

Ka, tra, na and
Consonant-final Roots
in Malagasy: Evidence
in Genitive Formation
and Reduplication

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Abstract

In Malagasy, most words have penultimate stress, yet words ending with “weak syllables” (i.e. *ka*, *tra* and *na*) usually have antepenultimate stress. Some may argue that antepenultimate stress appears because those “weak syllables” are invisible in stress assignment, but extrimetricity assumption cannot explain the fact that certain words ending in *ka*, *tra*, *na* also have penultimate stress. This paper aims to test the hypothesis that Malagasy words with antepenultimate stress have a consonant-final root, and penultimate stress is assigned before the epenthesis of the final vowel *a* in the derivation from the underlying forms to the surface forms of those words. Given that the consonant-final root hypothesis has not been tested in morphologically complex words, other than suffixed verbs, this paper investigates the behaviors of nouns and adjectives with *ka*, *tra*, *na* endings when they undergo possessive construction and reduplication. I show how the consonant-final root hypothesis could correctly predict the surface forms of morphologically complex words that are derived from antepenultimately stressed words. I also examine the phonological processes that words with antepenultimate stress might undergo when forming morphologically complex units.

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1 Introduction

This paper investigates the status of final syllables *ka*, *tra*, *na* in Malagasy, a Malayo-Polynesian language of the Austronesian family spoken in Madagascar. Malagasy has a four-vowel system: /i/, /u/, /e/ and /a/, and it has two diphthongs, /ai/ and /au/. The vowel /o/ appears in (primarily French) loan words (Erwin, 1996). The consonant inventory of Malagasy is shown in Table 1.1.1 following the analysis of Keenan & Polinsky (1998):

Table 1.1.1 Consonants in Malagasy

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Velar	Glottal
Stops	p, b, ^m p, ^m b		t, d, ⁿ t, ⁿ d			k, g, ^ŋ k, ^ŋ g	
Fricatives		f, v		s, z			h
Affricates				ts, dz, ⁿ ts, ⁿ dz	t ^r , d ^r , ⁿ t ^r , ⁿ d ^r		
Nasals	m			n			
Lateral				l			
Trill				r			

All syllables in Malagasy are of the form (C)V, and pre-nasalized stops such as /^mp/ and /ⁿd/ are individual phonemes in Malagasy, not nasal-stop clusters. While most Malagasy words have penultimate stress¹ (Erwin, 1996), words ending with *ka*, *tra* and *na* (i.e. the so-called “weak syllables”) usually have antepenultimate stress (Keenan & Razafimamonjy, 1995). One may argue that the occurrence of antepenultimate stress is because those “weak syllables” are invisible in stress assignment, yet this assumption of their extrametricality cannot account for the fact that words with *ka*, *tra*, *na* endings sometimes also have penultimate stress, such as *tanána* ‘village’ and *lalána* ‘road’. Following the assumption in Erwin (1996) and Albro (2005), this paper hypothesizes that Malagasy words with antepenultimate stress have consonant-final roots. Moreover, penultimate stress is assigned before the epenthesis of the final vowel *a*. This consonant-final root hypothesis is only tested in active verbs and suffixed verbs in Erwin (1996), and in reduplication data with an emphasis on verb reduplication (Albro 2005). This paper, with a focus on nouns and adjectives, provides evidence for the consonant-final root hypothesis by

¹ Words ending in diphthongs have final stress. Erwin (1996) argues that two moras are contained in diphthongs, thus the stress rule is consistent in the analysis of both penultimate stress and final stress: stress the syllable containing the penultimate mora.

examining the behaviors of words with *ka*, *tra*, *na* endings when they undergo morphological processes such as suffixation in genitive construction and reduplication.

The paper is organized as follows. Section 2 “Background and Proposal” presents the puzzles related to *ka*, *tra*, *na* final syllables and some previous analyses of these syllables. I will illustrate the consonant-final root proposal and the motivation of this proposal in detail. Section 3 “Supporting Evidence” provides evidence in pronominal genitive formation and reduplication and shows how the consonant-final root hypothesis could correctly predict the surface form of morphologically complex words derived from antepenultimately stressed words. A derivational rule-based analysis is adopted. Section 3 also examines the phonological processes that words with antepenultimate stress might undergo when forming a morphologically complex unit. Section 4 “Discussion and Conclusion” discusses remaining issues of this proposal and an alternative analysis regarding *ka*, *tra*, *na* final syllables, as well as possible avenues for future research.

2 Background and Proposal

2.1 Antepenultimate Stress and “Weak Syllables” *ka*, *tra*, *na*: The Puzzle and Background

In Malagasy, stress usually falls on the penultimate syllable of a word (Erwin, 1996). Antepenultimate stress occurs when a word ends in an arguably “weak” syllable – *ka*, *tra* or *na* (Keenan & Razafimamonjy, 1995). Nevertheless, some words ending in those “weak syllables” still have penultimate stress, which exhibit minimal pairs with their antepenultimate counterparts. Examples include *tanána* ‘village’ and *tánana* ‘hand’. These contrasts seem to show that *ka*, *tra* and *na* are sometimes invisible to stress assignment, yet sometimes they are not. Furthermore, when nouns with antepenultimate stress undergo genitive constructions from pronouns, instead of suffixing regular genitive pronouns, either the final vowel *a* or the whole final weak syllable is removed, and the genitive suffix (or part of it) is added. For instance, in the formation of *tánako* ‘my hand’, the final weak syllable *na* in *tánana* is removed, and the first-person singular suffix *-ko* is attached. In contrast, penultimately stressed nouns ending in weak syllables undergo regular pronominal genitive formation, with a genitive suffix added in the end. For instance, *-ko* is suffixed to the penultimately stressed word *tanána* ‘village’ to form *tanánako* ‘my village’, without omitting the final syllable *na*. These observations suggest that the syllable *ka*, *tra* or *na* may or may not be deleted in the process of genitive formation, depending on the position of stress. One possible analysis would be that the weak syllable has an extrametrical phonological status that could account for the assignment of antepenultimate stress, but it is puzzling why other words with weak syllable ending still have penultimate stress. Therefore, the phonological status of the weak syllables in some words needs to be analyzed differently than in the others in order to account for different stress positions and their different behaviors in possessive formation.

In an attempt to solve the puzzle, Keenan and Razafimamonjy (1995) define the group of pseudo-weak lexicon, in contrast with the words ending in real “weak syllables”. Although word-final “weak syllables” *ka*, *tra* and *na* are ignored in stress assignment, if the word is lexically defined as “pseudo-weak”, the final syllable will be visible again and the stress will be

penultimate. However, many issues have been raised regarding this analysis. For instance, the motivation is uncertain for this separate, “weak syllable” stress assignment rule as well as the many lexical exceptions to that rule (O’Neill 2015). Thus, a more unified and parsimonious analysis is necessary to account for this variation in stress assignment.

2.2 Consonant-Final Root Proposal

Alternative to the “weak syllables” analysis in Keenan & Razafimamonjy (1995), Erwin (1996) and Albro (2005) posit that all antepenultimately stressed words are underlyingly consonant-final, and the final vowel *a* is epenthetic to prevent word codas. *Ka*, *tra* and *na* are the surface realizations of all word-final consonants, which neutralize to one of /k, tʰ, n/ before undergoing vowel epenthesis² (O’Neil, 2015). Crucially, penultimate stress is assigned before the epenthesis of the final vowel. This assumption not only can account for the occurrence of different stress positions, but is argued to be more parsimonious. It requires no separate stress assignment rule based on what the final syllable is (O’Neill). Even though it necessitates an additional epenthetic process, the motivation is to maintain syllable structure (O’Neill, 2015). Following O’Neill (2015), the ordered-rule analysis of minimal pair *tánana* and *tanána* is given in the derivation table below. The root (i.e. UR) of *tánana* has a final consonant *n*, and the epenthesis of the vowel *a* occurs after stress assignment on the penultimate syllable. In contrast, the root of *tanána* is /tanana/, with a non-epenthetic vowel ending.

Table 2.2.1

Gloss	‘hand’	‘village’
UR	/tanana/	/tanana/
Stress assignment	/tánana/	/tanána/
Epenthesis	/tánana/	—
SR	[tánana]	[tanána]

Based on the consonant-final root proposal and ordered-rule analysis, Section 3 shows whether the surface forms of words with *ka*, *tra* or *na* endings can be predicted when they undergo certain morphological processes including suffixation in pronominal genitive formation and reduplication.

² For words with underlying consonant-final roots, the UR forms shown in this paper are roots after their final consonants neutralize to one of the consonants /k, tʰ, n/. This paper is not interested in the identity of the consonants before neutralization. The discussion about their identity can be seen in Albro (2005) and in O’Neil (2015).

3 Supporting Evidence

3.1 Evidence in Pronominal Genitive Formation

This sub-section provides reanalyses of the genitive formation from personal pronouns following the consonant-final root assumption. A genitive pronoun is suffixed to the noun root in regular pronominal genitive formation, for instance, *trano* ‘house’ becomes *tranoko* ‘my house’ with the first-person genitive pronoun *-ko* suffixed. Previous studies employ ad-hoc final vowel deletion rules and different types of genitive pronouns suffixed to words with *ka*, *tra*, *na* endings compared to those without (Keenan & Polinsky, 1998, Paul 1996). For instance, Table 3.1.1 shows two types of genitive pronouns for nouns without weak endings (Gen.1) and nouns with weak endings (Gen.2) according to Paul (1996).

Table 3.1.1

	1st sg.	2nd sg.	3rd sg./pl.	1st pl. inclusive	1st pl. exclusive	2nd plural
Gen. 1	-ko	-nao	-ny	-ntsika	-nay	-nareo
Gen. 2	-o	-ao	-ny	-tsika	-ay	-areo

Paul (1996) points out that the final vowel *a* drops in weak-ending nouns when the second types of genitives are suffixed, for instance, *soroka* ‘shoulder’ becomes *soroko* ‘my shoulder’, yet the motivation of this deletion rule is unclear. The genitive formation patterns of penultimately stressed words with weak endings actually behave like words with non-weak endings, but those “exceptions” are not discussed in Paul (1996). I will show that nouns with *ka*, *tra*, *na* endings, either antepenultimately stressed or penultimately stressed, have the same genitive suffixes as other nouns, and extra vowel deletion rules are not needed because the roots of nouns with antepenultimate have consonant endings. However, an incorporation process which refers to a set of phonological rules (e.g. deletion and fortition) that apply to consonant clusters (Lin 2005) is added after the suffixation of genitive pronouns, in order to satisfy the syllable constraints for the surface forms of Malagasy words.

Take the minimal pair *tánana* and *tanána* as an example, Table 3.1.2 provides ordered-rule analyses for both words when the same first-person singular genitive *-ko* is attached to both roots. Based on the consonant-final root proposal, the antepenultimately stressed word *tánana* has the root /tanán/ with final consonant *n*, whereas the root of penultimately stressed word *tanána*, /tanána/, does not have a final consonant. To derive the correct surface forms of both words, I argue that Suffixation occurs after the penultimate stress is assigned to the root. This is because otherwise the stress would be on the penultimate syllable of the suffixed form, which would incorrectly predict the surface forms to be *tanáko* and *tananáko*. The final *n* in the root

/tanana/ is deleted in the incorporation process, which occurs after the suffixation of *-ko*. The deletion of *n* is motivated by maintaining CV syllable structure and prohibiting consonant clusters in Malagasy phonology. Compared to Table 2.2.1 where the epenthetic vowel *a* is added to the consonant-final root, the vowel does not need to be added word finally to prevent codas in either word in Table 3.1.2, since the final syllables are already in CV structure.

Table 3.1.2

Gloss	'my hand'	'my village'
UR	/tanana/	/tanana/
Stress assignment	/tána/	/tána/
Suffixation	/tánako/	/tánako/
Incorporation	/tánako/	—
SR	[tánako]	[tánako]

The analyses of the complete pronominal genitive morphology for both words *tanána* and *tánana* are provided in Table 3.1.3 and 3.1.4. In Table 3.1.3, genitive suffixes are directly added to the end of the root /tanana/. Since the root does not end in a consonant, the incorporation process that targets consonant clusters resulting from suffixation does not apply here.

Table 3.1.3, village

Gloss	1sg.	2sg.	3sg./pl.	1pl.(incl.)	1pl.(excl.)	2pl.
UR	/tanana/	/tanana/	/tanana/	/tanana/	/tanana/	/tanana/
Stress assignment	/tána/	/tána/	/tána/	/tána/	/tána/	/tána/
Suffixation	/tána-ko/	/tána-nao/	/tána-ny/	/tána-ntsika/	/tána-nay/	/tána-nareo/
Incorporation	—	—	—	—	—	—
SR	[tánako]	[tánanao]	[tánany]	[tánantsika]	[tánanay]	[tánanareo]

As Table 3.1.4 shows, the genitive suffixes other than the first person singular *-ko* all start with the nasal *n*. When those genitive pronouns are suffixed to /tána/, which ends with *n*, either the nasals fuse into one, or one of the nasals deletes in the incorporation process. If the

nasal deletes, it is uncertain whether the initial *n* in the suffix elides or the final *n* in the root elides. To figure out a general and consistent incorporation rule, we need to look at the pronominal genitive formation in words with antepenultimate stress that end with *ka* and *tra*.

Table 3.1.4, hand

Gloss	1sg.	2sg.	3sg./pl.	1pl.(incl.)	1pl.(excl.)	2pl.
UR	/tanán/	/tanán/	/tanán/	/tanán/	/tanán/	/tanán/
Stress assignment	/tánán/	/tánán/	/tánán/	/tánán/	/tánán/	/tánán/
Suffixation	/tánán-ko/	/tánán-nao/	/tánán-ny/	/tánán-ntsika/	/tánán-nay/	/tánán-nareo/
Incorporation	/tánako/	/tánanao/	/tánany/	/tánantsika/	/tánanay/	/tánanareo/
SR	[tánako]	[tánanao]	[tánany]	[tánantsika]	[tánanay]	[tánanareo]

Table 3.1.5 and 3.1.6 below exhibit the analyses of genitive formation of *zanaka* and *tongotra* from different pronouns. To account for the incorporation patterns that occur in these two tables as well as in Table 3.1.4, I argue that the final consonant in a root is preferred over the initial consonant in a suffix in the process of incorporation. As we can see in Table 3.1.5 and 3.1.6, when *-nao*, *-nay* or *-nareo* is suffixed to /zának/ and /tóngotr/, the *n* in the suffixes deletes while the final consonants in the roots survive. Similarly, the deletion of the initial consonants in *-nao*, *-nay*, *-nareo* can also be applied in *na*-ending words, the uncertain case that we discussed in the previous paragraph. When the suffix *-ko* is added, the *k* in the suffix is dropped, and the final *tr* or *k* in the roots survives consistently. In Table 3.1.4, however, when *-ko* is attached, the final *n* in the root is deleted and the initial *k* in the suffix survives in the formation of the surface word *tánako*, not *tánano*. This exception can be explained by the suppletive status of *ko* in Malagasy and other Malayo-Polynesian languages, and the fact that the word *fantatro* ‘known by me’ can be said as *fantako* suggests some overgeneralization of the suffix *ko* to *tra*-ending words (Paul 1996). Nevertheless, exceptions also occur when *-ny* and *-ntsika* are suffixed to roots ending in *k* or *tr*. For instance, /tóngotr/ with *-ny* suffixed becomes *tóngony*, not *tóngotry* in Table 3.1.6. This may be because the third person genitive forms (e.g. *tongony*) can be phonetically and morphologically better distinguished from other possessive forms of nouns. For example, the form *tongotry* appears in the possessive constructions of proper nouns as in *tongotry Rakoto* ‘Rakoto’s foot’ (Paul 1996). As for the suffixation of *-ntsika* to roots ending in *k* or *tr*, the suffix’s initial consonant *nts* only loses its prenasalization; the affricate /ts/ is not deleted, instead, the final consonant *k* or *tr* in the root is dropped.

Table 3.1.5: *child*

Gloss	1sg.	2sg.	3sg./pl.	1pl.(incl.)	1pl.(excl.)	2pl.
UR	/zanak/	/zanak/	/zanak/	/zanak/	/zanak/	/zanak/
Stress assignment	/zának/	/zának/	/zának/	/zának/	/zának/	/zának/
Suffixation	/zának-ko/	/zának-nao/	/zának-ny/	/zának-ntsika/	/zának-nay/	/zának-nareo/
Incorporation	/zánako/	/zánakao/	/zánany/	/zánatsika/	/zánakay/	/zánakareo/
SR	[zánako]	[zánakao]	[zánany]	[zánatsika]	[zánakay]	[zánakareo]

Table 3.1.6: *foot*

Gloss	1sg.	2sg.	3sg. /pl.	1pl.(incl.)	1pl.(excl.)	2pl.
UR	/tongotr/	/tongotr/	/tongotr/	/tongotr/	/tongotr/	/tongotr/
Stress	/tóngotr/	/tóngotr/	/tóngotr/	/tóngotr/	/tóngotr/	/tóngotr/
Suffixation	/tóngotr-ko/	/tóngotr-nao/	/tóngotr-ny/	/tóngotr-ntsika/	/tóngotr-nay/	/tóngotr-nareo/
Incorporation	/tóngotro/	/tóngotrao/	/tóngony/	/tóngotsika/	/tóngotray/	/tóngotrareo/
SR	[tóngotro]	[tóngotrao]	[tóngony]	[tóngotsika]	[tóngotray]	[tóngotrareo]

In Table 3.1.7 below, I present more genitive formation data of *ka*, *tra*, *na* ending words with either penultimate or antepenultimate stress. We can see that these minimal or near minimal pairs all follow the above-mentioned patterns. Based on the consonant-final root proposal, the suffixed forms of the words with antepenultimate stress can be correctly derived using the same ordered-rule analysis described above.

Table 3.1.7

Word	lálana	lalána	áloka	alíka	pératra	rátra
Root	/lalan/	/lalana/	/alok/	/alika/	/peratr/	/ratra/
Gloss	'road'	'law'	'shelter'	'dog'	'ring'	'wound'
1sg.	lálako	lalánako	áloko	alíkako	pératro	rátrako
2sg.	lálanao	lalánanao	álokao	alíkanao	pératrao	rátranao
3sg./pl.	lálany	lalánany	álony	alíkany	pérany	rátrany
1pl.incl.	lálantsika	lalánantsika	álotsika	alíkantsika	pératsika	rátrantsika
1pl.excl.	lálana	lalánana	álokay	alíkanay	pératray	rátranay
2pl.	lalanareo	lalánanareo	álokareo	alíkanareo	pératrareo	rátranareo

3.2 Evidence in Reduplication

We now turn to look at Malagasy reduplication and examine the consonant-root final proposal in the reduplication of *ka*, *tra*, *na* ending words with antepenultimate stress and those with penultimate stress. In terms of reduplication in Malagasy nouns and adjectives, everything starting from the syllable with the primary stress to the right edge of the root is copied and suffixed to the root to derive its reduplicated form. For example, *fály* 'happy' becomes *fálfály* 'somewhat happy', and *saláma* 'healthy' becomes *salámáláma* 'somewhat healthy'. Based on the proposal that words with antepenultimate stress underlyingly end in consonants, the penultimate stress is first assigned to the consonant-final root, and then the syllables starting from the primary stress to the right edge of the root is copied and is suffixed to the root base. Then, the incorporation process applies, including a set of phonological rules such as deletion and fortition. Finally, the vowel *a* is epenthesized to the right edge of the reduplicated form after the incorporation. The derivation table in 3.2.1 illustrates the ordered-rule analysis of the reduplication in antepenultimately stressed words ending in *tra*. When the copied root is suffixed to the root base, the final consonant *tr* in the root base is deleted when the reduplicant starts with a consonant. For example, in *tèzitézitra*, since the reduplicant *tézitr* starts with *t*, the final *tr* in the root base is deleted to maintain CV syllable structure and prevent consonant cluster in the reduplicated form. In *àntitrántitra*, however, the final *tr* in the root base is reserved, since the reduplicant *àntitr* starts with a vowel and the syllables in the reduplicated form already have CV structures without any deletion. In *mihisatrísatra*, there is prefixation process in which *mi-* is attached to the left edge of the root³. The final *tr* in the root base is not deleted in the

³ It is not certain whether the *mi-* part in *mihisatr* is part of the root or it is prefixed to the root, especially it serves as an adjective in the data here instead of a verb. If *mi-* is a prefix, the prefixation can happen either

incorporation process, yet the initial *h* in the reduplicant is removed in the orthography. Since /h/ in Malagasy is barely pronounced, the reduplicant /hísatr/ is phonetically equivalent to /ísatr/ which starts with a vowel. Thus, the final *tr* in the root base does not need to be deleted to repair the syllable structure. Note that if the root were not consonant-final, it would derive an incorrect reduplicated form when the whole root starting from the stressed syllable were copied, including the final vowel. For example, if the root were /tezitra/, not /tezitr/, the reduplicated form would be expected as *teziratezitra. In this case, extra rules have to be added to delete the final vowel *a* in the root base /tezitra/ before the reduplicant is suffixed, yet again, it is unclear why words with *ka*, *tra*, *na* endings have to be treated differently with separate rules in the process of reduplication.

Table 3.2.1

Gloss	'somewhat angry'	'somewhat old'	'somewhat rough'
UR	/tezitr/	/antitr/	/hisatr/
Stress assignment	/tézitr/	/ántitr/	/hísatr/
Prefixation	—	—	/mihísatr/
Copy	/tèzitr-tézitr/	/àntitr-ántitr/	/mihísatr-hísatr/
Incorporation	/tèzitézitr/	/àntitrántitr/	/mihísatrísatr/
Epenthesis	/tèzitézitra/	/àntitrántitra/	/mihísatrísatra/
SR (reduplicated form)	[tèzitézitra]	[àntitrántitra]	[mihísatrísatra]

Table 3.2.2 demonstrates the reduplication in *ka*-ending antepenultimately stressed words. As in *pètapétaka* and *màsamásaka*, the final *k* in the base root is deleted to maintain CV syllable structure when the reduplicant is suffixed, at least for reduplicant that starts with a consonant. We do not have data that start with a vowel and end in *ka*, but such hypothetical words would likely have the same patterns as *tra*-ending words, in which the final *k* is not deleted to repair syllable structure. In *lànadánaka*, the initial /l/ in the reduplicant undergoes fortition, turning into the voiced stop /d/ with the same place of articulation.

Table 3.2.2

Gloss	'somewhat flat'	'somewhat exhausted'	'somewhat ripe'
UR	/petak/	/lanak/	/masak/
Stress assignment	/pétak/	/lának/	/másak/
Copy	/pètak-pétak/	/lànak-lának/	/màsak-másak/
Incorporation	/pètapétak/	/lànadának/	/màsamásak/
Epenthesis	/pètapétaka/	/lànadánaka/	/màsamásaka/
SR (reduplicated form)	[pètapétaka]	[lànadánaka]	[màsamásaka]

For the reduplication in na-ending words with antepenultimate stress shown in Table 3.2.3, it is interesting to see that the final /n/ in the base root is realized as homorganic as the initial consonant in the reduplicant. The nasals are not deleted to maintain the CV syllable structure, because they are realized as single prenasalized consonants with the following stops, namely, /mp/, /nd/ and /ŋk/. The initial consonant of the reduplicant undergoes fortition. For instance, the initial fricative /v/ in the reduplicant /vìzan/ becomes the stop /b/ in vîzambízana, and the initial fricative /h/ in /haíngan/ becomes the stop /k/ in haìngankaíngana. Moreover, as discussed before, the initial liquid /l/ in /lálín/ becomes the stop /d/ in làlindálina. If the root were /lalina/ which ends in a non-epenthetic vowel, the reduplicated form would be incorrectly derived as *lalinadalina, since there is no transparent motivation to remove the vowel *a* in the base. Similarly, if the root of antepenultimately stressed word *vízana* were /vizana/, then its reduplicated form would be *vizanabizana, which is not the correct form. Therefore, the reduplicated forms of antepenultimately stressed words with ka, tra, or na endings can be correctly derived under the hypothesis that the roots of those words end in consonants.

Table 3.2.3

Gloss	'somewhat hot'	'somewhat tired'	'somewhat quickly'
UR	/lalin/	/vizan/	/haingan/
Stress assignment	/lálín/	/vìzan/	/haíngan/
Copy	/làlin-lálin/	/vìzan-vìzan/	/haìngan-haíngan/
Incorporation	/làlindálin/	/vìzambízan/	/haìngankaíngan/
Epenthesis	/làlindálina/	/vìzambízana/	/haìngankaíngana/
SR (reduplicated form)	[làlindálina]	[vìzambízana]	[haìngankaíngana]

For words with penultimate stress, including those that end in *ka*, *tra*, *na*, their roots do not have a final consonant, as illustrated in section 2.2 (i.e. *tanána* vs. *tánana*). In reduplication, it is expected that the final vowel *a* of those words would not be epenthetic, thus the penultimate syllable and the final syllable of the root should be all copied in reduplication. In Table 3.2.4, we can see that the examples *mènaména* and *salàmaláma* (Lin 2005)⁴ follow this prediction. However, this is not always the case. The reduplicated form of the bisyllabic penultimately stressed word *léna* is expected to be *lènaléna*, since the root should be /lena/. The correct surface form is actually *lèndéna*, which seems to show that the root is /len/ with a final consonant, and the final vowel *a* is epenthesized after the root is copied. This construction resembles the pattern of antepenultimately stressed words. Similarly, the reduplicated form of *rátra* is *ràdrátra*, instead of *ràtrarátra*, which suggests that the root is /ratr/. The affricate /tr/ of the root and the following trill /r/ becomes voiced affricate /dr/ in the incorporation process. It is possible that some bisyllabic penultimately stressed words do have consonant-final roots, just like those polysyllabic antepenultimately stressed words. But since they only have two syllables, their underlying forms cannot be suggested by the assignment of stress position. In another word, the stress has to be assigned penultimately since there is no antepenultimate syllable, even though the antepenultimate stress would have been an optimal option for a word with consonant-final root. To further confirm this assumption, more reduplication data of polysyllabic words with penultimate stress and *ka*, *tra*, *na* endings are needed to compare their patterns with bisyllabic words and words with antepenultimate stress.

Table 3.2.4

Gloss	'somewhat ripe'	'somewhat healthy'	'somewhat wet'		'somewhat with wounds'	
UR	/mena/	/salama/	*/lena/	/len/	*/ratra/	/ratr/
Stress	/ména/	/saláma/	*/léna/	/lén/	*/rátra/	/rátr/
Copy	/mèna- ména/	/salàma- láma/	*/lèna- léna/	/lèn-lén/	*/ràtra- rátra/	/ratr-rátr/
Incorporation	—	—	*/lènaléna/	/lèndén/	*/ràtrarátra/	/ràdrátr/
Epenthesis	—	—	—	/lèndéna/	—	/ràdrátra/
SR (reduplicated form)	[mènaména]	[salàmaláma]	*/lènaléna]	[lèndéna]	*/ràtrarátra]	[ràdrátra]

⁴ The example *salàmaláma* is selected from Lin (2005) since the data I have are still limited, especially the reduplication data for polysyllabic words with penultimate stress and *ka*, *tra*, *na* endings.

4 Discussion and Conclusion

We have seen how the consonant-final root proposal and the use of ordered-rule analysis correctly predict the surface forms of words with antepenultimate stress that undergo genitive suffixation and reduplication. As mentioned in Section 2, an alternative analysis given in Keenan & Razafimamonjy (1995) and Keenan & Polinsky (1998) is to assume that all words, including both antepenultimately stressed and penultimately stressed words, have vowel-final roots, which are the same as their surface forms. Except for some “pseudo-weak” words⁵, the other *ka*, *tra*, *na* ending words are argued to be weak since their final syllables are deleted (or partially deleted, only the final vowel of the syllable is dropped) or substituted in morphological processes such as reduplication and compounding. As for reduplication, Keenan & Polinsky (1998) argue that the final vowel of the root will elide if the reduplicant is vowel-initial. For instance, *antitrantitra* is derived from the root /antitra/, and the final *a* of the root base elides. If the reduplicant is consonant-initial, Keenan & Polinsky (1998) claim that “the root endings *-ka* and *-na* are deleted”. For example, *tezitezika* is derived from the root /tezika/, and the final syllable *ka* of the root base elides. However, the motivation for the occurrence of these different patterns is not illustrated in Keenan & Polinsky (1998). If the motivation for deleting the final syllable of the root when the reduplicant starts with a vowel is to prevent a long vowel or certain diphthongs that are not allowed in Malagasy, it is unclear what would motivate the whole *ka*, *tra*, *na* syllables to be deleted when the reduplicant begins with a consonant. Essentially, it is not clear why some of the *ka*, *tra*, *na* ending words pattern as “weak”, yet others do not, according to this analysis. In contrast, by positing that words with antepenultimate stress have consonant-final roots and applying proposed rules in a consistent order, the surface forms of both antepenultimately stressed words and penultimately stressed words can be correctly derived. As discussed in section 3, the motivation for the process Incorporation is clear in this analysis, namely, to repair the CV syllable structure and to prevent consonant clusters, ultimately respecting the phonological constraints in Malagasy.

The incorporation rules that occur in genitive formation and reduplication of antepenultimately stressed words include deletion and fortition. To repair the CV syllable structure and prevent consonant clusters, deletion applies when a genitive suffix is attached. In deciding which consonants to keep and which to omit, the final consonants of roots are generally preferred over the initial consonants of genitive suffixes. In terms of fortition that occurs in reduplication, liquids and fricatives become stops with the same place of articulation. The glottal fricative /h/ in Malagasy is barely pronounced, and it behaves differently in the incorporation process. It is either deleted before a vowel, as in /misatr/ --> *mihisatrisatra*, or it becomes a velar stop /k/ as in /haigan/ --> *haingankaingana*. The behavior of /h/ in different phonological contexts can be further examined in a future study.

Nevertheless, some issues remain in this study. The reduplication data for words ending in *ka*, *tra*, *na* with penultimate stress are not sufficient, especially for polysyllabic words. It is expected that those words with penultimate stress should copy the penultimate and final

⁵ Those lexically defined “pseudo weak” words are actually penultimately stressed words ending with *ka*, *tra*, *na*, or bisyllabic words ending with *ka*, *tra*, *na*.

syllables of the root in reduplication and share the same incorporation process (i.e. deletion and fortition) with words with antepenultimate stress. However, some bisyllabic penultimately stressed words, like *léna*, do not follow the anticipated reduplication pattern. The unexpected reduplication patterns of bisyllabic penultimately stressed words need to be further investigated, and reduplication data of polysyllabic penultimately stressed words with *ka*, *tra*, *na* endings are also needed to further examine the consonant-final root proposal.

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