 2) assuming an unordered view of morphology requires that the prefix in Axininca 1 be marked as extraprosodic; 3) reduplication must precede the operation of [piro] and [wai] affixation since these modal suffixes never reduplicate, eg. *[komapirokompapiro]; 4) several morphological processes, reduplication, 'veracity' and 'continuative', require a bimoraic base; 5) in each morphological operation requiring the bimoraic base, person prefixation operates (thus fulfilling the bimoraic base) before Augmentation applies, as we do not get forms such as *[no-nata-nata...] in reduplication, nor such forms as *[no-nata-piro...] in modal affixation; and 6) not all morphology undergoes Augmentation; for example, we do not find Augmentation of the base in simple infinitive forms, e.g. *[nata-t-aang^hi].

With this summary of the morphological facts complete, we can now consider what properties an unordered model of morphology must have to account for the Axininca data; I continue to assume the LPM view in examining the data. First, shown in (21), as reduplication of the prefix can occur, reduplication and person prefixation are in the same stratum (assume the prefix is extraprosodic in Axininca 1). The veracity and continuative operations are in stratum 2, as these two processes never reduplicate: in LPM since morphological ordering exists only to the extent that some morphology occurs in an earlier stratum than other morphology, veracity and continuative are in a stratum following reduplication:

(21) Axininca 1 and 2 morphology ([prefix] Ex in Axininca 1)

- s1 prefixation, reduplication
- s2 piro (veracity), wai (continuative)

A stem enters stratum 1 on the morphology side and undergoes person prefixation and reduplication in either order. After undergoing the phonology of stratum 1, these forms pass to stratum 2 where the morphological operations of veracity and continuative can apply. But note the problem for LPM: stratum 2 is motivated not because there is a set of phonological rules operating on the subset of morphological operations in stratum 2; rather stratum 2 is a "diacritic" use of strata to avoid ordering morphology within a stratum: reduplication must precede modal morphology.

We might resolve this problem by assuming that stratum 2 does undergo distinct phonology; we have seen a phonological process that targets the veracity and continuative, Augmentation. However, reduplication also undergoes Augmentation; therefore if Augmentation is the phonological motivation for stratum 2, then reduplication must be in stratum 2, shown in (22).

(22) Axininca 1 and 2 morphology, revised

| <u>morphology</u> | <u>phonology</u> |
|-------------------------------|------------------|
| s1 prefixation, reduplication | |
| s2 piro, wai, reduplication | Augmentation |

Note that reduplication continues to be in stratum 1, along with person prefixation, thus explaining why a stem with a prefix never undergoes Augmentation in either reduplication or modal morphology: the prefix has attached to the stem before reaching stratum 2. The model continues to explain the potential reduplication of the prefix since prefixation and reduplication are in the same stratum.

(22) suggests that stratum 2 is motivated by the phonological process of Augmentation which operates on a subset of the morphology. But note that in this model, reduplication in stratum 2 still must precede the /piro/ and /wai/ operations, else these modal morphemes would falsely be expected to optionally reduplicate. We might order reduplication with Augmentation in stratum 2 and veracity and continuative with Augmentation in a 3rd stratum. The problem of morphological ordering then continues: strata are motivated by the requisite morphological ordering, rather than by any necessary phonology/morphology interaction.

A second problem for the unordered view of morphology arises when we consider the fact that not all morphology undergoes Augmentation; as we will see, strata must be optional in this view because 1) Augmentation is structure building; and 2) not all stems undergo Augmentation.

Veracity suffixation is to the immediate right of the stem; the infinitive then attaches to the veracity marker, eg. [koma-piro-t-aang^hi]. Thus the infinitive operation applies after modal morphology. However, a stem may be marked for the infinitive without undergoing modal morphology, eg. [koma-t-aang^hi]. If a monomoraic stem undergoes the simple infinitive, Augmentation does not apply: [na-t-aang^hi]. But if suffixed by a veracity or continuative modal it does undergo Augmentation: eg. [nata-wai-t-aang^hi]. All these facts converge on a model where the infinitive operation follows the continuative and veracity operations:

(23) Axininca 1 and 2 morphology including infinitive data

| | |
|-------------------------------|--------------|
| s1 prefixation, reduplication | |
| s2 reduplication | Augmentation |
| s3 piro, wai | Augmentation |
| s4 infinitive | |

In (23) the infinitive is motivated in stratum 4 as the infinitive 1) follows veracity and continuative affixation; and 2) does not undergo Augmentation. But note the consequences of this model: because Augmentation is a structure building, rather than a structure changing phonological rule (on the application of structure building phonological rules to underived stems see Kiparsky, 1982 and 1985), if a bare stem enters stratum 2 and does not undergo any morphology the stem is still expected to undergo Augmentation. The false prediction then is that all 'subminimal' stems entering levels 2-3 will undergo Augmentation, whether these stems actually undergo the morphology of levels 2-3 or not. The result will be that all stems will falsely consist of at least a bimoraic base when exiting levels 2-3. Thus stems marked for the infinitive will be predicted to be (mm): eg. *[nata-t-aan^hi].

In order to side-step the overgeneration of augmented stems, we must assume that levels 2-3 are optional levels which are entered just in case the morphology in strata 2-3 is to apply to a stem:

(24) Axininca 1 and 2 morphology including infinitive data, revised

| <u>morphology</u> | <u>phonology</u> |
|-------------------------------|------------------|
| s1 prefixation, reduplication | |
| s2 reduplication | Augmentation |
| s3 piro, wai | Augmentation |
| s4 infinitive | |

In this account, the process of Axininca morphology is transderivational (in the sense of Chung, 1983) to the extent that a stem must 'know' whether it is to undergo the morphology of strata 2-3; if not, it must skip strata 2-3. We might formalize stratum skipping via extension of the loop used in some accounts of LPM (Halle and Mohanan, 1985; Mohanan, 1986), that is where to account for certain extrinsic morphological ordering, a loop is available to return morphological constituents to earlier morphological strata. In Axininca, to account for Augmentation, the loop might allow us to skip strata altogether. It is surely obvious that this extension of the loop, motivated by transderivational considerations of the non-application of Augmentation in some morphological processes, constitutes a formal mechanism with far more power than a useful theory should have. We could continue on with suggestions to overcome the ordering problems in Axininca 1 and 2 ad infinitum. Such an enterprise would however distract from the simple conclusion that the problem of Axininca morphology, and the phonological process of Augmentation, which occurs to some

morphological forms and not to others, is not resolvable within an unordered view of morphology as that proposed by LPM.

In sum then, Axininca is problematic to unordered accounts of morphology. The first clue that Axininca data are problematic for unordered views of morphology comes when reduplication and person prefixation in Axininca 1 are examined. However, by pushing the conventions of phonological theory, that is by assuming prefix extraprosodicity in Axininca 1, we evade the problem of ordered morphology. But when the Augmentation facts in reduplication and modal morphology are seriously considered, the ordering problems compound. First, strata are motivated to explain ordering between reduplication and modal morphology, even though these processes share the same phonology, Augmentation. This ordering problem might be solved by building yet more strata in Axininca, a solution which reduces to an unsolved problem: strata are used to order morphology.

The second problem is that as Augmentation is structure building, we predict that bare stems undergo Augmentation. To account for the fact that not all stems undergo Augmentation, strata must be skipped unless the morphology of these Augmentation strata is to apply to a stem. However the power of a LPM theory incorporating the loop to account for stratum skipping, is out of control: an overpowerful model results as we might expect stratum skipping to occur anywhere. As far as I know, Axininca is the only data reported which requires this formalism.

We have seen that Axininca reduplication is problematic for models of morphology which are basically formalized to account for the behavior of affixational morphology. The problem is that reduplication does not act like an affixational process. Rather it has cyclic properties (as it applies first to the stem, then to the prefix and stem, and failing a prefix, it undergoes Augmentation) like a phonological rule, but is morphologically interpreted (cf. Schindwein, 1989, for arguments that Javanese reduplication must be in the phonological side of a LPM model of the lexicon).

Recent 'processual' accounts of phonology and morphology (eg. Anderson, 1989) may provide a step in the right direction toward explaining such phenomena like Axininca reduplication, as such models are powerful enough to formalize processual, in addition to affixational morphology. However, as such models maintain the distinction between the morphological and phonological subcomponents of grammar (see especially Anderson, 1989, who claims a behavioral distinction between phonology and morphology), they must move toward explaining the behavioral similarity between cyclic morphology, exemplified by Axininca reduplication, and the cyclic application of phonological rules in language.

Footnotes

*. Thanks to Diana Archangeli and Mike Hammond for discussion of this work.

2. Axininca is a Campa language; Campa is of the Arawakan genetic classification (Payne, 1981) and is spoken on the Apurucayali river in the Amazon jungle of Peru.

3. Spring (to appear, in progress) demonstrates that the surface realization of Axininca reduplication is a complex interaction of phonological and morphological phenomena. Due to space limitations, many of the phonological aspects of reduplication cannot be discussed; rather the focus is upon the morphological properties of reduplication. The reader is referred to Payne (1981), Spring (to appear, in progress) for complete paradigms.

4. While Payne does not discuss the null marked 3 singular masculine, we see its occurrence on such forms as [aatai] 'he will go back' from /aa-t-ag-i/ glossed: return-open-resolved-future (Payne 1981:46). Payne and Spring 1989 also elicited a number of reduplication forms where neither an overt prefix nor suffix was given; these forms are glossed as the 3 singular masculine.

5. Reduplication in Yidiny (Dixon, 1977) is like that in Axininca 2 in that verbal conjugation markers and some few inflectional markers can optionally reduplicate with the verb stem (1977:156; 254). For example we find both absolutive reduplicating (i), and not reduplicating (ii) in Dixon's corpus (vowel lengthening is a regular phonological process in ii):

- i. nala-l 'big-absolutive' -> nalanala
- ii. ɔambu-l 'two-absolutive' -> [ɔambuɔmbu:l]

These data suggest that reduplication and conjugational affixation are unordered with respect to each other, like the Axininca 2 verbal stem and prefix are unordered in reduplication.

6. Thanks to Diana Archangeli for suggesting this solution.

7. Should more cases of morpheme invisibility in morphological processes surface, we might have evidence for the notion of 'extramorphological' constituents, that is constituents invisible to morphological operations.

8. An immediate problem for the analysis of reduplication is presented by the augmentation data: I have assumed that the reduplication template is a prosodic word, with a minimal word requirement of ∞ . Yet the unprefixing stems suggest that mm is the

minimal reduplication. This problem is treated in Spring 1990.

9. Payne (1981, 1982) assumes that all consonant initial suffixes require the bimoraic base; he cites two examples, /-piro/ and /-wai/ in two morphological forms in support of this claim (Payne, 145). The two forms cited are, like reduplication, 'modals'. Examination of the Axininca texts in Payne's work reveals only prefixed 'subminimal' stems, i.e. there is no data to check the claim that all consonant initial suffixes trigger augmentation of monomoraic or smaller bases. I assume that some subset of modals, including reduplication, veracity, and continuative, require this bimoraic base. Of these modals, two are consonant initial while reduplication can be vowel or consonant initial.

References

- Anderson, Steven (1989) 'A-Morphous Morphology' John Hopkins University ms.
- Archangeli, Diana (1984) "Extrametricality in Yawelmani", The Linguistic Review, 1984-1985:101-120.
- Broselow, Ellen and John McCarthy (1984) "A Theory of Internal Reduplication", Linguistic Review 3(1); Sept. 1983, 1984.
- Clements, G.N. (1985) The Problem of Transfer in Nonlinear Phonology', Cornell Working Papers in Linguistics 7.
- Chung, Sandra (1983) 'Transderivational Relationships in Chamorro Phonology' Language 59, 1:35-66.
- Everett, Daniel (1988) "On Metrical Constituent Structure in Piraha Phonology", NLLT 6:207-246.
- Halle, Morris and K. P. Mohanan (1985) "Segmental Phonology of Modern English", LJ 16, 1:57-116.
- Hayes, Bruce (1980) and (1981) A Metrical Theory of Stress Rules, Ph.D Dissertation MIT Cambridge Massachusetts.
- Hoeksema, Jack and Richard Janda (1986) 'Implications of Process-Morphology for Categorical Grammar', in Richard Oehrle et al (eds.) Categorical Grammars and Natural Language Structures, 199-247.
- Ito, Junko (1986) Syllable Theory in Prosodic Phonology, University of Massachusetts, PhD dissertation, Amherst, Massachusetts.
- Kiparsky, Paul (1982) "From Cyclic Phonology to Lexical Phonology", in Harry van der Hulst, Norval Smith (eds.) The Structure of Phonological Representations, Foris Publications, Dordrecht, Holland.
- Kiparsky, Paul (1985) "Some Consequences of Lexical Phonology", Phonology 2.
- Levin, Juliette (1983) "Reduplication and Prosodic Structure", ms. MIT, Cambridge Massachusetts.
- Marantz, Alec (1982) "ReReduplication", LJ 13, 3:435-482
- McCarthy, John and Alan Prince (1986) "Prosodic Morphology", ms University of Massachusetts and Brandeis University.
- McCarthy, John and Prince, Alan (1989) "Foot and Word in Prosodic Morphology: The Arabic Broken Plural", (to appear) NLLT.
- Mohanan, K.P. (1986) The Theory of Lexical Phonology, D. Riedel Publishing Company, Dordrecht, Holland.
- Payne, David (1981) The Phonology and Morphology of Axininca Campa. Publication of The Summer Institute of Linguistics and The University of Texas at Arlington, Virgil L. Poulter (ed.).
- Payne, David, Judith Payne, and Jorge Santos Sanchez (1982) Morfología, Fonología y Fonetica del Asheninca del Apurucayali, SIL publication, Serie Linguistica Peruana.
- Payne, David and Cari Spring (1989) Unpublished field notes on Axininca Campa.
- Schlindwein, Deborah (1989) "Where's Reduplication? A Case Study of Javanese Plural Reduplication", talk presented at the Arizona Phonology Conference 2, March, 1989, Tucson, AZ.
- Spring, Cari (1989) "Reduplication as Copy: Evidence from Axininca Campa", to appear in Arizona phonology Conference 2, University of Arizona.

- Spring, Cari (1989) "The Ternary Foot in Axininca Stress", paper presented at the LSA annual meeting, December, 1989.
- Spring, Cari (1990) "Constraining Prosodic Theory: How Many Feet per Language?", to appear in WOCFL 9, March 3, 1990, Stanford, California.
- Spring, Cari (in progress) Implications of Axininca Campa for Prosodic Morphology and Reduplication, University of Arizona PhD Dissertation.
- Steriade, Donca (1988) 'Reduplication and Syllable Transfer in Sanskrit and Elsewhere' Phonology 5.
- Swift, Kenneth (1985) Morphology of Caquinte, Master of Arts thesis, University of Texas, Arlington.