

# Proceedings of AFLA 7

The Seventh Meeting of the Austronesian Formal  
Linguistics Association

Edited by  
Marian Klamer

Vrije Universiteit Amsterdam  
Department of Linguistics  
2000

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Held at the Vrije Universiteit Amsterdam  
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## Preface

This volume consists of papers presented at the seventh meeting of AFLA (Austronesian Formal Linguistics Association), held at the Vrije Universiteit on May 11-13, 2000.

For the first time in the history of AFLA, this meeting was held outside the North-American continent, and contained contributions by speakers from eleven different countries: New Zealand, Australia, Indonesia, Brunei Darussalam, Taiwan, the USA including Hawaii, Canada, the UK, France, Germany, and The Netherlands.

Apart from the languages that are traditionally well-represented at Austronesian conferences, we were happy to see that the program also contained work on relatively small or lesser described languages, such as the minority languages of Taiwan, North-West Borneo, Eastern Indonesia, Papua and Oceania.

Special themes of this conference were Iconicity and Argument marking. The papers in this volume show that the program covered a broad range of subdisciplines -- from discourse grammar, phonology, morphology, syntax, to semantics -- and that the authors are working within various theoretical frameworks. But despite the obvious differences in expertise, interest and background, the atmosphere on the conference was typically AFLA: lively and constructive, with an average rate of attendance of about 80%. The papers in this volume deserve the same rate of attention.

This meeting has again furthered the unwritten mandate of AFLA to encourage the formal study of Austronesian languages, especially work by speaker linguists and junior scholars. Six scholars presented analyses of their native language, and more than half of the 45 participants subscribed as 'student'. This suggests that the future of Austronesian linguistics looks very bright indeed.

The eight edition of Afla will be held in the spring of 2001 at the Massachusetts Institute of Technology (MIT) in Boston, USA. The principal organiser will be Ileana Paul.

Marian Klamer, Vrije Universiteit Amsterdam

### **Proceedings of previous AFLA meetings:**

A Selection of the papers of AFLA 2, in 1995 is published as:  
Paul, Ileana, Vivianne Phillips, and Lisa Travis (eds.). 2000. *Formal Issues in Austronesian Linguistics*. Dordrecht, Kluwer.

The proceedings of AFLA 3 and AFLA 4 in 1996/1997 are published as:  
Pearson, Mathew (ed.). 1998. *Recent papers in Austronesian Linguistics*. UCLA Working Papers in Linguistics 21.

The proceedings of AFLA 6 in 1999 are published as:  
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## Table of Contents

Gabriele Heike Cablitz Nominalisation of verbal clauses in Marquesan (Oceanic, French Polynesia).....	1
Adrian Clynes Phonological structures and expressiveness: The role of iconicity in 'the emergence of the marked' .....	15
William D. Davies Against long movement in Madurese.....	33
Alexandre François Vowel shifting and cloning in Motlav: Historical explanation vs. formal description.....	49
Madelyn Kissonck Transitivity alternations in Rotuman.....	69
Thomas B. Klein and Meta Y. Harris Fixed segmentism, markedness and faithfulness: Nominalising reduplication in Chamorro.....	81
Anja Latrouite and Ralf Naumann An interpretation of the voice affix /i-/ in Tagalog.....	101
Diane Massam Niuean nominalisation.....	121
Ulrike Mosel and Jessika Reinig Valence changing clitics and incorporated prepositions in Teop.....	133
Simon Musgrave Emotion predicates and grammatical functions in Indonesian.....	141
Ileana Paul Clefts vs. pseudo-clefts in Austronesian.....	155
Phil Quick A non-linear analysis of vowel harmony and vowel harmony blocking in Pendau.....	173
Charles Randriamasimanana Malagasy, binary branching and null subjects.....	193
Der-Hwa V. Rau Word order variation and topic continuity in Atayal.....	211

Ger P. Reesink	
Austronesian features in a linguistic area.....	231
Li-May Sung	
Nominalization in Rukai and Amis.....	245
Adam Ussishkin	
Fixed prosodic effects in Austronesian: An Optimality-Theoretic account.....	259
William A. Foley	
Categorial Change in Oceanic Languages:	
First Contact on the North New Guinea Coast.....	271

## Fixed segmentism, markedness and faithfulness: Nominalising reduplication in Chamorro\*

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Fixed segmentism in reduplication occurs when invariant segments appear where copying is expected otherwise. Fixed segmentism has been important for a number of issues in theoretical phonology including prespecification (Marantz 1982, among others) and underspecification (Pulleyblank 1988, among others) in rule-based phonology and the approach to markedness in Optimality Theory (OT) (Alderete *et al.* 1999). Given the theoretical significance of fixed segmentism, any newly uncovered pattern of this type of phonological structure is of inherent interest to phonological theory. A major result of the authors' fieldwork on Chamorro reported in this paper is that Chamorro nominalising reduplication exhibits two fixed vowels, the unmarked high front vowel [i] and the marked low front vowel [a]. Given that this pair of fixed segments includes a cross-linguistically marked vowel, the pattern from Chamorro presents a challenge to the idea formalised in the OT framework by Alderete *et al.* (1999) that fixed segmentism decreases phonological markedness. On the other hand, given that the fixed vowels of Chamorro nominalising reduplication include the cross-linguistically unmarked high front vowel, the OT approach to fixed segmentism appears as a viable framework for the formal analysis of this pattern. In addition to exploring the connection between phonological markedness and fixed segmentism, Alderete *et al.* (1999) have claimed that any phonological restriction resulting in fixed segmentism in reduplication must be matched as a possible restriction on default patterns or segmental inventories elsewhere. As is demonstrated below, the patterns of default vowel phonology found in Chamorro do not match the pattern of fixed segmentism observed with nominalising reduplication. Thus, Alderete *et al.*'s approach predicts that the set of fixed vowels found in nominalising reduplication should constitute the vowel inventory of some other language or languages. As is shown in this paper, this prediction is met through vowel inventories which are restricted to non-schwa vowels of maximally contrasting height.

The model of reduplication invoked in Alderete *et al.* (1999) is couched in the framework of correspondence theory presented in McCarthy & Prince (1995). However, McCarthy & Prince's (1995) model of correspondence has been shown to be problematic for cases in which the reduplicant morpheme appears to be more faithful to the input than to the surface reduplicative base (Raimy & Idsardi 1997, Spaelti 1997). In McCarthy & Prince's (1995) full model of correspondence, the reduplicant may be subject to input-reduplicant faithfulness to force faithfulness to the input root. As pointed out in Raimy & Idsardi (1997), this notion is problematic because it evaluates faithfulness by comparing the input of one morpheme to the output of another, thus weakening the idea of faithfulness itself by postulating cross-morphemic comparison (see Spaelti 1997 for further criticism of the full model). The data presented in this paper show that prefixal reduplicants in Chamorro take certain cues for their segmental from the input rather than the surface representation. Thus, low front [a] appears in the nominalising reduplicant with low vowel roots even though the surface base vowel may be reduced to schwa (cf. ['katsa?] 'to husk a coconut' versus ['ka+kɔtsa?] 'coconut husker'). Furthermore, mid vowels in the reduplicant of continuous aspect reduplication in Chamorro match the input root, but need not match the surface base

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as evidenced in [ˈkɔnniʔ] ‘to catch, to take’ versus [ˈko+kɔnniʔ] ‘catching, taking’. Thus, the data from Chamorro are evidence for the necessity to examine fixed segmentism in light of recent approaches to apparent input-reduplicant faithfulness. As a consequence, we present a model of reduplication in which word faithfulness (Struijke 2000) is indispensable to the understanding of fixed segmentism.

Chamorro is an Austronesian language spoken on the Mariana Islands of Guam, Saipan, Rota and Tinian and in expatriate communities in the United States. The available descriptions of contemporary Chamorro (Topping 1973, 1980, Topping *et al.* 1975) provide only a fragmentary description of fixed segmentism in nominalising reduplication. Furthermore, notwithstanding the great insight displayed in these sources, these works also employ certain descriptive generalisations that are not correct, as is shown below. Thus, there is a need for a more complete and more accurate description of fixed segmentism in Chamorro. The present paper addresses this need using data from our fieldwork on Guam in the Summer of 1999. The results of this fieldwork not only show that the vowel inventory of the nominalising reduplicant is restricted to [i] and [a], but also show that the nominalising reduplicant induces vowel fronting or *umlaut* in the base and that the base is subject to Vowel Lowering. Given that *umlaut* and Vowel Lowering have received much attention in recent theoretical works (Chung 1983, Halle & Vergnaud 1987, Crosswhite 1998, Klein 2000), the data from nominalising reduplication presented here have implications beyond the focus of this paper.

This paper is structured as follows. §1 lays out preliminaries that are essential for the understanding of the vocalism of nominalising reduplication. This is followed in §2 by a brief review of previous descriptions of this pattern. §3 presents and describes the data from our fieldwork and lays out the generalisations concerning the vocalism of nominalising reduplication. In §4 we present our analysis of fixed segmentism in nominalising reduplication paying particular attention to issues of markedness and faithfulness. §5 presents some conclusions and suggests directions for future work.

## 1. Preliminaries

In this section we describe the inventory of Chamorro monophthongs under primary and secondary stress and in unstressed position and comment on the distribution of tense and lax vowels and the phonemic status of mid vowels. Furthermore, we lay out some of the basic stress facts of Chamorro and comment on the behaviour of *umlaut* and Vowel Lowering. In particular, we present data showing that Vowel Lowering in the reduplicative base may result in a mismatch between the reduplicant and the base vowel in Chamorro reduplication. Finally, we present the feature system used to specify the vowels of Chamorro.

Given that Chamorro is a stress language, it is expected that the vowels of Chamorro covary depending on the degree of stress, as is common in other stress languages. Under primary stress Chamorro has a symmetrical six-vowel system of monophthongal underliers in lexical contrast (Topping 1973, Chung 1983). This system may be graphically represented as in figure 1. below.

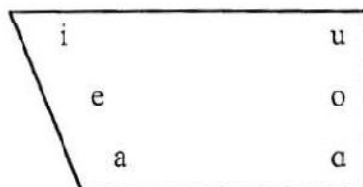


Fig. 1. Chamorro symmetrical system of six vowel underliers under primary stress

Note that the system displayed in fig. 1. emphasises the phonological symmetry of the series of three front vowels versus three back vowels distributed evenly along the height dimension. This system abstracts away from phonetic reality in that nonlow vowels show



tense and lax allophones which are distributed allophonically. The data in Chung (1983) and Topping (1973) show that nonlow vowels in Chamorro are lax in closed syllables and tense in open syllables. There is variation in the data presented in these works with respect to the tense versus lax distinction in open unstressed syllables. Whereas Topping (1973) maintains that nonlow vowels are lax in open unstressed syllables, the transcriptions in Chung (1983) show tense nonlow vowels in unstressed open syllables. The data in our corpus show evidence for the sum of these descriptions. Thus, nonlow vowels are lax in closed syllables regardless of the level of stress. Furthermore, nonlow vowels in open syllables are generally tense in stressed syllables, whereas they may be tense or lax in unstressed syllables. Note that for the purposes of the analysis presented in this article, we abstract away from the tense-lax distinction.

Chamorro shows stress reduction in that the inventory of low vowels is reduced under secondary stress and in unstressed position. Thus, the data in our corpus generally confirm Chung's (1983) observations that low vowels under secondary stress merge to [a] and that the low vowels merge to [a] in unstressed syllables. Furthermore, we also found data in evidence of Topping's (1973) observation that the low vowels may appear as [ə] in unstressed position (see below). Note that schwa may not occur under stress. In contrast to the low vowels, all nonlow vowels of Chamorro may occur under secondary stress and in unstressed position.

Some previous authors have claimed that mid vowels are not phonemic underliers in present-day Chamorro, at least not in the native vocabulary (Witucki 1973, 1974, Chung 1983). However, other works disagree with this view and maintain that mid vowels are possible underliers in Chamorro including the native vocabulary (Topping 1973, Halle & Vergnaud 1987). The primary evidence for the scepticism towards mid vowel underliers stems from the fact that their distribution is restricted in that they are primarily observed in stressed closed syllables whereas high vowels generally occur in the place of mid vowels elsewhere, that is, in open syllables and in unstressed position. However, a careful inspection of the available evidence shows that mid vowels may occur in stressed open syllables in items that are not borrowed from Spanish or English. Thus, lexical items such as *bélu* 'tottering, balanced (upright)' and ['bo?an] 'froth, bubbles' show that mid vowels may occur in stressed open syllables in roots. Furthermore, stress-attracting prefixes such as *ké-* 'about to, try' and *é-* 'look for, hunt' (Topping 1973) contain mid vowels in open syllables as in ['ke+kənni?] 'try to catch' (cf. ['kənni?] 'to catch'). In addition, the stress-attracting reduplicant in what Topping (1973) labels *continuative aspect reduplication* shows mid vowels in open stressed syllables. Consider the data in (1).

(1) Mid vowels in continuative aspect reduplication

(a)	['ʔentaluʔ]	'to interfere'	['ʔe+ʔentaluʔ]	'interfering'
(b)	[pɛska]	'to fish, to hunt'	['pe+pɛska]	'fishing, hunting'
(c)	[kənniʔ]	'to catch, to take'	['ko+kənniʔ]	'catching, taking'
(d)	[səddaʔ]	'to find'	['so+səddaʔ]	'finding'

As shown in (1), mid vowels regularly occur in the auto-stressing open syllable reduplicant in continuative aspect reduplication. Given this evidence for the occurrence of mid vowels in open syllables, we conclude that mid vowels are possible underliers in Chamorro even though their distribution is somewhat restricted, thus essentially following the view in Topping (1973) and Halle & Vergnaud (1987).

The default location of primary stress in Chamorro words is on the penultimate syllable ((2) (a)). However, certain roots have antepenultimate or final stress, as shown in (2) (b) and (2) (c), respectively.

(2) Chamorro primary stress (Data reproduced from Chung 1983: 38)

(a)	pulónnun	'triggerfish'
(b)	dárkulu	'big'
(c)	peskadót	'fisherman'

Certain Chamorro prefixes attract primary stress onto themselves, thus disrupting regular penultimate stress. Note that the reduplicant morphemes of continuative aspect reduplication (see (1)) and nominalising reduplication belong to the class of stress-attracting prefixes.

Chamorro has two well-known alternations in its vowel system, vowel fronting or *umlaut* (Topping 1973, Chung 1983, Klein 2000, among others) and Vowel Lowering (Chung 1983, Crosswhite 1998, among others). *Umlaut* in Chamorro is the fronting and, for rounded vowel underliers, the concomitant derounding of input back vowels induced by certain morphological units including the determiner *i* 'the'. Consider the data in (3).

(3) Chamorro umlaut

(a)	[ <sup>h</sup> gumaʔ]	'house'	[i <sup>h</sup> gimaʔ]	'the house'
(b)	[ <sup>h</sup> potta]	'door'	[i <sup>h</sup> petta]	'the door'
(c)	[ <sup>h</sup> atsuʔ]	'rock'	[i <sup>h</sup> atsuʔ]	'the rock'

The data in (3) show that Chamorro umlaut fronts the back vowel underliers to result in the corresponding front vowels.

The basic generalisation concerning Vowel Lowering is that nonlow vowels surface as mid in stressed closed syllables and as high elsewhere (Chung 1983). Vowel Lowering applies optionally in syllables that are unstressed in morphologically complex forms, but are under main stress in corresponding forms of lesser morphological complexity. Consider the data in (4).

(4) Chamorro Vowel Lowering (Chung 1983: 49)

(a)	[k <sup>w</sup> entus]	'to speak'	[k <sup>w</sup> en'tusi] or [k <sup>w</sup> in'tusi]	'to speak to'
(b)	[lɔklɔk]	'to boil'	[lɔk'lɔkɔ] or [lɔk'lɔkɔ]	'its boiling'

The data in (4) (a) and (4) (b) show that Vowel Lowering may cause an alternation between mid versus high front vowels and mid versus high back vowels, respectively.

*Umlaut* and Vowel Lowering interact with nonprimary stress in a quite complex manner. Given that the primary focus of the present paper is on the fixed segmentism of the stress-attracting nominalising reduplicant, the details of the interaction with nonprimary stress are for the most part abstracted away from in the remainder of this paper. However, the occurrence of *umlaut* and Vowel Lowering under nonprimary stress is important for the understanding of the vocalism of the base in nominalising and continuative aspect reduplication. In particular, note that Vowel Lowering optionally occurs in the base of continuative aspect reduplication (see also (1) above). Consider the data in (5).

(5) Optional Vowel Lowering in continuative aspect reduplication

(a)	[ <sup>h</sup> peska]	'to fish, to hunt'	(i)	[ <sup>h</sup> pe+piska]	'fishing, hunting'
			(ii)	[ <sup>h</sup> pe+peska]	'fishing, hunting'
(b)	[ <sup>h</sup> kɔnniʔ]	'to catch, to take'	(i)	[ <sup>h</sup> ko+kɔnniʔ]	'catching, taking'
			(ii)	[ <sup>h</sup> ko+kɔnniʔ]	'catching, taking'

As shown in (5) (a), [i] and [ɛ] may occur in the reduplicative base of roots such as [<sup>h</sup>peska], whereas (5) (b) shows that [u] and [ɔ] may occur in the reduplicative base of roots such as [<sup>h</sup>kɔnniʔ], resulting in mismatches between the reduplicant vowel and the reduplicative base vowel as in (5) (a) (i) and (5) (b) (i). Importantly, these data show that the reduplicant vowel in Chamorro reduplication may be more faithful to the input root vowel than to the reduplicative base vowel. This type of faithfulness has received much attention in the recent literature on reduplication (Raimy & Idsardi 1997, Spaelti 1997, Struijke 1998, 2000, Yip 2000) and plays a significant role for the analysis of fixed segmentism to be presented below.

Given that the theoretical analysis of the fixed segmentism observed in Chamorro nominalising reduplication to be presented below is based to a significant extent on proposals in Alderete *et al.* (1999), it is useful for the purposes of maximum comparability between our analysis and Alderete *et al.*'s to make analogous assumptions concerning phonological feature specifications. However, given that the feature system used by Alderete *et al.* is not worked out in great depth, a few necessary details must be filled in to get the analysis off the ground.

Alderete *et al.* (1999: 335f.) follow the system of stricture-based features presented in Clements & Hume (1995), but invoke the featural organisation of the Particle Phonology framework (Schane 1984; see also element theory (Harris & Lindsey 1995, among others) and Dependency Phonology (Ewen 1995, among others)) in maintaining that mid vowels combine the features of high and low vowels. Given this system of phonological features, the feature specifications for the Chamorro vowel underliers from fig. 1 are presented in (6). Headedness relations among elements must be added to the system outlined in Alderete *et al.* to represent the contrast between /e/ and /a/ in Chamorro. Following conventions in Dependency Phonology, these headedness relations are represented by an underline.

(6)

i	u	e	o	a	ɑ
	[LAB]		[LAB]		
	[DORS]		[DORS]		[DORS]
[COR]		[COR]		[COR]	
		[PHAR]	[PHAR]	[PHAR]	[PHAR]

The table in (6) presents the feature specifications of the Chamorro vowels arising from the stricture-based features [COR], [LAB], [DORS], and [PHAR] assumed in Alderete *et al.* (1999). Given that Alderete *et al.* invoke the featural organisation of Particle Phonology, the mid vowels /e/ and /o/ are both specified for [PHAR]. In addition, note that /e/ and /a/ are both specified through the features [COR] and [PHAR]. Thus, to encode the contrast between /e/ and /a/, we invoke the notion of headedness. Thus, [COR] is the head in the mid front vowel, whereas [PHAR] is the head in the low front vowel. Furthermore, note that both low vowels are headed by [PHAR].

This section has laid out essential preliminaries to the understanding of the Chamorro vowel and stress system. The next section presents a summary of the previous descriptions of the vocalism of nominalising reduplication and identifies issues and open questions that arise from these earlier descriptions.

## 2. Previous descriptions of nominalising reduplication

Fragments of Chamorro nominalising reduplication have been described in Topping (1973, 1980). Additional data relevant to nominalising reduplication may be found in Topping *et al.* (1975). The purpose of this section is to present the descriptive picture concerning nominalising reduplication according to these sources and to identify issues and open questions arising from this presentation. Note that the representation of the data in this section follows the transcription conventions of the sources.

Topping (1973: 181) characterises nominalising reduplication as follows.

The rule for reduplication for nominalization is to repeat the stressed vowel and preceding consonant (if one is present). The primary stress falls on the first vowel of the reduplicated form. If the stem vowel is back, then it gets fronted.

Topping exemplifies this description of nominalising reduplication with the following data. Note that, in accordance with the default location of primary stress in Chamorro, all of the roots in the data in (7) have primary stress on the penultimate syllable.

(7) Nominalising reduplication: Data from Topping (1973: 181 f.)

(a)	gupu	'to fly'	gígipu	'flyer'
(b)	adda'	'mimic'	á'adda'	'mimicker'
(c)	kanno'	'eat'	kákanno'	'eater'
(d)	tuge'	'write'	títuge'	'writer'

Note that the apostrophe in Topping's works stands for the glottal stop. Furthermore, note that Topping generally does not transcribe word-initial glottal stop in cases of glottal stop insertion to avoid vowel-initial words in Chamorro. Thus, items such as *adda'* 'mimic' and *á'adda'* 'mimicker' in (7) (b) have a word-initial glottal stop phonetically (cf. Topping 1973: 36).

The data in (7) support three important characteristics of nominalising reduplication. First, these data show that nominalising reduplication employs a CV reduplicant. Secondly, the data in (7) show that the nominalising reduplicant is prefixing. Finally, the data in (7) show that the nominalising reduplicant attracts primary stress onto itself. Given that normally all vowel underliers of Chamorro occur under primary stress, it is expected *ceteris paribus* that all six contrastive vowels of Chamorro are found in the stress-attracting reduplicant of nominalising reduplication. However, the data in (7) (a) and (d) show that this is not the case. Instead, the base vowel /u/ is replaced by [i] in the reduplicant under nominalising reduplication. Note that information regarding the quality of the low vowel in the reduplicant of nominalising reduplication may not be gleaned from the data in (7). This is because the representation of the Chamorro data in Topping (1973) employs for the most part orthographic conventions which do not distinguish between [a] and [ɑ]. Furthermore, note that no items with mid vowels subject to reduplication are presented in the data in (7). Moreover, note that Topping's (1973) statement that back stem vowels get fronted under nominalising reduplication is not conclusively established given the variation in the base observed in (7) (a) versus (7) (d) and the absence of the representation of the contrast between [a] and [ɑ] in (7) (b) and (7) (c).

Topping (1980: 328) expands on the description in Topping (1973) by stating that "if the first vowel of the stem is *o* or *u*, the first vowel of the reduplicated form will be *i*", but illustrates the behaviour of stem *o* only through one example ((8) (a) below). In our search of Topping *et al.* (1975), we have found one more example for the behaviour of stem *o* (see (8) (b)).

(8) Nominalising reduplication with /o/: Data from Topping *et al.* (1975), Topping (1980)

(a)	godde	'to tie'	i gígedde	'the tier'
(b)	logru	'give odds (gambling)'	lílogru	'odds maker'

The data in (8) show that for bases with /o/ the reduplicant of nominalising reduplication surfaces with the vowel [i]. Thus, the data in (7) and (8) are a good indication for the behaviour of stem *u* and *o*, but do not conclusively illustrate the behaviour of the other vowels of Chamorro under nominalising reduplication. However, some additional data may be gleaned from Topping *et al.* (1975).

Topping *et al.* (1975) distinguish between low front vowels and low back vowels under primary stress through the use of *æ* and *a*, respectively. Thus, data from this work may be used to throw light on the behaviour of low vowels in the reduplicant of nominalising reduplication (cf. (9) (a)).

(9) Nominalising reduplication: Data from Topping *et al.* (1975)

(a)	(i)	[æ]dda'	'mimic'	[æ]'adda'	'mimicker'
	(ii)	fahan	'buy'	f[æ]fahan	'buyer'
(b)	(i)	li'of	'dive'	li'of	'diver'
(c)	(i)	penta	'to paint'	píenta	'painter'
	(ii)	peska	'to fish, to hunt'	pípeska	'fisherman, hunter'
		peska	'to fish, to hunt'	pépeska	'fisherman, hunter'
	(iii)	bende	'to sell, to vend'	bíbende	'shopkeeper, seller'
	(iv)	de'on	'pinch, tweak'	déde'on	'pincher'

The data in (9) (a) show that low vowels appear as the front low vowel in the reduplicant of nominalising reduplication regardless of the location of the base low vowels along the front-back dimension. Note that there are a sizeable number of additional examples with low stem vowels behaving like the data in (9) (a) to be found in Topping *et al.* (1975). The datum in (9) (b) indicates that for bases with /i/ the reduplicant of nominalising reduplication appears as [i]. Note that there is one more example of this kind to be found in Topping (1980). The data in (9) (c) show variation with respect to the behaviour of base /e/ in the reduplicant of nominalising reduplication. The data in (9) (c), (i-iii) show that base /e/ may licence [i] in the reduplicant. On the other hand, the data in (9) (iv) and the variant *pépeska* 'fisherman, hunter' in (9) (c) (ii) suggest that base /e/ may appear as [e] in the reduplicant as well. Note that whereas the data with base /e/ shown in (9) (c) seem to exhibit variation under nominalising reduplication, there are too little data available from the previous literature to establish this conclusion firmly. In addition, it must be noted that the behaviour of base /e/ has not been explicitly described in any of Topping's works.

For all of the data in (7)-(9), it must be noted that the vowel quality of the base vowels in the reduplicant is represented through orthographic convention rather than phonetic transcription. This leaves the phonetic quality of the base vowels in the reduplicated forms underdetermined in two respects. First, it is not clear from the orthography which allophone of the low vowels appears initially in bases like <adda> 'to mimic' to reduplicated forms such as <[æ]'adda> 'mimicker'. Secondly, given that mid vowels alternate with high vowels under nonprimary stress, the orthography employed in Topping's works glosses over the phonetic height of the vowels in bases such as <penta> 'to paint' in reduplicated forms such as <píenta> 'painter'.

Topping (1973) has advanced the following explanation for the restricted inventory of vowels observed in the reduplicant of nominalising reduplication.

[T]he stressed vowel of the reduplicated form is fronted because the nominalized form is usually preceded by the article *i*. It will be recalled that *i* causes vowel fronting, as in *guma* 'house', *i gima* 'the house'. It does not seem feasible to try to account for the vowel fronting as the result of reduplication. (Topping 1973: 182)

Topping's statement is problematic from three perspectives. First, the data presented above suggest that the vowel inventory of the reduplicant of nominalising reduplication is limited to [i] and [a] and is, thus, not accounted for as a simple vowel fronting. Descriptively speaking, vowel raising seems to be involved as well, given that /o/ and /e/ appear to surface as [i]. Secondly, the observed fronting and raising does not seem to depend on the presence of the determiner *i* 'the', given that the vast majority of the reduplication data in Topping (1973) and Topping *et al.* (1975) appear without this determiner. Finally, vowel fronting as observed in the nonreduplicative phonology of Chamorro results in an /o/-[e] alternation for mid vowels, whereas /o/ in Topping's nominalising reduplication data appears to alternate with [i].

In sum, the data from the previous sources suggest that the vowels that may appear in the prefixal stress-attracting CV reduplicant of nominalising reduplication are limited to *i* and *æ* where *i* occurs with nonlow base vowels and *æ* occurs with low base vowels. However, this generalisation is not firmly established because there are few data available for

nonlow base vowels and because some data points appear to show reduplicant *e* with the base vowel *e*. In addition, the orthographic conventions employed in Topping's works prevent any firm conclusions as to the quality of the vowels in the bases of the reduplicated forms. Furthermore, Topping's claim that the restriction observed in the reduplicant vowels is due to *umlaut* or vowel fronting induced in the reduplicant by the determiner *i* is questionable in light of the fact that most of the data from nominalising reduplication presented in Topping's works appear without the determiner and that [e] appears at best inconsistently in the reduplicant. The data from our field research to be presented in the next section have been collected to shed light on these issues.

### 3. Vocalism in nominalising reduplication

The previous section has worked out three underinvestigated issues in the vocalism of Chamorro nominalising reduplication. First, the set of vowels that may appear in the nominalising reduplicant needs to be established with a greater degree of certainty than is possible from the existing sources. Secondly, the quality of the initial base vowels in reduplicated forms needs to be scrutinised. Finally, it is questionable that the restrictions concerning the vowels in the nominalising reduplicant are caused by the *umlaut*-inducing determiner *i*. The data from our fieldwork presented in this section contribute to the resolution of these issues.

It is shown in this section that nominalising reduplication is a case of fixed segmentism in that only [i] and [a] may occur as vowels in the nominalising reduplicant. Furthermore, it is shown that reduplicant [i] occurs only with nonlow root vowels and that [a] occurs only with low root vowels. This pattern is interesting for two reasons. First, given that usually the full inventory of Chamorro vowels is displayed under primary stress, it is surprising to find that the stress-attracting nominalising reduplicant is severely restricted as to the quality of vowels that may occur in it. Secondly, the dependence of the occurrence of the two reduplicant vowels on the height of the root vowel is of interest because this type of reduplicative pattern does not seem to have been found elsewhere to this point. Thus, the inventory and the distributional restrictions on the vowels in the nominalising reduplicant require a novel explanatory account. As an empirical prerequisite to establishing the case for fixed segmentism, one must compare the vowels found in the reduplicant with the vowels in the unreduplicated roots and in the bases of reduplication. Given the data in this section, there is consistent evidence for a systematic mismatch between the vowels in the reduplicant and the vowels in the corresponding roots and reduplicative bases.

The data for the present study are extracted from face-to-face interviews with six native speakers of Chamorro conducted on location on Guam in the Summer of 1999. All speakers are natives of the island of Guam and the group of speakers is composed of three women and three men with ages ranging from late twenties to mid sixties. The interviews were conducted by the authors of the present study using primarily translation-elicitation techniques to elicit Chamorro target items. All interviews took place in a quiet room and were recorded using a high-quality tie-clip microphone and a high-quality portable digital audio tape (DAT) recorder. The data from the DAT tapes were copied to analogue tape to provide a working copy of the material. The data from the analogue tapes were then digitised and analysed using standard software packages for speech analysis. The data presented below were obtained through auditory analysis of the digital sound files. This analysis was performed independently by the two authors of this study. The transcriptions of our data presented below follow IPA conventions. Consider now the data in (10) and (11).

#### (10) Root vowel /i/

(a)	[ <sup>h</sup> liʔiʔ]	'to see'	[ <sup>h</sup> li+liʔiʔ]	'seer'
(b)	[ <sup>h</sup> ʔipiʔ]	'to slice'	[ <sup>h</sup> ʔi+ʔipiʔ]	'slicer'
(c)	[ʔis <sup>h</sup> tudja]	'to study'	[ <sup>h</sup> ʔi+ʔistudja]	'studyer'

## (11) Root vowel /u/

(a)	[ˈgupu]	‘to fly’	(i)	[ˈgi+gipu]	‘flyer’
			(ii)	[ˈgi+gupu]	‘flyer’
(b)	[ˈtugiʔ]	‘to write’		[ˈti+tigiʔ]	‘writer’

The data in (10) and (11) show that with high root vowels the reduplicant vowel is [i] regardless of whether the root vowel is front /i/ or back rounded /u/. Note that the base vowel in the initial syllable of the reduplicated form is high and front whenever the root vowel in the same position is high and front. However, we observe an optional alternation in the quality of the first base vowel if the corresponding root vowel is /u/. In such cases, /u/ may alternate with [i], as the comparison between (11) (a) (i) versus (11) (a) (ii) exemplifies. We suggest that this alternation in the base is analogous to the vowel fronting or *umlaut* alternation observed in the nonreduplicative phonology of Chamorro. Consider now the data in (12) and (13).

## (12) Root vowel /e/

(a)	[ˈʔeggaʔ]	‘to watch’		[ˈʔi+ʔiggaʔ]	‘watcher’
(b)	[ˈpeska]	‘to fish, to hunt’	(i)	[ˈpi+piska]	‘fisherman’
			(ii)	[ˈpi+peska]	‘fisherman’

## (13) Root vowel /o/

(a)	[ˈkɔnniʔ]	‘to catch’	(i)	[ˈki+kɪnniʔ]	‘catcher’
			(ii)	[ˈki+kɛnniʔ]	‘catcher’
			(iii)	[ˈki+kunniʔ]	‘catcher’
			(iv)	[ˈki+kɔnniʔ]	‘catcher’
(b)	[ˈkɔʔkɔʔ]	‘to harvest’	(i)	[ˈki+kɔʔkɔʔ]	‘harvester’
			(ii)	[ˈki+kɛʔkɔʔ]	‘harvester’

The data in (12) and (13) show that mid root vowels appear with the reduplicant vowel [i] in nominalising reduplication. In other words, mid vowels appear to be banned from the reduplicant and [i] is observed instead. Thus, the data in (12) and (13) show that roots with initial high and mid vowels tolerate only [i] in the reduplicant of nominalising reduplication. Furthermore, analogous to (11), the data in (13) also show optional vowel fronting of the back vowel in the reduplicative base. In particular, compare the front vowels found in the reduplicative bases in (13) (a) (i) and (ii) and (13) (b) (ii) with the corresponding back vowels in (13) (a) and (b). Moreover, the data in (12) and (13) also show systematic variation in the vowel height in the closed initial syllables of the reduplicative bases. Thus, the initial high vowels in the bases in (13) (a) (i) and (iii) alternate with the corresponding mid vowels in (13) (a) (ii) and (iv). We suggest that this alternation is analogous to the Vowel Lowering alternation observed in the nonreduplicative phonology of Chamorro. Note that the combined effects of optional Vowel Lowering and vowel fronting may produce four different variants of root /o/, as seen in (13) (a).

The upshot of the data in (10) through (13) is that the vowel in the prefixing nominalising reduplicant is [i] regardless of whether the initial root or base vowel is [i]/[ɪ], [u]/[ʊ], [ɛ] or [ɔ]. Consider now the data on low vowels in (14) and (15).

## (14) Root vowel /a/

(a)	[ˈʔadzɪk]	‘to choose’		[ˈʔa+ʔadzɪk]	‘chooser’
(b)	[ˈʔaddaʔ]	‘mimic’		[ˈʔa+ʔaddaʔ]	‘mimicker’

## (15) Root vowel /a/

(a)	[ <sup>h</sup> kannuʔ]	'to eat'	[ <sup>h</sup> ka+kannuʔ]	'eater'
(b)	[ <sup>h</sup> fuhian]	'to buy'	[ <sup>h</sup> fa+fahian]	'buyer'
(c)	[ʔa <sup>h</sup> pasi]	'to pay'	[ʔa+ʔapasi]	'payer'
(d)	[ <sup>h</sup> katsaʔ]	'to husk a coconut'	[ <sup>h</sup> ka+katsaʔ]	'coconut husker'

The data in (14) and (15) show that low root vowels appear with the reduplicant vowel [a] under nominalising reduplication. In other words, the front low vowel [a] reflects the low height of the root vowel in the nominalising reduplicant regardless of whether the root low vowel is front or back. Furthermore, note that the initial base vowel may appear as [a] or [ə]. There are two crucial points to be taken away from the data in (14) and (15). First, the lowness of the reduplicant vowel corresponds to the lowness of the initial root vowel, but not always to the vowel in the reduplicative base. Secondly, the reduplicant is low front [a] regardless of whether there is /a/ or /ɑ/ in the initial syllable of the root. This is in sharp contrast to the occurrence of [i] in the reduplicant with nonlow root or base vowels observed earlier.<sup>1</sup>

The data in (10)-(15) show without a doubt that the vowels in the stress-attracting reduplicant of Chamorro nominalising reduplication are limited to [i] and [a]. In addition, the data in (10)-(13) show that [i] appears as the reduplicant vowel with nonlow root vowels, that is, /i/, /u/, /e/ and /o/. In contrast, the data in (14) and (15) show that the reduplicant vowel is [a] if the root vowel is a low vowel, that is, /a/ or /ɑ/. Furthermore, data such as (15) (d) show that the lowness of the reduplicant vowel is not always copied from the reduplicative base, but instead may be carried over from the input root. Thus, the six vowel system under primary stress in the nonreduplicative phonology of Chamorro is reduced to a two vowel system under primary stress in the nominalising reduplicant. Note in particular that reduplicant [i] occurs consistently with mid vowel roots, as the data in (12) and (13) show.<sup>2</sup> The table in (16) graphically displays these results.

## (16) Vocalism of Chamorro nominalising reduplication

Root	Reduplicant	Base
/i/, /e/, /u/, /o/	[i]	[i]/[ɪ], [ɛ], [u]/[ʊ], [ɔ]
/a/, /ɑ/	[a]	[a], [ə]

The data in (10)-(15) have all been produced by the speakers of Chamorro without the determiner *i*. Thus, Topping's idea that the segmental restrictions in the nominalising reduplicant are observed because vowel fronting or *umlaut* must be induced by the determiner *i* is shown to be unfounded. Furthermore, given the limitation of the vowels in the nominalising reduplicant to [i] and [a], the set of vowels produced by *umlaut* is at odds with the set of vowels appearing under fixed segmentism in nominalising reduplication. Thus, *umlaut* results in high, low, and mid front vowels whereas only high and low front vowels may occur in the reduplicant of nominalising reduplication. In sum, the fixed segmentism observed is an integral part of the morphophonological process of nominalising reduplication and not induced by *umlaut*. Interestingly, though, the nominalising reduplicant itself appears to be an *umlaut*-inducing element in that unlauded vowels may appear in the initial syllable of the reduplicative base. Thus, the nominalising reduplicant needs to be

<sup>1</sup> Note that the variable appearance of [a] versus [ə] in the initial vowel in the reduplicative base corresponding to an initial low vowel in the root observed in (15) is probably due to variable secondary stress versus no stress, respectively, in adjacency to the main-stressed reduplicant. The details of the issue of the level of stress in reduplicative stems are left for future work.

<sup>2</sup> There is one exception to this generalisation in the corpus under consideration. Thus, [ʔentaluʔ] 'to interfere' was nominalised as [ʔe+ʔentatuʔ] 'interferer' in one instance.



added to the list of *umlaut*-inducing elements compiled in the earlier literature on Chamorro *umlaut* (Topping 1968, Chung 1983, Klein 2000).

In sum, the data presented in this section show that the nonlow root vowels are optionally affected by *umlaut* or Vowel Lowering in the reduplicative base. In addition, low root vowels appear as [a] or may be reduced to schwa in the reduplicative base. Furthermore, we have seen that the marked reduplicant vowel [a] occurs in correspondence to low vowels in the initial root or base syllable. Finally, the unmarked reduplicant vowel [i] occurs elsewhere, that is with initial high or mid root vowels. Thus, markedness in the reduplicant vowel is decreased unless overruled by faithfulness to the input or the reduplicative base in terms of vowel lowness. These findings are the empirical backdrop for the OT analysis of fixed segmentism in Chamorro nominalising reduplication presented in the next section.

#### 4. Fixed segmentism, markedness and faithfulness

The preceding description of the fixed vocalism in the reduplicant of Chamorro nominalising reduplication has shown that the vowel in the nominalising reduplicant is [a] if the first root or base vowel is a low vowel, but appears as [i] elsewhere. This pattern clearly incorporates a reduction in phonological markedness in that /u/ plus the cross-linguistically marked vowels /e/, /o/, and /ɑ/ are banned from appearing in the nominalising reduplicant even though this reduplicant is under primary stress. To capture this pattern we propose that the appearance of [a] is due to two factors. First, the lowness of the vowel in the root or the base is matched in the reduplicant through word or base-reduplicant faithfulness, respectively. Secondly, /ɑ/ is excluded through markedness so that only the front low vowel of the two low vowels is available to appear in the reduplicant. In all other environments, unmarked *i* is the default vowel in the reduplicant of nominalising reduplication.

This section is organised as follows. §4.1. explores the connection between the fixed segmentism observed in Chamorro nominalising reduplication, vowel inventories in other languages and the question of default vowel phonology in Chamorro. §4.2. is an initial demonstration of the effects of the markedness constraint hierarchy of Alderete *et al.* (1999) in relation to the markedness reduction observed in the vocalism of the nominalising reduplicant. In §4.3. we show the necessity of word faithfulness in the sense of Struijke (2000) and the usefulness of base-reduplicant faithfulness to account for the phonology of low vowels in nominalising reduplication. §4.4. rounds out the analysis by showing how unmarked [i] emerges as the reduplicant vowel in the correct environments.

##### 4.1. Fixed segmentism, default phonology and vowel inventories

Alderete *et al.* (1999) base their framework on three generalisations concerning the relation between reduplicative morphemes and segmental inventories. These generalisations are reproduced in (17)-(19) (cf. Alderete *et al.* 1999: 332f.).

- (17) Reduplicant/Inventory relation I  
Except when copying the base, the reduplicant's inventory is a proper subset of the whole language's.
- (18) Reduplicant/Inventory relation II  
Any phonological restriction on the whole of one language is a possible restriction on the reduplicant of another language.
- (19) Reduplicant/Inventory relation III  
Any phonological restriction on the reduplicant of one language is a possible restriction on the whole of another language.

The case of fixed segmentism in Chamorro nominalising reduplication falls under the generalisation in (17) in that the vowel inventory of the nominalising reduplicant is a subset of the vowel inventory of Chamorro as a whole. Given the phonological nature of fixed

segmentism in Chamorro nominalising reduplication, the fact that only part of the Chamorro vowel inventory is observed in the nominalising reduplicant must be due to some kind of phonological restriction. Consequently, in accordance with the generalisations in (18) and (19), Alderete *et al.*'s (1999) framework predicts that the restriction of the Chamorro nominalising reduplicant to [i] and [a] must be matched as some aspect of the phonology of Chamorro itself or as a restriction on the non-reduplicative phonology of another language.

Alderete *et al.* (1999) discuss two general areas in which segmental restrictions on reduplicants may be met in the nonreduplicative phonology of the same language or some other language, namely, default segmentism and segmental inventories. Consequently, we investigate if the restriction to [i] and [a] is matched as some kind of default segmentism in Chamorro or if the restriction is mirrored as a vowel inventory in other languages.

The most obvious candidates for default vowel phonology are vowel insertion and vowel reduction under nonprimary stress. Chamorro is not attested to have any process of vowel insertion so that the vowel inventory of nominalising reduplication may not be compared to vowel insertion. As far as vowel reduction is concerned, we have seen in §1 that Chamorro displays stress reduction only in the inventory of low vowels that may occur under nonprimary stress. Thus, one option is for /a/ and /ɑ/ to merge to [a] under secondary stress and to [ɑ] in unstressed position. The other option for the low vowels is the reduction to [ə] in unstressed position. Importantly, all high and mid vowels may occur under secondary stress and in unstressed position in the nonreduplicative phonology of Chamorro. Thus, the pattern of vowel reduction displayed in the nonreduplicative phonology of Chamorro does not match the vowel inventory of the nominalising reduplicant.

As far as the comparison between the vowel inventory under nominalising reduplication and the vowel inventories of other languages is concerned, there appear to be languages whose nonschwa vowel inventory matches the vowel inventory of the Chamorro nominalising reduplicant. Thus, the literature reports on languages in which the inventory of contrastive nonschwa vowels consists of just /i/ and /a/. Such vowel inventories have been reported for Margi (Ladefoged & Maddieson 1996: 286) and Iatmul and Abelam (Foley 1986: 49). In what follows, languages with this type of vowel inventory are referred to as *MIA languages*. It appears then, that the restricted vowel inventory of Chamorro nominalising reduplication is matched by the vowel inventory of MIA languages in that in both sets of inventories round or back vowels are not allowed and in that nonschwa vowels are maximally dispersed along the height dimension, resulting in the absence of noncentral mid vowels in both sets of inventories. Thus, it may be concluded that Alderete *et al.*'s (1999) generalisations (18) and (19) are confirmed in that the restrictions on the vowel inventory of Chamorro nominalising reduplication are mirrored as the vowel inventories of MIA languages and vice versa.

#### 4.2. Markedness decrease in Chamorro fixed segmentism

As laid out above, the fixed segmentism in Chamorro nominalising reduplication is a markedness decrease in the sense that the unmarked vowel [i] occurs in the reduplicant unless this is overruled by faithfulness to a low vowel in the root or the base. In OT, segmental markedness is expressed through universal hierarchies of markedness constraints. The universal markedness hierarchy concerning place invoked by Alderete *et al.* (1999) is given in (20). Recall that Alderete *et al.* assume, following Clements & Hume (1995), that vowels bear the same place features as consonants.

- (20) Place-markedness hierarchy (Alderete *et al.* 1999: 335)  
 \*PL/LAB, \*PL/DORS >> \*PL/COR >> \*PL/PHAR

According to the hierarchy in (20), round and back vowels are more marked than high front vowels which in turn are more marked than low vowels. Importantly, recall Alderete *et al.* follow the idea that mid vowels are specified by the features [COR] and [PHAR]. Thus, according to Alderete *et al.*, the hierarchy in (20) always induces worse marks for any mid

vowel than its peripheral counterparts because mid vowels violate the constraints \*PL/COR and \*PL/PHAR. Furthermore, Alderete *et al.* (1999: fn. 9) allude to the fact that dispersion effects also militate against mid vowels. For the purposes of this paper, we capture the markedness of mid vowels through the constraint \*E/\*O given in (21).

(21) \*E/\*O: Mid vowels are prohibited.

The tableau in (22) shows the effects of the hierarchy of markedness constraints from (20) and (21) on vowels in the reduplicant. In tableau (22), we abstract away from the segmental form of the base of reduplication to bring out the effects of the constraint hierarchy on reduplicant vowels more clearly.

(22)

	*PL/LAB	*PL/DORS	*E/*O	*PL/COR	*PL/PHAR
☞ a. Ci <sub>Red</sub> +base				*	
b. Cu <sub>Red</sub> +base	*!	*			
c. Ce <sub>Red</sub> +base			*!	*	*
d. Co <sub>Red</sub> +base	*!	*	*		*
⊗ e. Ca <sub>Red</sub> +base				*	*!
f. Ca <sub>Red</sub> +base		*!			*

The tableau in (22) shows the violations of the markedness constraints incurred by vowels, given the feature specifications of the Chamorro system of six vowel underliers laid out in §1. All round, back and mid vowels including [ɑ] are suboptimal in this system because they violate the high-ranking constraints \*PL/LAB, \*PL/DORS or \*E/\*O, respectively. Furthermore, [a] violates \*PL/COR and \*PL/PHAR and is, thus, suboptimal in comparison to [i] which only violates \*PL/COR. Thus, the markedness constraint hierarchy in (22) renders [i] optimal to the exclusion of all other Chamorro vowel underliers. This result is only partially desirable, as shown by the sad face next to viable candidate (22) (e). It captures the idea that [i] emerges in the reduplicant because it is the least marked underlier vowel of Chamorro. However, this system cannot license the appearance of [a] properly. Thus, the constraint hierarchy in (22) must be enhanced by constraints that favour [a] in the correct environments. We propose that two faithfulness relations are needed to capture the appearance of [a] in the reduplicant correctly. The first one demands a match in vowel lowness between input root and reduplicative word; the second one demands a match in vowel lowness between reduplicant and reduplicative base. We address these faithfulness relations in turn in the following section.

#### 4.3. Word faithfulness and base-reduplicant faithfulness

The data presented in this paper have shown ample evidence that reduplicant vowels in Chamorro may be more faithful to the input root than to the output reduplicative base. Thus, in continuative aspect reduplication mid vowels appear in the reduplicant with mid vowel roots even though the reduplicative base may contain a high vowel in these cases (cf. [kɔnni?] 'to catch, to take' versus [ko+kunni?] 'catching, taking'). Furthermore, we have seen that the low vowel [a] appears in the reduplicant of nominalising reduplication with low vowel roots even though the reduplicative output base may contain a local schwa (cf. [katsa?] 'to husk a coconut' versus [ka+katsa?] 'coconut husker'). This type of pattern in which the reduplicant morpheme appears to be more faithful to the input root than to the output reduplicative stem has been the subject of extensive discussion in the recent literature (Raimy & Idsardi 1997, Spaelti 1997, Struijke 1998, 2000; see also Yip 2000). To a significant extent, these works converge on the idea that, in order to capture the type of input-reduplicative word faithfulness displayed in Chamorro and other languages, reduplication must be understood as the fission of an input root where faithfulness to the input may be satisfied in the whole of the reduplicative output, rather than just the

reduplicative base. This is in sharp distinction to the full model of correspondence in McCarthy & Prince (1995) in which input-reduplicant faithfulness is captured through the cross-morphemic correspondence between input and reduplicant (see Raimy & Idsardi 1997 and Spaelti 1997 for arguments against this approach). For the purposes of this paper, we invoke Struijke's (2000) model in which there are three correspondence relations as displayed in fig. 2.

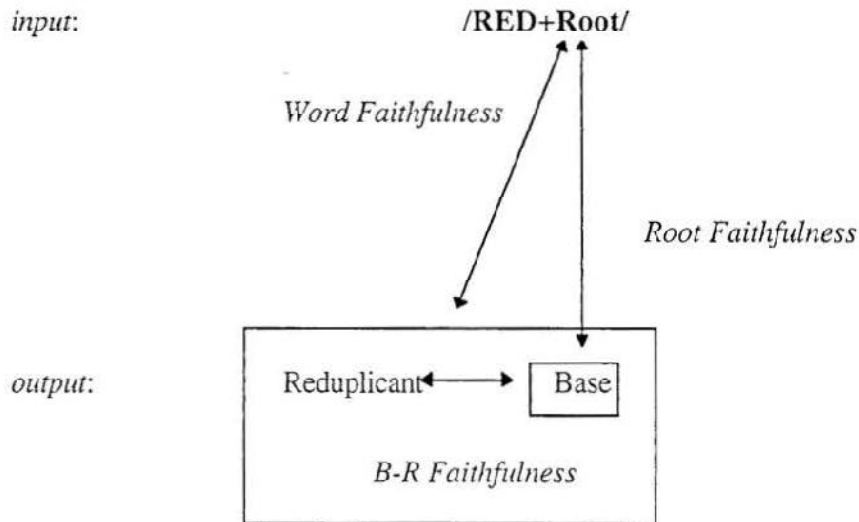


Fig. 2. Model of Correspondence with Word Faithfulness (Struijke 2000)

BR faithfulness in fig. 2. is analogous to BR faithfulness in McCarthy & Prince (1995). The difference lies in the conception of root faithfulness and word faithfulness. Root faithfulness is satisfied if an input element is matched in the reduplicative base. In contrast, word faithfulness (cf.  $MAX_{WD}$  in (23) below) is satisfied if an input element is matched anywhere in the word, that is, either in the reduplicant or in the base. A more specific faithfulness constraint utilising this correspondence relation is exemplified in (24) (cf. Struijke 2000).

(23)  $MAX_{WD}$ : Every segment in the input has some correspondent in the output word.

(24)  $ID-FEATURE_{WD}$ : If a segment  $S$  is  $[\alpha F]$  in the input, then some correspondent of  $S$  is  $[\alpha F]$  in the output.

Given constraints of the general form in (24), it is clear that reduplicative items such as  $['ka+k\text{ə}ts\text{ə}]$  'coconut husker' formed from the root  $['k\text{ə}ts\text{ə}]$  'to husk a coconut' satisfy a constraint that demands matching low vowels in input and reduplicative word. This constraint is formulated in (25).

(25)  $ID-[\text{PHAR}]_{WD}$ : If a segment  $S$  is  $[\text{PHAR}]$  in the input, then some correspondent of  $S$  is  $[\text{PHAR}]$  in the output.

The constraint in (25) demands that headedness by the feature  $[\text{PHAR}]$  in any given input segment must be matched as headedness by the feature  $[\text{PHAR}]$  in some segment of the output word. While this constraint is shown below to contribute significantly to the account of low vowel matching in Chamorro nominalising reduplication, it is obvious that this constraint captures only a subset of the input-word correspondence relations in Chamorro continuative aspect reduplication. For reasons of space, we leave the analysis of input-word correspondence in nominalising versus continuative aspect reduplication as a task for future

research and, consequently, focus on the analysis of nominalising reduplication in the remainder of this paper.

Recall from tableau (22) in section 4.2. that the place-markedness hierarchy by itself favours fixed [i] to the exclusion of matching [a]. Thus, the task is to show how the proper ranking of the input-word correspondence constraint  $ID-[PHAR]_{WD}$  contributes to the account of faithfulness to the lowness of input vowels in nominalising reduplication.

(26)

Input: RED+/katsaʔ/	*PL/DOR	$ID-[PHAR]_{WD}$	*PL/COR	*PL/PHAR
a. [ka <sub>Red</sub> +kətsaʔ]	*		*	**
b. [ki <sub>Red</sub> +kətsaʔ]	*	*!	*	*
c. [ka <sub>Red</sub> +kətsaʔ]	**!			**

All candidates in (26) incur a violation of \*PL/DOR because of the faithful rendition of the final input low back vowel. However, the low back vowel in the reduplicant in (26) (c) is suboptimal because it incurs an additional, fatal violation of \*PL/DOR. Reduplicant [i] as in (26) (b) is suboptimal with low vowel roots because it incurs a fatal violation of the constraint  $ID-[PHAR]_{WD}$ . Thus,  $ID-[PHAR]_{WD}$  is violated in (26) (b) because the lowness of the first root vowel does not have a match anywhere in the reduplicated word. In sharp contrast, (26) (a) passes  $ID-[PHAR]_{WD}$  because the lowness of the first root vowel /a/ is matched through the lowness of the reduplicant vowel [a]. Note that the change along the horizontal dimension is forced in the reduplicant through the high ranking of the place-markedness constraint \*PL/DOR. In short, [a] is correctly favoured over [i] as the reduplicant vowel with low input vowels because it incurs the fewest violations of the high-ranking constraints \*PL/DOR and satisfies the constraint  $ID-[PHAR]_{WD}$ , thus overruling the unmarkedness of [i].

The constraint hierarchy motivated to this point is not able to account for the preference for the reduplicant vowel [a] in cases in which the low vowel of the root surfaces as a low vowel in the reduplicative base. Consider tableau (27).

(27)

Input: RED+/ʔapasi/	$ID-[PHAR]_{WD}$	*PL/COR	*PL/PHAR
a. [ʔa <sub>Red</sub> +ʔapasi]		***	***!
b. [ʔi <sub>Red</sub> +ʔapasi]		***	**

If all low vowels of the input root are matched as low vowels in the reduplicative base, such candidates pass the constraint  $ID-[PHAR]_{WD}$ , leaving the decision between the reduplicant vowels [i] and [a] to the place-markedness constraints. Given that the place-markedness hierarchy favours [i] over [a], the incorrect result obtains with low vowel roots, as shown through the comparison of (27) (a) with (27) (b). To resolve this situation we invoke the general faithfulness constraint MAXBR (cf. McCarthy & Prince 1995).

(28) MAXBR: Every segment of the base has a correspondent in the reduplicant.

The constraint MAXBR demands that all segments in base and reduplicant must match. Consider now the tableau in (29).

(29)

Input: RED+/ʔapasi/	$ID-[PHAR]_{WD}$	*PL/COR	MAXBR	*PL/PHAR
a. [ʔa <sub>Red</sub> +ʔapasi]		***		***
b. [ʔi <sub>Red</sub> +ʔapasi]		***	*!	**

Both candidates in tableau (29) pass the constraint  $ID-[PHAR]_{WD}$  because the low vowels in the input root appear as low vowels in the reduplicative base. Furthermore, both candidates

in (29) violate the constraint \*PL/COR in equal measure because they contain three front vowels each. Crucially, candidate (29) (b) fatally violates the constraint MAXBR because the vowel in the CV reduplicant in (29) (b) does not match the appropriate vowel in the base. Consequently, candidate (29) (a) correctly emerges as optimal even though its three low vowels incur more violations of the constraint \*PL/PHAR than its competitor (29) (b).

In the preceding paragraphs we have shown that the appearance of the reduplicant vowel [a] with low vowel roots must be accounted for through correspondence relations between the input and the reduplicative word and between the reduplicant and the base. It remains to be shown how [i] emerges in this system as the reduplicant vowel with roots and bases containing nonlow vowels.<sup>3</sup>

#### 4.4. The emergence of unmarked [i]

In this subsection we show that [i] emerges as the reduplicant vowel with nonlow vowel roots and bases because the general MAXBR constraint requiring faithfulness of all segments in the base-reduplicant relation is ranked quite low.

(30)

Input: RED+/peska/	*E/*O	ID- [PHAR] <sub>WD</sub>	*PL/COR	MAXBR	*PL/PHAR
a. [pi <sub>Red</sub> +peska]	*		**	*	**
b. [pe <sub>Red</sub> +peska]	**!		**		***
c. [pa <sub>Red</sub> +peska]	*		**	*	***!

The reduplicant vowel [e] with roots or bases containing initial front mid vowels is correctly suboptimal with nominalising reduplication through the high ranking of the markedness constraint \*E/\*O, as shown in candidate (30) (b). The comparison between candidate (30) (a) and (30) (c) shows that the decision between these two candidates cannot be made by the constraints ID-[PHAR]<sub>WD</sub>, \*PL/COR or MAXBR. Both candidates pass ID-[PHAR]<sub>WD</sub> because the input low vowel is represented faithfully in the output. Furthermore, both candidates violate \*PL/COR equally because they contain the same number of front vowels. Moreover, (30) (a) and (30) (c) violate MAXBR equally because the initial base vowel does not match the reduplicant vowel in either of the candidates. Thus, the decision is passed along to the low-ranked markedness constraint \*PL/PHAR. Candidate (30) (c) incurs more violations of this constraint than (30) (a) because the low reduplicant vowel in (30) (c) incurs a violation of \*PL/PHAR that is not present for the reduplicant vowel [i] in (30) (a). Thus, candidate (30) (a) correctly emerges as optimal. For the sake of completeness, tableaux for nominalising reduplication with the remaining input vowels are presented in (31) to (33).

(31)

Input: RED+/li?i?/	*PL/COR	MAXBR	*PL/PHAR
a. [li <sub>Red</sub> +li?i?]	***		
b. [la <sub>Red</sub> +li?i?]	***	*!	*

(32)

Input: RED+/gupu/	*PL/COR	MAXBR	*PL/PHAR
a. [gi <sub>Red</sub> +gupu]	*	*	
b. [ga <sub>Red</sub> +gupu]	*	*	*!

<sup>3</sup> Note that our analysis abstracts away from a number of issues in nominalising reduplication peripheral to our present concerns including the CV shape of the nominalising reduplicant and its stress-attracting nature.

(33)	Input: RED+/kɔnniʔ/	*PL/COR	MAXBR	*PL/PHAR
a.	[ <sup>i</sup> ki <sub>Red</sub> +kɔnniʔ]	**	*	
b.	[ <sup>a</sup> ka <sub>Red</sub> +kɔnniʔ]	**	*	*!

The tableaux in (31)-(33) demonstrate that the reduplicant vowel [i] is always favoured over the reduplicant vowel [a] with roots and bases with nonlow vowels either because reduplicant [a] fatally violates MAXBR or because it fatally violates \*PL/PHAR.

Given the discussion in this paper, the phonology of the Chamorro nominalising reduplicant vowel is accounted for through the constraint hierarchy given in (34).

- (34) Summary of constraint hierarchy  
 \*PL/LAB, \*PL/DORS, \*E/\*O >> ID-[PHAR]<sub>WD</sub> >> \*PL/COR >> MAXBR >> \*PL/PHAR

Given high-ranking constraint(s) ensuring that consonants are copied faithfully in Chamorro reduplication, the high ranking of \*PL/LAB, \*PL/DORS and \*E/\*O eliminates round, back and mid vowels from the nominalising reduplicant. The proper ranking of ID-[PHAR]<sub>WD</sub> accounts for the fact that the reduplicant vowel is low with low vowel roots even if the adjacent base vowel is reduced to schwa. Given the feature specifications of Chamorro vowels in §1, the constraint \*PL/COR cannot decide between the reduplicant vowels [i] and [a]. The decision for a matching reduplicant vowel falls to MAXBR if the base vowels are low or high and front. In the remaining cases, \*PL/PHAR favours [i] as the reduplicant vowel because [a] incurs a violation of \*PL/PHAR that [i] does not.

## 5. Conclusion

The data from our fieldwork presented in this paper have contributed towards a complete description of Chamorro nominalising reduplication and have provided ample evidence for fixed segmentism in nominalising reduplication. Thus, the vowel in the prefixing reduplicant of nominalising reduplication is low front [a] if the first vowel of the input root or the output base is a low vowel, whereas the vowel in the reduplicant is [i] if the first vowel in the root or the base is a nonlow vowel. Furthermore, in line with the predictions of Alderete *et al.* (1999), the restriction of the vowel inventory of the Chamorro nominalising reduplicant to [i] and [a] has been shown to be matched as nonschwa vowel inventories in the phonology of other languages such as Margi, Iatmul and Abelam. In addition, in contrast to earlier descriptions, we have shown that the vocalism of the nominalising reduplicant is not caused by *umlaut*/vowel fronting and does not depend on the presence of the determiner *i*. Instead, the vocalism of the reduplicant in nominalising reduplication has been shown to be an integral part of the morphophonological process of reduplication. Furthermore, the vocalism of the base in nominalising reduplication has been shown to be influenced by Vowel Lowering and by *umlaut* induced by the reduplicant itself.

The fixed segmentism in Chamorro nominalising reduplication has been shown to be a case of markedness reduction with some interesting complexities. Markedness straightforwardly excludes back, round and mid vowels from the stress-attracting nominalising reduplicant although such vowels are part of the phonology of Chamorro elsewhere. However, the appearance of [a] versus [i] in the reduplicant depends on the height of the root or base vowel. Thus, the cross-linguistically marked low front vowel [a] appears if there is a local low vowel in the root or the base, whereas the unmarked vowel [i] appears only if there is no local low vowel in the input or in the base of reduplication. In this respect, the preference for reduplicant [i] is a case of the emergence of the unmarked in the sense of McCarthy & Prince (1994).

The appearance of [a] in nominalising reduplication has been shown to be cued by faithfulness to the reduplicative base and to the input to reduplication. Whereas the model proposed in Alderete *et al.* (1999) has been shown to be well-suited to account for the

markedness reduction observed in the fixed segmentism of Chamorro nominalising reduplication, their model cannot account for the fact that reduplicant vowels in Chamorro under certain conditions take their cue from the input to reduplication rather than the reduplicative output. We have proposed to resolve this issue by integrating recent models of correspondence theory, in particular Struijke (2000), into the markedness reduction framework for fixed segmentism. Thus, the proper ranking of a word faithfulness constraint accounts for the appearance of [a] in the nominalising reduplicant even if there is no local low vowel in the reduplicative output. Clearly, the relation between fixed segmentism, markedness and faithfulness needs to be examined further in future work. Other issues arising from the present paper that are well worth further investigation include the account of *umlaut* and Vowel Lowering in the reduplicative base of nominalising reduplication, the analysis of stress in reduplication and the analysis of continuative aspect reduplication in Chamorro.

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