Reduplication in Kodi: A paradigm function account

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Abstract

This paper investigates reduplication in Kodi, an under-documented and understudied language spoken in Sumba Island, Nusa Tenggara Timur Province, eastern Indonesia. Reduplication in Kodi shows various patterns that fall under two major types: full reduplication and partial reduplication. Full reduplication mostly involves reduplication of the entire disyllabic base. In partial reduplication, the salient patterns that are copied are initial parts (a syllable and a foot), an internal part (a syllable), or final parts (foot) of the base. Furthermore, the reduplication process serves to express salient semantic properties, such as verbal number or pluractionality, indirect noun pluralization, attenuation or numeral distributivity. It is argued that (i) stress determines the reduplication process in Kodi in that the syllable or foot which is reduplicated is predictable from the stress patterns, (ii) semantic context triggers reduplication processes, and (iii) the framework of the theory of (Generalized) Paradigm Function Morphology ((G)PFM) (Stump 2001, 2015; Stewart & Stump 2007; Spencer & Stump 2013; Spencer 2013; Nikolaeva & Spencer 2019) can satisfactorily capture how stress determines the reduplication of the base and how semantic context triggers the reduplication process. This study provides additional evidence in support of the (G)PFM theory, which can arguably be extended to handle complex reduplicative patterns beyond Kodi.

Keywords: Kodi language, reduplication, stress, semantic triggering, (Generalized) Paradigm Function Morphology, form-meaning pairing

Introduction

Kodi is an underdocumented eastern Indonesian language which is actively spoken by roughly 100,000 speakers (Ghanggo Ate forthcoming) in four sub-districts: Kodi, Kodi Mbangedho, North Kodi, and Kodi Mbalanghar of Southwestern Sumba regency,

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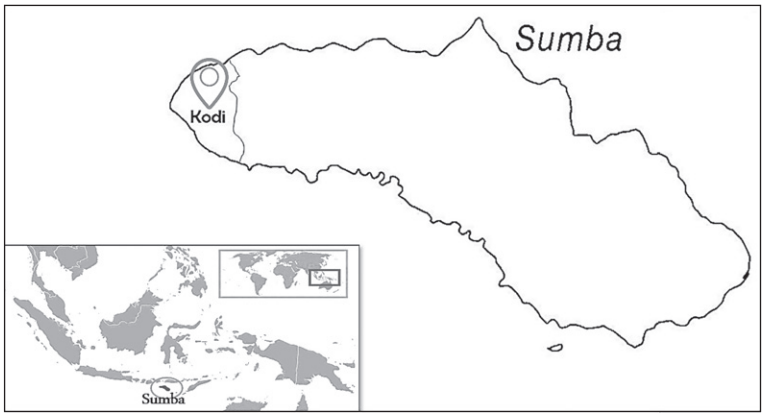

Figure 1: Location of Kodi in Sumba Island Indonesia*
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Sumba Island, East Nusa Tenggara (NTT) Province. Figure 1 shows the location of Kodi. Kodi belongs to the Sumba-Hawu subgroup (see Blust 2008) which also includes Laboya, Wanukaka, Weyewa (Wewewa), Mamboru, Anakalangu and Kambera, Hawu, and Dhao; themselves, a part of Central-Eastern Malayo-Polynesian languages. The term *Kodi* [ko:dɪ̄] is used by speakers to refer to the people, the language, and the area.

Kodi reduplication is fundamentally triggered by stress and semantic mechanisms. In example (1a), stress is assigned to the penultimate syllable, with reduplication copying only the penultimate syllable. Likewise, in (1b), reduplication copies the foot headed by the antepenultimate syllable where the stress is assigned.[1]

(1) a. *tūnu* 'burn' → *tu∼tunu* 'iterative, intensive-imperative, distributive event, indirect pluralization'
b. *ūɗoko* 'kiss' → *uɗo∼uɗoko* 'iterative, distributive event'

Concerning the semantics of Kodi reduplication, the two types of reduplication, syllable and foot reduplications exemplified in (1a-b) above, have more than one meaning depending on the pragmatic context. For example, *tu∼tunu* may convey four different meanings: iterative, intensive-imperative, distributive event, and indirect pluralization. Despite this variability, the two different reduplication types in example (1) still share the same 'iterative and distributive event' meanings. Since the form-meaning correlation in Kodi reduplication does not follow a straightforward one-to-one mapping, the semantic context plays a pivotal role – it triggers the reduplication process in which the type of

[1] All data in the paper are from my own field notes except where otherwise indicated. Throughout the examples, the boundary between a base and reduplicant is indicated by a tilde (∼), while the boundary between a base and affix is indicated by a hyphen (-).

reduplication is realized depending on the context. This results in opacity of form-meaning correspondence which will be explained and exemplified further in §3.

Thus, the basic facts concerning Kodi reduplication may be summarized as (i) stress determines which prosodic unit is reduplicated within the base, and (ii) semantic context triggers reduplication processes in Kodi. In order to offer a precise account of the reduplicative templates and semantic triggering, as well as solve the form-meaning pairing issue, the Generalized Paradigm Function Morphology framework (GPFM) (Stump 2001, 2015; Stewart & Stump 2007; Spencer & Stump 2013; Spencer 2013; Nikolaeva & Spencer 2019) is adopted. The reason motivating the selection of the (G) PFM theory is due to its ability to satisfactorily handle both prosodic and semantic triggering at the morphology-phonology interface. It can also account for the syntactic properties, semantic representations, and lexemic index of reduplicated forms, whether systematic or non-systematic, by deploying an extension to the notion of Stump's (2001) notion of paradigm function. Conversely, the ability to handle the issue of form-meaning correspondence is less available in other theories (c.f. prosodic morphology (McCarthy & Prince 1994; 1995) and Optimality Theory (Prince & Smolensky 2004)).

This paper is organized as follows. After providing basic facts of Kodi phonology (§2), which will support the analyses in §3 and §4, I discuss the forms and semantics of reduplication in Kodi (§3). §4 analyses the principles by which stress conditions reduplication. §3 and §4 are crucial to pave the way for (G)PFM analysis in §5. §5 shows how (G)PFM makes it possible to model these principles. Concluding remarks are given in §6.

2. Kodi phonology: A brief overview

2.1. Sound inventories

The Kodi phonemic inventory consists of 5 vowels and 21 consonants (Hoskins 1994; Ekayani, Mbete, and Putra 2015; Ghanggo Ate 2018; Lovestrand & Balle 2019). The IPA symbols are accompanied by the practical orthography (in angle brackets < >) employed in Ghanggo Ate (2018). The Kodi orthography basically follows Indonesian orthography. Tables 1 and 2 below detail the Kodi phonemic inventory.[2]

2.2. Syllables

Kodi syllables are V, CV, VC or CVC, as exemplified in Table 3. The most common of those structures is CV. The heavy syllable structure CVC (as in *nom.mo* 'six', *mek.ke* 'shy', and *lab.ba* 'betel nut') and VC (as in *ih.ha* 'one', *iɣ.ɣa* 'fish', *ih.ho* 'bathe') are not pervasive. The coda and onset of the first and second syllables of such Kodi words are long consonants whose parts are syllabified separately. In addition, the CVC pattern is only attested in a small number of words.

[2] Parentheses indicate questionable phonemic status (see Lovestrand & Balle 2019).

Table 1: Kodi vowels

	Front	Central	Back
Close	i		u <u>
Mid	e <e>		o <o>
Open		a <a>	

Table 2: Kodi consonants

	Bilabial	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	p <p>	t <t>		(c) <c>	k <k>	
Implosive	ɓ <bh>		ɗ <dh>	(ʃ) <jh>		
Pre-Nasal	^{m}b <mb>		^{n}d <nd>	(^{n}ʃ) <nj>		
Nasal	m <m>		n <n>	(ɲ) <ny>	ŋ <ng> ^{ŋ}g <ngg>	
Trill			r <r>			
Fricative					ɣ <gh>	h <h>
Approximant	w <w>			j <y>		
Lateral				l <l>		

Table 3: The syllable patterns of the Kodi lexicon

Types	Syllable patterns	Examples
Monosyllabic items	V, CV	*a* 'DEF', *ha* 'PL', *pa-* 'CAUS'
Disyllabic items	V.CV, VC.CV, CV.CV, CVC.CV	*a.na* 'child', *ih.ha* 'one', *tu.nu* 'burn', *k^{y}e.to* 'knife', *nom.mo* 'six'
Trisyllabic items	V.CV.CV, CV.CV.CV	*i.ki.co* 'eagle', *hi.ŋi.ro* 'clean', *^{m}bu.lo.ko* 'fractured', *ba^{n}dilo* 'shoot', *waluko* 'roll up'
Quadrisyllabic items	CV.CV.CV.CV	*waricoyo* 'woman' *kabokelo* 'group' *manawaro* 'love (v)'

By contrast, CVC structures commonly occur phonetically at the end of the short form of a Kodi di-/tri-/quadrisyllabic word when the final vowel is dropped, as seen in the following examples (Lovestrand & Balle 2019).

(2) a. Long form 'burn' (V)
[tu:nu]

b. Short form
[tun]

(3) a. Long form
['wa:laho] 'reply' (V)
b. Short form
['wa:lah]

In terms of base size, nouns in Kodi can maximally have four syllables. Adjectives and verbs can minimally have two syllables and maximally have three syllables; nevertheless, they can be quadrisyllabic because of archaic affixes such as **ma-* and **ka-* (see §3.5). Affixes, on the other hand, are maximally monosyllabic, such as the causative marker, *pa-*.

2.3 Stress

Prominence in Kodi is produced by a combination of (i) greater length (duration), (ii) greater intensity (loudness), and (iii) higher pitch (Ghanggo Ate 2018; Lovestrand and Balle 2019). The prominence of stress in Kodi is culminative in that only one syllable will ever occupy the maximally prominent peak within a stress domain. This means that every word only has one stressed syllable, regardless of whether it is a disyllabic word or trisyllabic word.

Stress placement in Kodi depends on the number of syllables. In disyllabic words, stress is penultimate. In trisyllabic words, stress placement varies, and is lexically specific as either antepenultimate or penultimate. These stress patterns are discussed further in §4 with phonetic evidence.

3 Reduplication in Kodi

Reduplication in Kodi is a morphophonological process whereby a phonological part of a base is repeated, possibly with a slight modification in form. Some reduplications are partial, repeating a syllable (σ) or a foot (Ft [σσ][3]); other instances of reduplication involve full repetition of the base (ω). Reduplication applies productively only to verbs, adjectives and numerals, and serves to express a variety of meanings.

It is evident that the reduplicative form is semantically unpredictable. A particular type of reduplication is not consistently associated with a certain meaning. In other words, a single reduplicative type can relate to multiple meanings. As a result, the semantics of a reduplicated form are lexically or pragmatically determined; hence, in this paper, the semantics of Kodi reduplication is treated separately from the form.

Table 4 summarizes the forms and meanings of reduplication in Kodi with attested patterns of reduplication denoted by '+' and non-occurring patterns as '–'.

Kodi is typologically unusual compared to neighbouring Austronesian languages and beyond in that its nouns do not exhibit reduplication; cross-linguistically, noun

[3] Where a foot is a group of two syllables [σσ]; see §4.2 for more information.

Table 4: Summary of reduplicative patterns and meanings in Kodi

	Verb	Adjective	Numeral	Noun
Full				
1. Disyllabic base	+	+	–	–
2. Tri- or quadrisyllabic base	–	–	+	–
Partial				
1. σ-	+	+	+	–
2. σ- with final syllable deletion of a base	+	+	+	–
3. σC-	+	+	+	
4. [σσ]-	+	+	–	–
5. [σσC] -	+	–	–	–
6. -σ-	+	+	–	–
7. -[σσ]	+	+	–	–
Meaning				
1. Iterativity (including *diminution*)	+	–	–	–
2. Frequentativity	+	–	–	–
3. Habituality	+	–	–	–
4. Durative-continuation	+	–	–	–
5. Dispersive-discontinuation	+	–	–	–
6. Indirect noun pluralization	+	+	–	–
7. Intensity	+	+	–	–
8. Distributivity	+	–	+	–
9. Attenuation	–	+	–	–
10. Contrast	–	+	–	–

reduplication is very common, as in Pangasinan (Rubino 2005), Indonesian (Dalrymple & Mofu 2012), Balinese (Arka and Dalrymple 2021), Rote Dengka (Loe & Beratha 2017), Teop (Palmer 2012), Djaru (Nomura & Kiyomi 1993), Dyirbal (Dixon 1972), Agta (Niepokuj 1991), Comox (Sapir 1915), Pima (Riggle 2006), Papago (Zepeda 1983), and Tohono O'odham (Hill & Zepeda 1994; Fitzgerald 2003). The absence of noun reduplication in Kodi might be related to the presence of plural markers and to the occurrence of indirect noun pluralization by means of reduplicating verbal and adjectival modifiers (discussed briefly in §3.4.2 and §3.4.3). For a more detailed discussion of the absence of nominal reduplication, see Ghanggo Ate (2018).

3.1 Formal shapes of Kodi reduplication

The main forms or elements of a base that may be copied in the Kodi reduplication process are the full base[4], a foot and a syllable.

Reduplicant shapes are determined by the number of syllables the base has, and certain bases can vary in terms of how many possible reduplicants they have, as illustrated in (4)-(6). In particular, if an adjective or a verb has two syllables, then the base can have more than one shape that is able to be reduplicated: the full base or a syllable reduplicant, as in (4). If an adjective or a verb has three syllables then the reduplicant produced is a foot or syllable, as exemplified in (5). However, for numerals, reduplication is restricted in that each base, whether it is di-,tri-, or quadrisyllabic, only allows one reduplicant, as illustrated in (6).

(4) The reduplicative forms of base *mekke* 'shy'
   a. *mekke* → *mekke∼mekke* 'always shy'
   b. *mekke* → *me∼mekke* 'a little shy'

(5) The reduplicative forms of base *^{m}bokolo* 'fat'
   a. *^{m}bokolo* → *^{m}boko∼^{m}bokolo* 'getting fatter'
   b. *^{m}bokolo* → *^{m}bo∼^{m}bokolo* 'fat (indr. pl) or X fatter than before'[5]

(6) The reduplicative forms of bases *pitu* 'seven' and *ba^{n}daiha* 'nine'
   a. *pitu* → **pitu∼pitu*
   b. *pitu* → *pit∼pitu* 'seven Xs each'
   c. *ba^{n}daiha* → *ba^{n}daiha* 'nine Xs each'

3.2. Full reduplication

Cross-linguistically, full or complete reduplication is the process of copying the entire base (Inkelas & Downing 2015; Körtvélyessy 2016; Rubino 2005). General constraints on the realization of full reduplication in Kodi are as follows:

(i) If a verbal and adjectival base is disyllabic then it can be entirely reduplicated;
(ii) If a di-/trisyllabic verbal or adjectival base ends in *yo* (see §3.3.4), then full reduplication is blocked; and
(iii) If a trisyllabic or quadrisyllabic base is a numeral, then it can be fully reduplicated.

Each constraint is discussed and exemplified in detail in the following subsections.

[4] A base, in this article, is a form that a reduplicant or affix is attached or affixed to.
[5] Abbreviations follow the Leipzig Glossing Rules. Other abbreviations: ATTN attenuative; CONTR contrastive; DISCONT discontinuous-dispersive; FREQ frequentative; INTSV intensive; INDR. PL indirect plural; ITER iterative; PREP preposition; RED reduplicant; SUB subordinative.

3.2.1 *Full disyllabic verbal/adjectival reduplication*

A disyllabic base of a verb or adjective undergoes full reduplication when its both syllables are entirely reduplicated. Consider the following examples in (7):

(7) a. *otu* 'go' → *otu∼otu* 'go now and then' (V)
b. *inu* 'drink' → *inu∼inu* 'drink abundantly' (V)
c. *ɓuri* 'water' → *ɓuri∼ɓuri* 'water X repeatedly and slowly' (V)
e. *ŋahi* 'slow' → *ŋahi∼ŋahi* 'too slow' (A)
f. *mete* 'black' → *mete∼mete* 'black (indr. pl)' (A)
g. *ɗaŋa* 'many' → *ɗaŋa∼ɗaŋa* 'many (indr. pl)' (A)

Regarding numerals, no disyllabic numeral can undergo full reduplication. The copying of the whole base renders an ill-formed result, as in (8) below:

(8) a. *ih.ha* 'one' → **ih.ha∼ih.ha*
b. *tal.lu* 'three' → **tal.lu∼tal.lu*
c. *poto* 'four' → **poto∼poto*

The inability of disyllabic numerals to undergo full reduplication is somewhat surprising, given that most verbs and adjectives permit a full reduplication process.

3.2.2 *Full tri- and quadrisyllabic numeral reduplication*

Tri- and quadrisyllabic numerals may undergo full reduplication, as exemplified by (9).

(9) a. *harata* 'one thousand' → *harata∼harata* 'one thousand each'
b. *ɓaⁿdaiha* 'nine' → *ɓaⁿdaiha∼ɓaⁿdaiha* 'nine Xs each'
c. *hakaᵐbulu* 'ten' → *hakaᵐbulu∼hakaᵐbulu* 'ten Xs each'

Reduplicated trisyllabic verbs and adjectives cannot be reduplicated, and this is exemplified in (10) below:

(10) a. *uroho* 'care for or organise' → **uroho∼uroho* (V)
b. *ɯalaho* 'reply' → **ɯalaho∼ɯalaho* (V)
c. *ᵑgumuro* 'cut off hair' → ** ᵑgumuro∼ ᵑgumuro* (V)
d. *ɣoɓolo* 'tie long grasses in a bundle' → **ɣoɓolo∼ɣoɓolo* (V)
e. ɓaniŋo 'important' → **ɓaniŋo∼ɓaniŋo* (A)
f. laᵑgiho 'sweet' → ** laᵑgiho∼laᵑgiho* (A)
g. ᵐbihoko 'deflated' → ** ᵐbihoko∼ ᵐbihoko* (A)
h. koɓolo 'invincible' → ** koɓolo∼koɓolo* (A)

3.3 Partial reduplication

According to Inkelas (2014), partial reduplication comprises two types. First is the reduplication of a foot ([σσ]) and second is the reduplication of a smaller phonological constituent of a base, such as a syllable (σ).

Table 5: Reduplication constraints

Foot reduplication constraints

(i) If the trisyllabic base is a verb or adjective, then its foot occurring initially or finally can be reduplicated as diagrammed below.

a. $\boldsymbol{\sigma_1}\ \sigma_2\ \sigma_3$ V/A $\rightarrow \boldsymbol{\sigma_1}\ \sigma_2 + \overline{\boldsymbol{\sigma_1}}\ \sigma_2\ \sigma_3$ *^{m}bana∼^{m}bhanah*o ‘hot (indr. pl)’

b. $\sigma_1\ \overline{\boldsymbol{\sigma_2}}\ \sigma_3$ V/A $\rightarrow \sigma_1\ \overline{\boldsymbol{\sigma_2}}\ \sigma_3 + \overline{\boldsymbol{\sigma_2}}\ \sigma_3$ *terohi∼rohi* ‘frequently continue’

(ii) If the base is a trisyllabic verb, then its initial foot can be reduplicated along with an extrametrical consonant.

$\overline{\boldsymbol{\sigma_1}}\ \sigma_2\ \sigma_3$ V $\rightarrow\ \overline{\boldsymbol{\sigma_1}}\ \sigma_2$C + $\overline{\boldsymbol{\sigma_1}}\ \sigma_2\ \sigma_3$ *kon^{ŋ}gor∼kon^{ŋ}goro* ‘irritate repeatedly’

Syllable reduplication constraints

(i) If the disyllabic base is a verb, adjective, or numeral, then its penultimate syllable may be reduplicated as diagrammed below.

$\overline{\boldsymbol{\sigma_1}}\ \sigma_2$ V/A/NUM $\rightarrow\ \overline{\boldsymbol{\sigma_1}} + \overline{\boldsymbol{\sigma_1}}\ \sigma_2$ *ka∼kahi* ‘buy X repeatedly’

(ii) If the trisyllabic base is a verb or adjective, then either its initial (antepenultimate) syllable or its internal syllable may be reduplicated, as diagrammed below.

a. $\overline{\boldsymbol{\sigma_1}}\sigma_2\ \sigma_3$ V/A $\rightarrow\ \overline{\boldsymbol{\sigma_1}} + \overline{\boldsymbol{\sigma_1}}\ \sigma_2\ \sigma_3$ *la∼laŋgiho* ‘a bit sweet’

b. $\sigma_1\ \overline{\boldsymbol{\sigma_2}}\ \sigma_3$ V/A $\rightarrow \sigma_1 + \overline{\boldsymbol{\sigma_2}} + \overline{\boldsymbol{\sigma_2}}\ \sigma_3$ *te∼ro∼rohi* ‘continue repeatedly’

(iii) If the verbal, adjectival or numeral disyllabic base ends with the specific word-final syllable *yo*[*], then the syllable *yo* is dropped (see §3.3.4).

$\overline{\boldsymbol{\sigma_1}}$ yo V/A/NUM $\rightarrow \boldsymbol{\sigma_1} + \overline{\boldsymbol{\sigma_1}}$ *mu∼mu* ‘eat quickly’ (/muyo/)

(iv) If the numeral base is disyllabic, then its initial syllable can be reduplicated along with an extrametrical consonant.

$\boldsymbol{\sigma_1}$ σ_2 NUM $\rightarrow \overline{\boldsymbol{\sigma_1}}$ C+ $\overline{\boldsymbol{\sigma_1}}\ \sigma_2$ *tal∼tallu* ‘three Xs each’

[*]For the purposes of reduplication, *yo* deletion implies *yo* is not part of the base.

There are seven partial reduplicative patterns in Kodi, as shown previously in Table 4, including a foot occurring initially or finally ([σσ]- and -[σσ]), an extrametrical foot[6] occurring initially ([σσC]-), an initial syllable (σ-), an initial syllable (σ-) with final syllable *yo* deleted from the base, an initial extrametrical syllable (σC-) and an internal syllable (-σ-).

Partial reduplication has the following general constraints that are categorized into syllable reduplication constraints and foot reduplication constraints, where the overline symbol (¯) marks primary stress placement in Kodi.

The constraints above not only demonstrate that bases can undergo more than two or three types of partial reduplication (cf. examples (4)-(6)), but that reduplication is also

[6] “Extrametrical foot” and “extrametrical syllable” refer to a base consisting of a foot or syllable plus a following consonant that is not part of the foot/syllable.

predictable from the stress pattern of the base. The effect of stress on Kodi reduplication will be spelled out in more detail in §4.

Each constraint provided in 0 and 0 above is discussed and exemplified in detail in the following subsections.

3.3.1 *Foot reduplication ([σσ])*

Foot reduplication in Kodi is when an initial or final foot of a trisyllabic verb or adjective is reduplicated, as in (11). In tri- and quadrisyllabic numerals, this kind of reduplication is not allowed, as shown in examples (11f-g). Note that a given trisyllabic verb or adjective only has one reduplicated foot, meaning that a speaker cannot freely choose a foot of the trisyllabic base (i.e., a foot reduplicant is lexically specified).

(11) Initial foot reduplication of trisyllabic bases

a.	*uɗoko*	'kiss'	→ *uɗo∼uɗoko*	'kiss many Xs quickly'	(V)
b.	*ɓoleto*	'deceive'	→ *ɓole∼ɓoleto*	'always deceive'	(V)
c.	*kaharo*	'treat harshly'	→ *kaha∼kaharo*	'always treat harshly'	(V)
d.	*ᵐbeleko*	'wide'	→ *ᵐbele∼ᵐbeleko*	'getting wider and wider'	(A)
e.	*ɓaniŋo*	'important'	→ *ɓani∼ɓaniŋo*	'very important'	(A)
f.	*harata*	'one thousand'	→ **hara∼harata*		(NUM)
g.	*ɓaⁿdaihha*	'nine'	→ **ɓaⁿda∼ɓaⁿdaihha*		(NUM)

Finally, final foot reduplication has thus far only been found in a marginal set of lexical verbs, as shown in (12) below:

(12) Final foot reduplication of trisyllabic bases

a.	*taŋaro*	'look up'	→ *taŋaro∼ŋaro*	'always look up'	(V)
b.	*terohi*	'continue'	→ *terohi∼rohi*	'always continue'	(V)

3.3.2 *Extrametrical foot ([σσ C]) reduplication*

Extrametrical foot reduplication refers to the prefixal reduplication of an initial foot together with the following consonant, as in (13). In (13a), for example, the foot *ɓuᵑge* and the consonant /r/ are reduplicated and prefixed to the base *ɓuᵑgere* 'open' yielding *ɓuᵑger∼ɓuᵑgere* 'open X repeatedly'.

(13)

a.	*ɓuᵑgere*	'open'	→ *ɓuᵑger∼ɓuᵑgere*	'open X repeatedly'	(V)
b.	*ⁿdakuro*	'stab'	→ *ⁿdakur∼ⁿdakuro*	'stab X repeatedly'	(V)

The examples in (14) illustrate that this kind of reduplication is lexicalized: it is not generally applicable to trisyllabic words whose final syllable is an /r/-onset syllable, nor

to those whose final syllable has an onset other than /r/. Indeed, extrametrical foot reduplication has only been identified in a few verbs.

(14) a. *to$^{\eta}$goro* 'hard' → **to$^{\eta}$gor∼to$^{\eta}$goro* (A)
b. *to$^{\eta}$goro* 'hard' → *to$^{\eta}$go∼to$^{\eta}$goro* 'hard'
c. *ko$^{\eta}$goro* 'irritate' → **ko$^{\eta}$gor∼ko$^{\eta}$goro* (V)
d. *ko$^{\eta}$goro* 'irritate' → *ko$^{\eta}$go∼ko$^{\eta}$goro* 'irritate repeatedly'
e. *ɗo$^{\eta}$golo* 'arrest' → **ɗo$^{\eta}$gol∼ɗo$^{\eta}$golo* (V)
f. *ɗo$^{\eta}$golo* 'arrest' → *ɗo$^{\eta}$go∼ɗo$^{\eta}$golo* 'arrest many people'

3.3.3 *Syllable (σ) reduplication*

Syllable reduplication is when an initial or medial syllable of a base is reduplicated, as shown in examples (15)-(18). Furthermore, the reduplicant cannot come after the base, as in (15). The fact that final syllable reduplication is not allowed may be because it is constrained by stress which is mostly penultimate and antepenultimate in Kodi; this is further explored in §4.

(15) a. **inu∼u* c. **baniŋo∼ŋo* e. **kabaŋo∼ŋo*
b. **leca∼ca* d. **pi:tu∼tu*

The initial syllables (σ-) of disyllabic verbs, adjectives and numerals are allowed to be reduplicated:

(16) a. *inu* 'drink' → *i∼inu* 'drink X repeatedly' (V)
b. *leca* 'fast' → *le∼leca* 'very fast' (A)
c. *tallu* 'seven' → *tal∼tallu* 'three Xs each' (NUM)

The initial and internal syllables (σ- and -σ-) of a trisyllabic verb or adjective base can be reduplicated.

(17) Initial syllable reduplication of trisyllabic base
a. *kabaŋo* 'try' → *ka∼kabaŋo* 'try repeatedly' (V)
c. *kaharo* 'treat harshly' → *ka∼kaharo* 'treat harshly repeatedly' (V)
d. *^{m}beleko* 'wide' → *^{m}be∼^{m}beleko* 'wide (indr. pl) or X wider than before' (A)
e. *ɓokolo* 'big' → *ɓo∼ɓokolo* 'big (indr. pl) or X bigger than before' (A)

Internal syllable reduplication, as in (18), is not as productive or uncommon as initial syllable reduplication; the pattern is lexicalized. Additionally, the initial syllable of the verbs that undergo internal syllable reduplication cannot be reduplicated (as in 18c).

(18) Internal syllable reduplication of trisyllabic base

a.	*taŋaro*	'look up'	→ *ta∼ŋa∼ŋaro*	'look up repeatedly'	(V)
b.	*terohi*	'continue'	→ *te∼ro∼rohi*	'continue or not stop over'	(V)
c.	**taŋaro*	'look up'	→ *ta∼taŋaro*	'look up repeatedly'	(V)

With respect to numeral reduplication, the initial, internal and final syllable of tri- and quadrisyllabic numerals cannot undergo reduplication:

(19)

a.	*ɗuŋahu*	'two hundred'	→	**ɗu∼ɗuŋahu*
b.	*ɗuŋahu*	'two hundred'	→	**ɗu∼ŋa∼ ŋahu*
c.	*ɗuŋahu*	'two hundred'	→	**ɗuŋahu∼hu*
d.	*po^{n}dopoto*	'eight'	→	**po∼po^{n}dopoto*
e.	*po^{n}dopoto*	'eight'	→	**po∼^{n}do∼^{n}dopoto*
f.	*po^{n}dopoto*	'eight'	→	**po^{n}dopoto∼to*

Initial syllable reduplication is widely attested in Austronesian languages (Blust 2013: 242), while medial (internal) syllable reduplication, which is less pervasive in Kodi, is present in few Austronesian languages including Helong (Balle 2017: 52), Rapa Iti (Walworth 2015: 60) and Hawaiian (Alderete & MacMillan 2015: 6, 8).

Differences with respect to syllable reduplication are also found between Kodi and other Austronesian languages. Partial reduplication with duplifixes[7] and *Ca*-reduplication (Blust 2013), for instance, are not allowed in Kodi. However, partial reduplication with duplifixes is permitted in Austronesian languages, including Javanese and Indonesian. In Javanese, the copied segment consists of the first consonant of the base and a fixed vowel, /ə/ (Booij 2005: 35), as is exemplified in (20) below. Duplifixes are usually permitted in verbs and adjectives (Booij 2005: 35–36).

(20) Javanese (Booij 2005)

a.	*tamu*	'guest'	→	*tətamu* 'visit'
b.	*tua*	'old'	→	*tətua* 'elder'

Ca-reduplication refers to the reduplication of the initial consonant of the base and the addition of a fixed vowel, /a/. It is productively produced in many Austronesian languages (Blust 2013: 425) such as the Formosan languages, languages of the Philippines, Balinese, languages in various parts of eastern Indonesia, such as Sangir and Tetun, and in some Oceanic languages[8]. The target syllable and its reduplicated form appear in bold in (21).

[7] Duplifixes are elements consisting of both copied segments, as with reduplicants, and fixed segments, as with affixes (Haspelmath & Sims 2010: 39).

[8] See Blust (1998, 2013) for more details of *Ca*-reduplication.

(21) a. Amis (Reid 2009)
mirosaros 'saw' → *mi∼**ra**∼rosaros* 'keep sawing'

b. Balinese (Barber 1979, cited in Blust 2013)
bisik 'to whisper' → ***ba**∼bisik-an* 'whispering'

3.3.4 *Syllable (σ) reduplication with final syllable* yo *deletion*

In certain cases, initial syllable reduplication is enabled by means of dropping the specific final syllable *yo* in verbal, adjectival or numeral bases with two syllables, as seen in example (22) below. This final syllable deletion is only applicable to the *yo* 'syllable'.

(22) a. *wo**yo*** 'give' → *wo∼wo* 'give each of them X' (V)
b. *ba**yo*** 'new' → *ba∼ba* 'new (indr. pl)' (A)
c. *ɗu**yo*** 'two' → *ɗu∼ɗu* 'two Xs each' (NUM)

Retaining of final *yo* implies ungrammaticality: *woyo∼woyo, **ba∼bayo, *ɗu∼ɗuyo*.

For trisyllabic bases ending with *yo*, this kind of deletion is optional, as is demonstrated in (23):

(23) a. *palayo* 'run' → *pa∼la∼la(yo)* 'run repeatedly' (V)
b. *maloyo* 'long' → *ma∼lo∼lo(yo)* 'long (indr. pl)' (A)

However, it remains an open question whether the deletion of *yo* results from a morphological constraint, a semantic constraint and/or a phonological constraint.

Regarding the morphological issues which *yo* poses, it is possible that this syllable is a fossilized infinitival suffix that behaves as part of the base and must be absent when its stem operates as part of a reduplication process.

Since *yo* is retained in di/trisyllabic bases with syntactic categories other than verbs, this raises the possibility that *yo*-dropping may arise due to phonological or metrical constraints (i.e., weak syllable deletion). Infinitival affixes only attach to verbs, not to other categories, such as nouns (e.g., *toyyo* 'person'), pronouns (e.g., *yayo* '1SG') and numerals (e.g., *dhuyo* 'two'), and the *yo* syllable in those words probably cannot be attributed to a fossilized suffix.

A third possible answer to the *yo* issue is that Kodi may disfavour monosyllabic lexical words, and so it favours the addition of a semantically empty morpheme *-yo*. Nevertheless, when the word is reduplicated, it is thereby two syllables long, so this *-yo* is not needed. Then the optional absence of *-yo* in the reduplication of three-syllable words could either (i) be an imitation of the pattern of reduplication with two-syllable words, or (ii) reflect an old prefix boundary between *pa-* and *ma-* and a disyllabic word ending in *-yo*. This idea is reinforced by example (24) where *-yo* is absent in (24b), presumably because the pronominal object clitic *=ni* is suffixed to the verb. In order to provide an exact answer to this issue, further research into the behaviour of *-yo* is required.

(24) a. *Ta=woyo* *a* *lakedha* *minye=nda* *tanggu=na* *Homba.*
1PL.INCL.NOM=give DEF child girl=1PL.INCL.GEN for=3SG.NOM name
'We gave our daughter to Homba.'

b. *Ta=wo=ni* *lakedha* *miny(e)=nda* *a* *Homba.*
1PL.INCL.NOM=give=3SG.DAT child girl=1PL.INCL.GEN ? name
'We gave Homba our daughter.'

3.3.5 *Extrametrical syllable (σC-) reduplication*

Extrametrical syllable reduplication in Kodi refers to the prefixal reduplication of the base's initial syllable plus a consonant, which is an onset of its second syllable; this is exemplified in (25). This pattern is lexically restricted since it has thus far only been found to be applicable to two numerals: 'four' and 'seven'.

(25) a. *po:to* 'four' → *pot∼po:to* 'four Xs each'
b. *pi:tu* 'seven' → *pit∼pi:tu* 'seven Xs each'

3.4 Semantics of reduplication

This section will give a brief overview of the range of meanings expressed by verbal, adjectival and numeral reduplication. Additionally, this section will also address the semantic unpredictability of reduplicative forms (§3.4.5). A complete description of the semantics of reduplication in Kodi can be found in Ghanggo Ate (2018).

3.4.1 *Verbal number*

Verbal reduplication in Kodi most often indicates verbal number/pluractionality, which consists of distributive events and repeated plural events such as iterativity, frequentativity, continuity, habituality and dispersive-discontinuation and indirect noun pluralization.

Verbal number is defined as a verbal category related to events. It reflects the plurality of events in terms of the number of times an action/state takes place or the number of participants in the action (Durie 1986; Corbett 2000; Arka 2012). Plurality of events is conceptualized as repeated events (iterative) involving the same participant or as distributive events involving multiple participants (Arka 2012; Arka & Dalrymple 2017).

3.4.1.1 Repeated plural events

Repeated plural events in Kodi are characterized by time intervals or temporal points. There are two types of events which are differentiated in terms of time intervals: event-internal and event-external plurality.

Event-internal plurality is when the time interval among plural events is closed, or not open. In other words, a closed time interval of repeated events is 'closed' because it has a boundary, or because the repeated events have endpoints, or because repeated events are bounded in time. Further, Cusic states that event internal plurality can be discovered when 'a single event on a single occasion consists of internal phases' (1981: 67).

On the other hand, event-external plurality is when the time interval among plural events is open. It is 'open' as there is no boundary, meaning that any endpoints of a repeated event are absent, or the repeated events are unbounded in time and/or space. Cusic also proposes a definition related to external event plurality, namely that event external plurality can be discovered when 'a single bounded event (internally plural or not) is repeated on a single occasion' or 'when a single bounded event is repeated on different occasions' (1981: 67).[9]

The internal event in sentences (26)-(33) is usually categorized as iterative (including diminutive, tentative, conative, incassative, intensive, intensive-imperative, excessive, and augmentative meanings), while the external event in sentences (34)-(37) is categorized as frequentative, habitual, continuative and discontinuous-dispersive. Reduplicated foms appear in bold.

(26) Diminutive:

Enetu	*lakedha*	*na=**ka**∼**kati**=ya*	*a*	*kabhi.*
DEM.SG	child	3SG.NOM=RED-bite=3SG.ACC	DEF	meat

'That child **nibbled** the meat.'

(27) Tentative:

*Na=**ti**∼**tingu***	*a*	*watu.*
3SG.NOM=RED-pull	DEF	stone

'S/he **pulled** the stone **slightly**.'

(28) Conative:

Enetu	*kahila*	*na=**le**∼**lera**.*
DEM.SG	bird	3SG.NOM=RED-fly

'That bird **fluttered**.'

[9] To understand the *phase/event/occasion* (or event ratio), consider the following examples:

(i) *The mouse nibbled and nibbled the cheese*.
Repetition at the level of *phases.* Here, a nibbling event involves repeated phases of small biting.
(ii) *The mouse bit the cheese again and again on Thursday*.
Repetition at the level *events.* In this sense, more than one nibbling event happened on a single Thursday.
(iii) *The mouse was always nibbling the cheese*.
Repetition at the level of *occasions.* This means that nibbling took place on repeated occasions.

(29) Incassative:
Lo∼londo, *kabhani!*
RED-sit, man
'**Just sit**, man!'

(30) Intensive:
*A loka=nggu na=**inu∼inu** kopi.*
DEF uncle=1SG.GEN 3SG.NOM= RED-drink coffee
'My uncle **drank** coffee **abundantly** (more and more).'

(31) Intensive-imperative:
mu∼mu ta=haloko la pranggongo.
RED-eat 1PL.INCL=go PREP traditional market
'**Eat quickly**! Then we go to the traditional market.'

(32) Excessive:
*Enetu kabhani na=**madhi∼madhico** mera to anga.*
DEM man 3SG.NOM=RED-laugh like person crazy
'That man **laughed more than was appropriate** and like a madman.'

(33) Augmentative:
*Na=**konda∼konda** tana.*
3SG.NOM=RED-dig land
'S/he **digs many** holes.'

(34) Frequentative:
*Na=**pa∼palu**=ya ana=na.*
3SG=RED-hit=3SG.ACC child=3SG.GEN
'He **hit** his child **frequently**.'

(35) Habitual:
*Mahemba **o∼otu**=ni la hakola.*
Mahemba RED-go=3SG.DAT PREP school
'Mahemba **usually goes** to school.'

(36) Durative-continuative:
*Enetu kabhani na=**manduru∼nduru** wali yiwa.*
DEM.SG man 3SG.NOM=sleep-RED since just now
'That man **keeps sleeping** since several hours ago.'

(37) Discontinuous-dispersive:
*Yayo **otu∼otu**=ngga la mongo.*
1 RED-go=1SG.DAT PREP garden
'I **go** to the garden **now and then**.'

3.4.1.2 Distributive events

Distributive events in Kodi are defined by plural events that are performed at several places (spatial distributive), at various times (temporal distributive) or distributed over multiple participants. Consider an example below:

(38) *Enetu to pote* ***na=bha∼bhaghe*** *ndingi.*
DEM.SG person rich 3SG.NOM=RED-distribute money

(i) 'The rich man **gave** money **to the same person repeatedly/habitually**';
(ii) 'The rich man distributed money **to many people on one occasion**';
(iii) 'The rich man **gave** money **to many people on more than one occasion/repeatedly**.'

3.4.2 Indirect noun pluralization via modifying verb reduplication

A noun phrase (NP) can be pluralized indirectly by reduplicating a verb as shown in the following example.

(39) a. *Ha polihi a=dheke=ya* [*enetu to*[10] ***peghe***].
PL police 3PL.NOM=take=3SG.ACC DEM.SG person know
'The police arrested the **intelligent person**.'.

b. *Ha polihi a=dheke=hi* [*ehetu to* ***pe∼peghe***].
PL police 3 PL.NOM=take=3SG.ACC DEM.PL person RED-know
'The police arrested **intelligent people**.'

Modifying verbs in Kodi immediately follow the NP and describe what the noun is used for. The modifying verb is not only recruited from a class of stative verbs (e.g., *peghe* 'know'), but also active verbs (e.g., *mangguna* 'play'). The reduplicated modifying verb encodes a plural state that marks the head nouns as plural. In the above example, *peghe* is a modifying verb within the object NP. It is important to note that the noun head *toyyo* 'person' in these examples is unmarked for plurality.

3.4.3 *Semantics of adjectival reduplication*

Adjectival reduplication most often indicates indirect noun pluralization (comparably to the verb in (39)), which is a strategy of pluralizing nouns that is also attested in Balinese

[10] *To* is the short form the word *toyyo* 'person'. Note that final syllable deletion in Kodi occurs if a modifier follows the noun.

(Arka and Dalrymple 2017).[11] Additionally, adjectival reduplication often indicates intensity (high and medium), (pragmatic) attenuation, and contrast. These meanings are illustrated in (40)-(45).

(40) Indirect noun pluralization:
a. [*A dhawa Nippon* ***pandaka***] *na=pla?.*
DEF foreigner Japan short 3PL.NOM=run
'That **short** Japanese **man** ran.'

b. [*Ha dhawa Nippon* ***pa∼pandaka***] *a=pla?.*
PL foreigner Japan short-RED 3PL.NOM=run
'The **short** Japanese **people** ran.'

(41) Intensive (high):
*A=**ngahi∼ngahi** bha=paghili la mongo ehetu to?.*
3PL.NOM=RED-slow SUB.3PL.NOM=work PREP farm DEM.PL person
'Those people are **very slow** when they work in the farm.'

(42) Intensive (medium)
***Le∼leca** bhi=haloko la witi ha lakedha la!*
RED-fast SUB.2PL.NOM=walk PREP foot PL child PART
'If you walk on foot, walk **faster**, okay?'

(43) Attenuative:
Kalula=na ***ka∼kaka***.
skin=3SG.GEN white-RED
'Her skin is **whitish**.'

(44) Pragmatic attenuative:
*A=konggoro=ni, monno na=**me∼mekke**=ka.*
3PL.NOM=tease=3SG.DAT CONJ 3SG.NOM=RED-shy=PRF
'They teased her, and then she was **a little bit shy**.'

[11] An example of pluralizing nouns by means of adjectival reduplication in Balinese (Arka & Dalrymple 2017: 282):

(i) a. [*Umah-ne* ***cenik∼cenik** nto*] *suba adep-a.*
house-3SG.POSS small-RED that PRF sell-PASS
'His/her **small houses** have been sold.'
b. *Tiang ningalin* [*anak* ***gede∼gede***].
1SG.AV see person big-RED
'I saw **big people**.'

(45) Contrastive:

a. *Walu* *na=**mbokolo*** *a* *ihi=na.*
name 3SG.NOM=fat DEF body=3SG.GEN
'Walu is **fat**.'

b. *Walu* *na=**mbo∼mbokolo**=ka* *ihi=na.*
name 3SG.NOM=RED-fat=PRF body=3SG.GEN
'Walu is **fatter** now than before (than several days, months or years ago).'

3.4.4 *Distributive Numeral*

In contrast, reduplicated numerals are restricted to a single meaning of distributivity. Distributivity in numerals and distributive events discussed above are similar in that a distributive numeral can encode a distributive event as well[12].

(46) a. *Katodha* *mono* *Mahemba* *a=kahi=ya* ***dhu*** *mbu* *mbalon.*
name CONJ name 3PL.NOM=buy=3SG.ACC two CLS balloon
'Katodha and Mahemba bought **two** balloons.'

b. *Katodha* *mono* *Mahemba* *a=kahi=ya* ***dhu∼dhu*** *mbu* *mbalon.*
name CONJ name 3PL.NOM=buy=3SG.ACC RED-two CLS balloon

(i) 'Katodha and Mahemba bought **two** balloons **each at the same time or separate times**.'

(ii) 'Katodha and Mahemba bought **two** balloons **each at the same place or different places**.'

3.4.5 *Form-meaning correlation and opaque semantics*

In terms of the form-meaning correspondence, Kodi shows irregularities since reduplicative forms do not display a one-to-one relation with meanings, as exhibited by Table 6. As a consequence of semantic opacity, context plays an important role in determining the meanings carried by reduplicated forms. Citing Zeitoun & Wu (2006) and Mattes (2006), the fact that the semantics of Kodi reduplication is unpredictable is not unique to Kodi as it is also attested in other Austronesian languages.

Table 6 shows where reduplicative types share the same semantic properties. For example, a syllable, foot and full base of a verb/adjective can equally produce frequentativity. It also shows that a reduplicated form can have various meanings – the reduplication of the first syllable of verbal base *boleto* 'deceive' (47) results in frequentative (47a), distributive event (47b) and indirect plural (47c) meanings.

[12] Ghanggo Ate (2018) provides more detailed discussion relating to numeral distributivity in Kodi.

Table 6: Form-meaning correlation of Kodi reduplication

SEMANTICS	REDUPLICATIVE PATTERNS			
	Syllable σ-, σC-, -σ-	Foot [σσ]-, [σσC]-	Full (entire disyllable ω)	
Iterativity (including *diminution, intensity*)	+	+	+	V
Frequentativity	+	+	+	V
Habituality	–	+	+	V
Durative-ontinuation	–	+	+	V
Dispersive-discontinuation	–	+	+	V
Indirect pluralization	+	–	–	V/A
Distributivity	+	+ *(NUM)	+	V/NUM
Intensity	+	+	+	A
Attenuation	+	–	–	A
Contrast	+	–	–	A

Among the given examples, the alternation between meanings, therefore, is dependent on the pragmatic context.

(47) a. *Ku=bho∼bholet=ni ari=nggu.*
1SG.NOM=RED-deceive=3SG.DAT young.brother=1SG.GEN
'I usually deceive my brother.'

b. *Ndanna na=bho∼bholet=ndi ehetu to?.*
name 3SG.NOM=RED-deceive=3PL.DAT DEM.PL person
'Ndanna deceived those people.'

c. *Emi=ndi to bho∼bholet la uma=dha.*
come=3PL.DAT person RED-decieve PREP house=3PL.GEN
'The deceivers came to their house.'

3.5 Reduplication and affixes

The following section explores the interaction between reduplication and affixes with attention given to how affixes and fossilized affixes interact with reduplication in Kodi.

The Kodi morphological affixes are moderate in number (Shibatani, Artawa and Ghanggo Ate 2015), meaning that only a medium number of morphological markers are attested in Kodi. As yet, this study has found only a few affixes employed in Kodi, as in (48); other attested bound forms are primarily clitics. This claim, however, needs further study.

(48) a. *pa-* 'causative, reciprocal'
b. *ha-* 'causative, reciprocal'
c. *paha-* 'causative'
d. *ma-* 'anticausative'

In the case of causative meaning, the prefixes *pa-*, *ha-* and *paha-* are used to derive verbs from verbs, nouns and adjectives, as in (49). On the other hand, reciprocal prefixes are mostly affixed to verbs, as in (50). More research is needed to see what constrains causative prefixes and reciprocal prefixes.

(49) a. causative *pa-*
pa-londo 'cause X sit'
pa-wiha 'rice grain ripens'
pa-kabola 'make X beautiful'
pa-maringi 'make X cold'
b. causative *ha-*
ha-mate 'cause X die or kill X'
ha-mete 'become black or blacken X'
ha-palu 'hit each other'
c. causative *paha-*
paha-muta 'cause X vomit'
paha-mbahu 'make X full'

(50) Reciprocal *pa-* and *ha-*
a. *pa-ndapu* 'hug each other'
b. *pa-udhoko* 'kiss each other'
a. *ha-palu* 'hit each other'
b. *ha-mate* 'kill each other'

The anticausative prefix *ma-* is semi-productive in Kodi. By comparison with the prefix *pa-*, it is not a pervasive prefix.

(51) a. *ma-bunggere* 'opened'
b. *ma-todi* 'closed'

Kodi is also characterized by the fossilized prefixes **ma-* and **ka-*. The fossilized **ma-* prefix is often associated with stative predicates expressed by adjectives in other languages (such as 'old' and 'mature') or with middle verbs such as 'laugh'. This fossilized *ma-* prefix should not be confused with the anticausative *ma-* prefix. Many properties help to distinguish these prefixes from each other. For instance, the anticausative *ma-* is only attached to free verbal roots, such as *bunggere* 'open' and *todi* 'close'.

In terms of its productivity, the fossilized or stative **ma-* is no longer actively and regularly used in the creation of new words. The stative **ma-* is found both in intransitive

verbs such as *manduru* 'sleep' and in adjectives such as *matuyo* 'mature'. The formative **ma-* has lost its affixal status because removing it from words would derive roots such as *nduru* and *tuyo*, which have no meaning in modern Kodi.

Kodi's fossilized **ma-* is possibly related to the Proto Austronesian prefix **ma-* (Blust 2013: 263) which is used to form adjectives from a root word. Anticausative *ma-* is also a reflex of the Proto Austronesian anticausative **ma-* (Evans & Ross 2001).

While the fossilized **ka-* prefix appears in words *kabola* 'beautiful', *kambohi* 'afraid', *katapa* 'small', *kabango* 'try', *karohengo* 'grind', and *kaliro* 'ask', its affixal function in Kodi morphology is no longer apparent. Blust (2003: 473) states that the *ka-* prefix has two sources in Proto-Austronesian: the stative verb **ka-* and the formative for abstract nouns **ka-*.

These two fossilized prefixes **ma-* and **ka-* are widely well-attested (and therefore, still productive) in many Austronesian languages, such as the languages of the Philippines, the Formosan languages and the Oceanic languages.

The interaction between reduplication and affixes is productive in that reduplication can coincide with the derivational affixes *pa-, ha-*, and *ma-* 'anticausative' to create complex meanings. However, the prefixes themselves are not targeted in the reduplication process. In other words, the reduplicant of derived verbal reduplication forms always comes from the stem since the affixes cannot be included in reduplication. This is demonstrated in (52) below:

(52) a. *pa-rahi* 'make a promise' → **pa∼pa-rahi*
b. *pa-rahi* 'make a promise' → **pa-rahi∼pa-rahi*
c. *ha-mate* 'kill' → **ha∼ha-mate*
d. *ha-mate* 'kill' → **ha-mate∼ha-mate*
e. *matodi* 'opened' → **ma∼ma-todi*
d. *matodi* 'opened' → **ma-todi∼ma-todi*

The fact that affixes *pa-* 'causative, reciprocal', *ha-* 'causative' and *ma-* 'anticausative' are not targeted in reduplication suggests a morphological constraint in the reduplication mechanisms in Kodi: reduplication is only allowed to target the phonological structure of the base and not that of an affix.

In what follows, the interaction of reduplication with each prefix (*pa-*, *ha-*, *ma-*, and fossilized **ma-* and **-ka*) is described and exemplified. First is the reduplication process involving words with the prefix *pa-*. A base exhibiting the prefix *pa-* may undergo either syllable reduplication, as in (53a), or full reduplication, as in (53b). The two patterns convey different meanings:

(53) a. *rahi* 'promise' *pa-rahi* 'to promise' → *pa-*[*ra∼rahi*]
'promise repeatedly to more than one person'
b. *rahi* 'promise' *pa-rahi* 'make a promise' → *pa-*[*rahi∼rahi*]
'promise repeatedly to one person'

As can be seen from the glosses in (53), the meaning created by the process of reduplication is that of a 'plural event'. This event is spatially and temporally 'distributive' in (53a), meaning that the event of 'promising' is spread over different participants and across various occasions. The plural event is only temporally distributive (or 'frequentative') in (53b). Following the claims made in §3, these facts support the argument that Kodi reduplication cannot be predicted from semantics alone.

The examples in (53) raise an important question: why can the base noun *rahi* 'promise' be reduplicated? Recall that nouns cannot be reduplicated in Kodi (see Table 4). The notion of bracket erasure in Lexical (Morpho)Phonology (Kiparsky 1982) offers a suitable explanation for this issue. The process which leads to the reduplication of the noun *rahi* is cyclic. On level 1, *rahi* 'promise' is a noun. On level 2, *rahi* undergoes a morphological operation whereby a derivational affix is prefixed to *rahi*. On level 3, the derivational affix *pa-* is prefixed to the stem *rahi*, which results in *pa-rahi* 'to promise' and thus, the internal brackets of the stem are erased in that the morpheme boundary and syntactic category of *rahi* are removed. Consequently, on the post-cylic lexical level, the reduplication mechanism treats the whole structure of *parahi*, including its stem, as verbal. Thus, the stem *rahi* is partially and fully targeted in the reduplication process and yields *pa-ra∼rahi/pa-rahi∼rahi* (53). Note that the noun stem still cannot be reduplicated when it stands by itself:

(54) a. *rahi* 'promise' → **ra∼rahi*
b. *rahi* 'promise' → **rahi∼rahi*

This fact also holds true for other prefixes, such as *ha-*.

The second interaction between reduplication and affixes relates to the prefix *ha-*. The interaction between a base with the prefix *ha-* and the reduplication process commonly produces different reduplicant shapes: a syllable reduplicant and a full base reduplicant, as in example (55) below, or a syllable reduplicant and foot reduplicant if the base is trisyllabic.

Each reduplicant also typically carries two different meanings of plural events, namely spatial plurality with plural participants, as in (55a), and temporal distributive plurality with a singular object at a time, as in (55b).

(55) a. *mate* 'death' → *ha-mate* 'kill' → *ha-*[*ma∼mate*] 'repeatedly kill people at the same place and time'
b. *mate* 'death' → *ha-mate* 'kill' → *ha-*[*mate∼mate*] 'repeatedly kill people (not many) at different times and/or places'

The third interaction between reduplication and affixes involves the 'anticausative' prefix *ma-*. Normally, two different kinds of formal shapes are formed in this interaction: a syllable reduplicant and a full base reduplicant, as exemplified in (56). The difference in meaning between these reduplicative shapes is associated with temporal gaps between the repetitions involved in the plural events.

(56) a. *todi* 'close' → *ma∼todi* 'closed' → *ma-*[*to∼todi*] 'X is repeatedly closed'
b. *todi* 'close' → *ma∼todi* 'closed' → *ma-*[*todi∼todi*] 'X is frequently closed'

As can be seen in example (56), syllable reduplication carries an 'iterative' meaning with very close temporal points, whereas the full base reduplication carries iterative meaning with significant temporal gaps, labelled here as 'frequentative'.

The fourth and final interaction is between the reduplication process and the fossilized prefixes **ma-* and **ka-*. Unlike other prefixes described above, these prefixes can be included in the reduplication process. This provides strong evidence that **ma-* and **ka-* have been fossilized and integrated into their respective stems. In other words, the reduplication process treats the prefix as being an inseparable part of the stem, and not a distinct morphological entity. Consider the examples below:

(57) a. *madico 'laugh'* → *ma∼madico* 'laugh repeatedly and indr. pl'
b. *madico 'laugh'* → *madi∼madico* 'laugh more than is appropriate'
c. *kabaŋo* 'try' → *ka∼kabaŋo* 'try repeatedly'
d. *kabaŋo* 'try' → *kaba∼kabaŋo* 'always try'

As in example (57a), *ma* forms a syllable and is reduplicated by itself. It can also be part of a reduplicated foot, as in (57b). However, it is important to recall that productive affixes cannot be reduplicated: compare the impossibility of reduplicating *matodi* 'closed' as **mamatodi* with the possibility of *ma∼to∼todi* in (56). This is due to a prosodic constraint which prevents reduplication from taking place, which will be further discussed in §4.

4. How stress determines the reduplication process

Stress is a fundamental feature to address since the reduplication process in Kodi is determined by stress—specifically, it is only stressed units, syllable or foot, which may be copied. In other words, the unstressed ones are not permitted to be reduplicated.[13]

4.1 Stress and syllable reduplication

This section will outline (i) the stress patterns among Kodi disyllabic bases, followed by trisyllabic bases, derived words and finally, bases with fossilized affixes, and (ii) how stress determines which syllable is reduplicated.

First, stress in disyllabic bases is normally assigned to the penultimate syllable and never to the final syllable, as denoted by the macron in example (58).

(58) Stress in underived disyllabic bases
a. *ō.tu* 'go' c. *bū.ri* 'water (V)'
b. *īh.ha* 'one' d. *me.te* 'black'

[13] The following section will only discuss the stress of word classes that license reduplication, namely verbs, adjectives, and numerals.

Table 7: Phonetic analysis of penultimate stress on *ōtu* and *būri*

	ōtu 'go'		*būri* 'water (v)'	
	ō	*tu*	*bū*	*ri*
Vowel duration (ms)	45	36	40	22
Intensity (dB)	72	66	79	73
Pitch (Hz)	170	133	146	123

The stressed syllable may consist of just V as in (58a), VC as in (58b), or CV as in (58c–d). When these bases are pronounced, the stressed syllable is given prosodic prominence, such as vowel lengthening.

Consider, for example, the phonetic analysis of *ō.tu* 'go' and *būri* 'water (v)' in Table 7. The first syllable in each word is consistently stressed as evidenced by its longer duration, higher average intensity and higher average pitch frequency relative to the final syllable.

Since only stressed syllables are available for reduplication in Kodi, the syllables *ō* and *mē* in the bases *ō.tu* and *mē.te* are reduplicated, as shown in the following examples:

(59) a. *ō.tu* → *o∼otu* 'usually go to X'
b. *mē.te* → *me∼mete* 'somewhat black'

In Kodi trisyllabic bases, stress can be assigned to the antepenultimate or penultimate syllable, and is lexically determined (that is, native speakers learn the stress patterns individually). The final syllable never receives primary stress.

Consider the examples in (60):

(60) Stress in trisyllabic bases
a. *ū.ɗo.ko* 'kiss'
b. *ta.ŋā.ro* 'look up'
c. *bō.ko.lo* 'big'
d. *ᵐbī.ho.ko* 'deflated (A)'
e. *ɗō.ᵑgo.lo* 'catch'

For example, in the base *ūɗoko* in (60a), the stress is antepenultimate, being assigned to the syllable *ū*. In contrast, the base *taŋāro* in (60b) displays penultimate stress on the syllable *ŋā*.

Phonetic evidence also confirms the above claim that stress can be either penultimate or antepenultimate in trisyllabic bases. Consider the actual measurements of trisyllabic base *taŋāro* (60b) and *ɗōᵑgolo* (60e) in the following tables. The stressed syllable *ŋā* is characterized by longer duration, greater loudness and a raised pitch relative to the remaining two syllables, *ta* and *ro*. In terms of *ɗōᵑgolo*, the stress is antepenultimate. The first syllable's duration is longer with a higher pitch and intensity relative to the second and third syllables. Though the intensity measurements for first and second syllables of *ɗōᵑgolo* are similar, it is clear through the lower pitch measurement and the short duration of the second syllable that the stress lies on the first syllable.

Table 8: Phonetic analysis of penultimate stress on *taŋ̄aro*

	taŋ̄aro 'look up'		
	ta	*ŋ̄a*	*ro*
Vowel duration (ms)	10	42	29
Intensity (dB)	75	77	68
Pitch (Hz)	144	152	114

Table 9: Phonetic analysis of antepenultimate stress on *d̄oŋgolo*

	d̄oŋgolo 'catch'		
	d̄oᵑ	*go*	*lo*
Vowel duration (ms)	36	31	21
Intensity (dB)	76.3	76.1	69
Pitch (Hz)	160	139	121

Since the stress falls on the syllables *ŋ̄a* and *d̄o* in *taŋ̄aro* and *d̄oᵑgolo* respectively, the reduplication mechanism only accesses these syllables, as exemplified below:

(61) a. *taŋ̄aro* → *ta*∼*ŋa*∼ *ŋaro* 'look up repeatedly'
b. *d̄oᵑgolo* → *d̄o*∼*d̄oᵑgolo* 'catch more than one X at different times and/or places'

The stress assignment in derived verbs follows the general principles of stress assignment that was mentioned earlier – namely that stress is penultimate or antepenultimate depending on the number of syllables in the stem. Consider the stress assignment in the following derived verbs:

(62) Stress in derived verbs
a. *pa-r̄a.hi* 'promise'
b. *pa-h̄a.ɣi* 'owe'
c. *ma-t̄o.di* 'opened'
d. *pa-b̄o.ko.lo* 'enlarge'
e. *pa-te.r̄o.hi* 'to make X continue'

In example (62a), the affix *pa-* 'causative' does not receive stress placement, but its stem, *r̄ahi* 'promise', is stressed instead and specifically upon the first syllable of the base. The same is also true for example (62d), where stress assignment occurs on the second syllable, *b̄o*, within the stem.

The phonetic evidence supports this claim. As for *pa-h̄a.ɣi*, the prefix *pa-* shows shortened duration (14 ms), lessened intensity (62 dB), and lowered pitch (125 Hz)

in comparison to the duration (41 ms), intensity (67 dB) and pitch (146 Hz) of the syllable *ha*.

Since the stress is placed on the syllable *ha*, that syllable is reduplicated, as shown in the following example:

(63) *pa-ha.ɣi* → *pa-ha∼haɣi* 'owe X repeatedly to more than one person'

Note that although the stress of a trisyllabic stem is penultimate, the affix still cannot play a role in stress assignment. For example, in the word *pa-terohi* the stress is penultimate and the affix *pa-* cannot force the stress to occur in first syllable of the stem. Phonetic analysis confirms the claim. The second syllable of the stem is the strongest as its length is 31 ms, its intensity is 78 dB, and its pitch is 123 Hz. By contrast, the first syllable's duration, intensity, and pitch are 15 ms, 77 dB, and 117 Hz respectively.

Since the stress is on the syllable *ro*, that syllable is reduplicated, as shown in the following example:

(64) *pa-terohi* → *pa-te∼ro∼rohi* 'keep making X continue'

Finally, it is necessary to discuss the stress patterns of stems bearing the fossilized prefix *ma-*. Words with the fossilized *ma-* syllable may assign stress on this fossilized affix or the stem-initial syllable, as shown in (65) below.

(65) Stress in words with fossilized prefix

a.	*ma.^{n}du.ru*	'sleep'	d.	*ka.ɓo.ŋo*	'try'
b.	*ma.lo.yo*	'long'	e.	*ka.ʋico*	'nip (V)'
c.	*ma.ɗi.co*	'laugh'	g.	*ka.tu.ɗi.lo*	'short (inanimate)'

The variation in stress assignment among words containing the fossilized prefix **ma-* and **ka-* suggests that *ma-* and *ka-* has been fossilized to a certain degree but are not completely integrated within the particular stem. In (65a) and (65g) for example, the fossilized prefix is unstressed, suggesting that its morphological status as a prefix remains. Examples (65c–e), on the other hand, reveals that the same prefix can be stressed, suggesting that it may not be regarded as a prefix in this word.

Because fossilized **ma-* and **ka-* can be stressed, as in *maɗico* and *kaɓoŋo*, this permits **ma-* and **ka-* to undergo reduplication (cf. (57)).

The fact that fossilized **ma-* and **ka-* can receive stress assignment is further confirmed by phonetic analysis. Consider the actual measurements of word *maɗico and kaɓoŋo*, as shown by Table 10. The fossilized prefix **ma-* and **ka-* are assigned stress. The duration, intensity, pitch on both fossilized prefix are lengthened, increased, and raised respectively, while the other two syllables of *maɗico and kaɓoŋo* have lower values for their respective duration, intensity, and pitch.

Table 10: Phonetic analysis of antepenultimate stress on *māḍico and kābōŋo*

	māḍico 'laugh'				*kābōŋo* 'try'	
	mā	*ḍi*	*co*	*kā*	*bo*	*ŋo*
Vowel duration (ms)	41	27	26	31	15	26
Intensity (dB)	78	62	70	74	69	73
Pitch (Hz)	149	128	108	152	136	132

4.2 Stress and foot and prosodic word reduplication

In Kodi, only a foot whose first syllable is stressed may be reduplicated. A foot represents the rhythmic unit of a bases and enables the analysis of stress patterns. Each foot usually comprises more than one syllable, of which one is regarded as stronger or more prominent (stressed) than the remaining weaker syllables (unstressed). The stronger syllable is considered to be the head of a foot in the base. The feet of disyllabic and trisyllabic bases in Kodi are left-dominant. Further, disyllabic or trisyllabic bases in Kodi usually have one foot, while any remaining syllables are considered as non-foot material (i.e., extrametrical material).

The Kodi foot may be categorized as a binary foot. This means that trisyllabic bases in Kodi have a maximum of one foot, and this corresponds to the fact that each Kodi base only has one stressed syllable as has been discussed in §4.1.

The foot in trisyllabic bases is generally determined by a combination of lexically determined foot structure and the morphological make-up of the word, such as whether it contains a prefix or not. For example, if the internal syllable of a trisyllabic base is prominent, then this internal syllable and the final syllable comprise a foot, with the left syllable characterized as dominant and the initial syllable not part of any foot. To illustrate this point, consider example (66a) where the foot *ŋāro* in the base *taŋāro* is built from an internal syllable and a final syllable. If the initial syllable is assigned stress, then the initial and internal syllable will comprise a foot, as exemplified by feet *ūḍo* and *bōko* in example (66b–c).

(66) a. *ta.ŋā.ro* 'look up'
b. *ū.ḍo.ko* 'kiss'
c. *bō.ko.lo* 'big'

The binary branching foot of *bōkolo and taŋāro* is depicted in Figure 2.

When the foot reduplication process takes place, only the feet, *ŋāro, ūḍo*, and *bōko*, are eligible for reduplication, as shown in (67), while the other syllables are left uncopied, and this is because they are considered as extrametrical or non-foot material in the reduplication process.

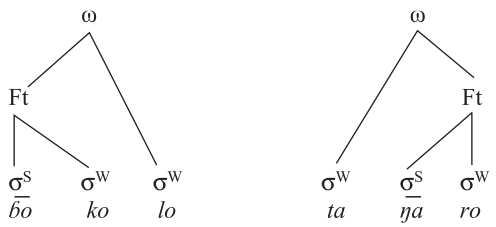

Figure 2: Metrical trees for *bokolo* 'big' and *taŋaro* 'look up'

(67) a. *ta.ŋa.ro* → *ta∼ŋaro∼ŋaro* 'always look up'
b. *u.ɗo.ko* → *uɗo∼uɗoko* 'kiss more than one person (imperative)'
c. *bo.ko.lo* → *boko∼ bokolo* 'getting bigger'

As for the prosodic word structure, each morphological word in example (68) is considered to be one prosodic word.

(68) a. *ihho* 'bathe' d. *kabaŋo* 'try'
b. *kuhi* 'lock' e. *ka^{m}butuku* 'fall'
c. *uɗoko* 'kiss'

In the full reduplication process in Kodi, the entire base is simply copied. Stress is not relevant for the full reduplication process.

5. (Generalized) Paradigm Function Morphology Analysis

Previous sections have demonstrated that syllable or foot reduplication can be predicted from the base's stress pattern. At the same time, the semantics of the reduplicative types is not necessarily predictable. By way of synthesising these two key facts, the theory of (G)PFM is proposed. The following section will show that generalized paradigm function (GPF) can capture the information of a reduplicative word: the form, the syntax, and the meaning of reduplicative words, and their relatedness to one another. Put differently, by mapping the lexical entry and lexical relatedness within the framework of (G)PFM, the two aforementioned facts may be properly accounted for.

5.1 A brief overview of (G)PFM

The (G)PFM model is an extended version of Stump's Paradigm Function Morphology (PFM) (Stump 2001, 2002, 2015; Stewart & Stump 2007; Spencer & Stump 2013; Bonami & Stump 2016), which is a lexeme-based inferential-realizational theory of inflectional morphology. Before we proceed to an analysis using (G)PFM, it is important to sketch out the theory of PFM briefly.

The earlier version of PFM (Stump 2001), PFM1, focuses on the complex inflectional system in which the mapping of paradigm cell to its realization is relatively transparent.

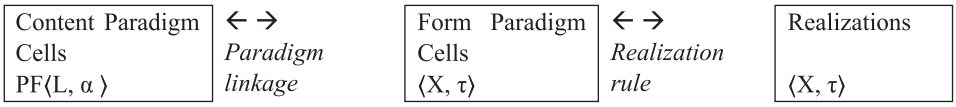

Figure 3: The Architecture of PFM

In PFM1, a word-form of the lexeme L (or, a cell in the paradigm) is a realization of the pairing of root X of L, to a word-form Y for a given set of morphosyntactic features, denoted by sigma (σ)[14] (Stump 2001), as in (69). Further, since morphology consists of a set of morphosyntactic features, these features are represented by rules which are defined in terms of FUNCTIONS[15]. The function from cells to their realizations is called the language's Paradigm Function (PF).

(69) PF(⟨X, α ⟩) = ⟨Y, α ⟩

The recent enriched version, PFM2, distinguishes two sorts of paradigms: CONTENT and FORM paradigms where paradigm function may apply (Stump 2002, 2015; Spencer & Stump 2013; Stewart & Stump 2007). Content paradigm is where a paradigm function associates a lexeme L with a set of morphosyntactic properties α: ⟨L, α ⟩. By contrast, the form paradigm is where the stem S is paired with a set of morphosyntactic properties τ, where tau τ is a subset of α, for which S is inflectable: ⟨S, τ⟩. A realization is the set of realized cells of a lexeme L, which pairs a word W and its morphosyntactic properties α: ⟨W, τ ⟩. Such two paradigms have a close connection or canonical correspondence. Their relation is specified by paradigm linkage and realization rules, as depicted by the PFM architecture in Figure 3:

To illustrate this model, consider the English word, *breaks*, within the context of the simple present tense paradigm of the lexeme BREAK.

Given the paradigm above, the realization rule in (70) captures the realization of *breaks:*

(70) Realization rule
$PF_{SIMPLE.PRES}(\langle X\ \alpha{:}\{3SG.PRES\}\rangle) = \langle X\mathbf{s}\ \alpha\rangle$

(71) Realization
⟨*breaks* α:{3SG.PRES}⟩

[14] In order to avoid confusion, the sigma σ is replaced with the alpha α symbol in this paper, since the sigma symbol has previously been used to represent syllables.

[15] This theory is based on the idea that the definition of a language's inflectional morphology is the definition of a function (F) – a mathematical function that applies to cells and paradigms, which generates its realization.

The realization of the cell, which pairs the lexeme *break* with the property set ⟨3 sg pres⟩, is going to be this pairing of *breaks* with the same property set; and so on for the other cells in the paradigm. For a thorough understanding of this framework, see Stump (2015).

Spencer (2004, 2010, 2013) extends the pairing of lexical root and morphosyntactic property sets to a complete lexical representation: a generalization of Stump's PFM. The goal of (G)PFM is moving beyond the inflectional emphasis of PFM and towards accounting for lexical relatedness more generally by incorporating the inflectional machinery of PFM.

The underlying assumption of this theory is that a lexeme has a simple four-dimensional vector: ⟨FORM, SYN(TAX), SEM(ANTICS), L(EXEMIC) I(NDEX)⟩, each of which defines morphological forms, syntactic properties, semantic representations and a lexemic index (LI). The simplified form of GPF takes shape as in:

(72) Generalized Paradigm Function:
GPF(⟨LEXEME, α⟩) =def ⟨LEXEMÉ⟩

A more complex representation or complete lexical entry includes four attributes (FORM, SYN, SEM, LI) associated with a lexeme as given in the following examples. The English Lexeme, WRITE, is used as an example. Now consider how the model accounts for write**s**$_V$ and writ**er**$_N$ from write$_V$, as given in (73), (74), (75), and (76) respectively. Examples (73), (74), and (75) are taken from Spencer (2010: 12–14) with slight technical modifications such as adding subscripts $_{V, A}$ after the lexeme to indicate its lexical category. We begin with the lexical entry for write$_V$, whose lexical entry contains the following attributes:

(73) FORM(write) = *write*
SYN(write) = Verb
SEM(write) = [WRITE(x, y)]
LI(write) = write

The GPF for realizing 3SG PRES and subject nominalisation (SN) applies to the lexical entry of WRITE as follows.

(74) GPF (⟨WRITE, α:{3SG PRES}⟩) =
f_{form}(⟨WRITE$_V$, α⟩) = ⟨*write**s***, α'⟩
f_{syn}(⟨WRITE$_V$, α⟩) = ⟨write**s**, α'⟩
f_{sem}(⟨WRITE$_V$, α⟩) = (default, i.e., no semantic change)
f_{li}(⟨WRITE$_V$, α⟩) = (default, i.e., no lexemic identity change)

(75) GPF ⟨WRITE$_V$, α:{SN}⟩ =
f_{form}(⟨WRITE$_V$, α⟩) = ⟨*write **er***, α'⟩
f_{syn}(⟨WRITE$_V$, α⟩) = ⟨NOUN, α'⟩
f_{sem}(⟨WRITE$_V$, α⟩) = ⟨[PERSON(x), [WRITE(x, y)]], α'⟩
f_{li}(⟨WRITE$_V$, α⟩) = ⟨SN (WRITE)⟩

Table 11: Simple present tense paradigm

a. Content paradigm (lexemes and a set of morphosyntactic features)		
	sg	pl
1	⟨BREAK, α:{1SG.PRES}⟩	⟨BREAK,α:{1PL.PRES}⟩
2	⟨BREAK, α:{2SG.PRES}⟩	⟨BREAK,α:{2PL.PRES}⟩
3	⟨BREAK, α:{3SG.PRES}⟩	⟨BREAK,α:{3PL.PRES}⟩
b. Form Paradigm (a set related formal properties)		
	sg	pl
1	⟨X, α:{1SG.PRES}⟩	⟨X, α:{1PL.PRES}⟩
2	⟨X, α:{2SG.PRES}⟩	⟨X, α:{2PL.PRES}⟩
3	⟨**X, α:{3SG.PRES}**⟩	⟨X, α:{3PL.PRES}⟩

The general rule for English subject nominalization (SN) in (76) is given in (75).

(76) GPF (⟨Lv, α:{SN}⟩) =
f_{form}(⟨L_V, α⟩) = ⟨*verb* ***er***, α'⟩
f_{syn}(⟨L_V, α⟩) = ⟨NOUN, α'⟩
f_{sem}(⟨L_V, α⟩) = ⟨[PERSON(x), [WRITE(x, y)]], α'⟩
f_{li}(⟨L_V, α⟩) = ⟨SN (VERB)⟩

The above examples show that WRITE can have an inflected form ⟨*writes*, α'⟩ and a derived noun form, ⟨*writer*, α'⟩, where α' is precisely like α.

The above examples of (G)PFM analysis allow capturing not only the form but also the syntactic properties, the semantic representation and the lexemic index of the form. In order to account for the process and the semantics of Kodi reduplication, the following sub-section will employ (G)PFM machinery.

For a thorough understanding of the (G)PFM model, see Spencer (2013) and Nikolaeva and Spencer (2019).

5.2 Kodi reduplication within (G)PFM

What is evident from the earlier discussion is that different featural contexts can trigger the same type of reduplication process. To reiterate this point, consider Table 12, particularly the examples *bo*∼*bokolo:* 'indirect plural', 'contrastive' and *me*∼*mete*: 'indirect plural', 'attenuative', and 'contrastive'. It is apparent that the same formal shape can have multiple semantically unrelated meanings.

Before proceeding with a (G)PFM analysis, we must establish generalization rules which independently define both the reduplication process and the semantics of

Table 12: Reduplicative verbs and adjectives

	L_V				L_A	
	HIT	DECEIVE	SHARE	BIG	GOOD	BLACK
Iterative	*palu~palu*		*ba~baɣe*			
Continuative	*palu~palu*	*bole~boleto*				
Frequentative	*pa~palu*	*bo~boleto*	*baɣe~ baɣe*			
Habitual		*bole~boleto*	*ba~baɣe*			
Distributive Event	*pa~palu*	*bo~boleto*	*ba~baɣe*			
Indirect Plural		*bo~boleto*	*ba~baɣe*	*bo~bokolo*	*nda~ndaha*	*me~mete*
Intensive				*boko~bokolo*		*mete~mete*
Attenuative						*me~mete*
Contrastive				*bo~bokolo*	*nda~ndaha*	

reduplication. Generalization rules are vital due to the fact that Kodi reduplication processes do not have a one-to-one correlation with their morphosyntactic/semantic contexts. By generalizing the Kodi reduplication process rules and the rules for their semantics, we can easily capture how stress affects the Kodi reduplication process and see how the semantic context triggers reduplication processes in Kodi. The problem of the lack of one-to-one form-meaning pairings can also be solved.

Given the types of reduplication discussed in §3.2 and §3.3, a relevant series of phonological rules is defined in (77). The rules focus on defining the productive types of reduplication, especially S(yllable) R(eduplication) and F(oot) R(eduplication), which determine the syllable or foot to be copied based on where the stress is assigned. Before the rules are described, several symbols should be explained: X is any lexeme, while XX is any reduplicated lexeme. In terms of prosodic units, the first stressed syllable that is reduplicated is symbolized by the overlined, underlined sigma 1 [$\overline{\underline{\sigma_1}}$], while the second stressed syllable is symbolized by the overlined, double underlined sigma 2 [$\overline{\underline{\sigma_2}}$]. [$\underline{\mathrm{Ft}_1}$] and [$\underline{\mathrm{Ft}_2}$] denote the initial strong foot and final strong foot, respectively, which are subsequently targets for the reduplication process.

(77) Kodi reduplication process rules

Rules		Examples	
a. S(yllable) R(eduplication) Rule			
SR(X) ≡			
$\mathrm{FORM}_1[\overline{\underline{\sigma_1}}\sigma_2]\omega$	= $\mathrm{XX}[\overline{\underline{\sigma_1}}]$	PALU	= *pa ~ palu*
$\mathrm{FORM}_2\ [\overline{\underline{\sigma_1}}\sigma_2\sigma_3]\omega$	= $\mathrm{XX}[\overline{\underline{\sigma_1}}]$	BOKOLO	= *bo~boko.lo*
$\mathrm{FORM}_3\ [\sigma_1\underline{\overline{\sigma_2}}\sigma_3]\omega$	= $\underline{\mathrm{XX}}[\overline{\underline{\sigma_2}}]$	TANARO	= *ta~ŋa~ŋaro*

b. $\mathrm{SR(X)} \equiv \mathrm{XX}[\overline{\underline{\sigma_1}}]\ ^{\vee}\ \mathrm{XX}[\overline{\underline{\sigma_2}}]$ *or* $\mathrm{SR(X)} = \mathrm{XX}$

c. F(oot) R(eduplication) Rule
FR(X) ≡
$\text{FORM}_1[\underline{\sigma_1}\underline{\sigma_2}]_{\text{Ft}}]\sigma_3]]]\omega$ = XX[$\underline{\text{Ft}_1}$] BOKOLO = *boko*∼*boko lo*
$\text{FORM}_2[\sigma_1[\underline{\sigma_2}\underline{\sigma_3}]_{\text{Ft}}]]]\omega$ = XX[$\underline{\underline{\text{Ft}_2}}$] TANARO = *taŋaro*∼*ŋaro*

d. FR(X) ≡ XX[$\underline{\sigma_1}\underline{\sigma_2}$] ˅ XX[$\underline{\underline{\sigma_2}}\underline{\underline{\sigma_3}}$] *or* FR(X) = XX

e. W(ord) R(eduplication) Rule
WR(X) ≡
$\text{FORM}[\overline{\sigma_1}\sigma_2]\omega$ = XX[$\omega_1\omega_1$] PALU = *palu*∼ *palu*

f. WR(X) ≡ X[ω] = XX[$\omega_1\omega_1$] *or* WR(X) = XX

The above rules demonstrate that SR and FR rules spell out stem/lexeme X as having more than one phonological realization. Multiple realizations occur because each X in each of the two rules has more than one phonological input. As an illustration, consider the syllable reduplication process. The SR rule realizes X in two different forms, XX[$\underline{\sigma_1}$] and XX[$\underline{\sigma_2}$], as shown in (77a) and abbreviated in (77b). The SR rule yields X as the reduplicated form XX[$\underline{\sigma_1}$], iff stem X's phonological forms are FORM_1 and FORM_2. FORM_1 is a disyllabic base with stress on the penultimate syllable $[\underline{\sigma_1}\sigma_2]\omega$; while FORM_2 is a trisyllabic base with stress on the penultimate syllable $[\underline{\sigma_1}\sigma_2\sigma_3]\omega$. Likewise, SR rule realizes X as XX[$\underline{\sigma_2}$], iff X's phonological form is FORM_3. FORM_3 is a trisyllabic base with stress on the antepenultimate syllable $[\sigma_1\underline{\sigma_2}\sigma_3]\omega$.

Regarding the semantics of Kodi reduplication, the relevant defining rules based on the discussion in §3.4 and §3.4.5 are given below:

(78) Semantics of Kodi reduplication rules
a. SEM{ITER} = WR(X) ˅ FR(X) ˅ SR (X)
b. SEM{FREQ} = WR(X) ˅ FR(X) ˅ SR (X)
c. SEM{HAB} = WR(X) ˅ FR(X) ˅ SR (X)
d. SEM{DUR} = WR(X) ˅ FR(X) ˅ SR (X)
e. SEM{DISCONT} = WR(X) ˅ FR(X) ˅ SR (X)
f. SEM{INDR.PL} = SR (X)
g. SEM{DISTR} = WR(X) ˅ FR(X) ˅ SR (X)
h. SEM{INTSV} = WR(X) ˅ FR(X) ˅ SR (X)
i. SEM{ATTN} = SR (X)
j. SEM{CONTR} = SR (X)

The rules specified in (78) include a semantic triggering mechanism for the Kodi reduplication process. For instance, the distributive context rule in (78g) states that the distributive featural context triggers three different types of reduplication[16]: (WR(X) ˅ FR(X) ˅ SR(X)), as mapped in (77)[17].

[16] For semantic categories that only have one possible reduplication type such as SEM{INDR.PL}, SEM {ATTN} and SEM{CONTR}, it is thus far attested that they only select syllable reduplication.
[17] Where the vel ˅ denotes a combination of two/three types of reduplication.

Several reduplicative words shown in Table 12 are now analyzed under (G)PFM: *palu*∼*palu* 'iterative', *pa*∼*palu* 'frequentative', *boko*∼*bokolo* 'intensive', and *bo*∼*bokolo* 'indirect pluralization'. Their basic stems[18] are *palu* and *bokolo*.

The lexical representation lists for the lexemes PALU and BOKOLO are given in (79) and (80), respectively. It is important to note that LI is excluded as it is presumed that the two LEXEMES, PALU and BOKOLO are not derived from other lexemes, thus they are default.

(79) Lexical representation of PALU 'HIT'
FORM *palu*
SYN V
SEM [$_{\text{EVENT}}$HIT (x, y)]

(80) Lexical representation of BOKOLO 'BIG'
FORM *bokolo*
SYN A
SEM [$_{\text{QUALITY}}$BIG (x)]

The basic stem selection functions or rules are given in (81) for the lexemes PALU 'HIT' and BOKOLO 'BIG'. The stem is, by convention, represented as X in the subsequent realization rules. Hence X in example (81) is *palu*. Its prosodic structure can be abbreviated as X[ω]. The latter means that *palu* is a disyllabic stem [ω], with stressed *pa* being σ_1 and unstressed *lu* being σ_2.

(81) Basic stem selection functions:
a. $f_{\text{BASIC.STEM}}\langle \text{PALU}_{\text{V}}, \alpha{:}\{\}\rangle = \langle \text{X}[palu], \alpha{:}\{\}\rangle$
b. $f_{\text{BASIC.STEM}}\langle \text{BOKOLO}_{\text{A}}, \alpha{:}\{\}\rangle = \langle \text{X}[bokolo], \alpha{:}\{\}\rangle$

For simplicity, the pairing of lexeme L and its stem form X with its prosodic structure generated in (81) is abbreviated as ⟨L[X:ω], α:{}⟩, where relevant. For example, ⟨PALU [X:ω] α:{}⟩ means that the lexeme PALU selects the whole stem.

To show how the reduplication process of *palu* and *bokolo* is triggered by their semantic context, the reduplication process and semantic rules in (77) and (78) are applied in (82).

(82) a. $f_{form}(\langle \text{L}, \alpha{:}\{\text{ITER}\}\rangle) = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X)}, \alpha'{:}\{\}\rangle$
b. $f_{form}(\langle \text{L}, \alpha{:}\{\text{FREQ}\}\rangle) = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X) } \alpha'{:}\{\}\rangle$
c. $f_{form}(\langle \text{L}, \alpha{:}\{\text{INTSV}\}\rangle) = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X)}, \alpha'{:}\{\}\rangle$
d. $f_{form}(\langle \text{L}, \alpha{:}\{\text{INDR.PL}\}\rangle) = \langle \text{SR(X)}, \alpha'{:}\{\}\rangle$

The GPF of (82a) may be interpreted in this way: the function, f_{form}, takes the Lexeme L whose stem is X[ω] and whose feature set α receives the aspectual value of {ITER} as its input, and this gives an output where the stem is spelled out formally as WR(X) or FR(X) or SR (X) – this output is also paired with the same feature set α. That is, X's prosodic word ω

[18] *Basic stem* here is a term usually used in PFM and GPFM to indicate 'base' or 'root'.

or X's strong foot Ft or X's stressed syllable $\overline{\sigma}$ is reduplicated to carry the iterative feature α. In a nutshell, the iterative meaning is both fully and partially reduplicated. In selecting a reduplicated base for {ITER}, the base's semantic context or lexical specification is the determinant. Thus, in yielding *palu∼palu*, the feature {ITER} is unified with the lexical entry for disyllabic lexeme $\overline{\text{PA}}\overline{\text{L}}$U (i.e., the reduplicant is lexically specified for {ITER}). The GPF would generate the output full base reduplication ⟨*palu∼palu*, α:{ITER}⟩.

A similar input–output operation applies to (82b–d), but the nature of the reduplication output is different depending on the values in the feature set. Consider how *pa∼palu* is realized by applying (82b): the function f_{form} in the featural context α:{FREQ} that is associated with L $\overline{\text{PA}}\overline{\text{L}}U[\underline{\overline{\sigma}_1}\overline{\sigma}_2]\omega$ results in the realization of SR (X) where the reduplicant is the stressed penult $\underline{\overline{\sigma}_1}$ (cf. (77a) and (78b)). Likewise, the application of the rule (77c) in realizing *boko∼bokolo* may be described as follows: for L $\overline{\text{BO}}\overline{\text{K}}OLO[\underline{\overline{\sigma}_1}\overline{\sigma}_2]_{\text{Ft}}\sigma_3]]]\omega$, a trisyllabic base, in the INTSV context, the rule will parse the prosodic structure for an initial foot and then reduplicate the initial foot, thus turning $L[\underline{\overline{\sigma}_1}\overline{\sigma}_2]_{\text{Ft}}\sigma_3]]]\omega$ into ⟨FR(X), α':{INTSV}⟩.

The FORM functions represented in (82) are just one kind of function as part of the realization rules in (G)PFM. The full set of the realization rules accounting for reduplication in Kodi is given in (83). As demonstrated in (83), the rules also handle the syntax and semantics related to different types of reduplication processes. For example, the reduplication that carries frequentative semantics is regulated by (83b). This rule formally involves the copying of the whole prosodic word or foot or stressed syllable (i.e., $f_{form}\langle L_V, \alpha: \{\text{FREQ}\}\rangle$) of lexemes respective to the prosodic templates formulated in (77); morpho-syntactically it takes a verbal stem but keeps this verbal category in the output (i.e., $f_{syn}\langle L_V, \alpha: \{\text{FREQ}\}\rangle$); semantically it adds the semantic feature of MULTIPLY to the output feature, the semantic feature set (i.e., $f_{sem}\langle L_V, \alpha: \{\text{FREQ}\}\rangle$).

(83) Realization Rules

a. Iterative reduplication

$\text{GPF}(\langle L_V, \alpha:\{\text{ITER}\}\rangle) =$
$f_{form}(\langle L_V, \alpha:\{\text{ITER}\}\rangle) = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X)}, \alpha'\rangle$
$f_{syn}(\langle L_V, \alpha:\{\text{ITER}\}\rangle) = \langle \text{VERB}, \alpha'\rangle$
$f_{sem}(\langle L_V, \alpha:\{\text{ITER}\}\rangle) = \langle [\text{EVENT (x)}, [\text{MULTIPLY (x)}]], \alpha'\rangle$

b. Frequentative reduplication

$\text{GPF}(\langle L_V, \alpha:\{\text{FREQ}\}\rangle) =$
$f_{form}(\langle L_V, \alpha:\{\text{FREQ}\}\rangle = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X)} , \alpha'\rangle$
$f_{syn}(\langle L_V, \alpha:\{\text{FREQ}\}\rangle) = \langle \text{VERB}, \alpha'\rangle$
$f_{sem}(\langle L_V, \alpha:\{\text{FREQ}\}\rangle) = \langle [\text{EVENT (x)}, [\text{MULTIPLY (x)}]], \alpha'\rangle$

c. Intensive reduplication

$\text{GPF}(\langle L_A, \alpha:\{\text{INTSV}\}\rangle) =$
$f_{form}(\langle L_A, \alpha:\{\text{INTSV}\}\rangle) = \langle \text{WR(X)} \vee \text{FR(X)} \vee \text{SR (X)}, \alpha'\rangle$
$f_{syn}(\langle L_A, \alpha:\{\text{INTSV}\}\rangle) = \langle \text{ADV}, \alpha'\rangle$
$f_{sem}(\langle L_A, \alpha:\{\text{INTSV}\}\rangle) = \langle [\text{INTENSITY}[\text{QUALITY(x)}, [\text{INTESIFY(x)}]]], \alpha'\rangle$

d. Indirect pluralization reduplication
GPF(⟨$L_{A/V}$, α:{INDR.PL}⟩) =
f_{form}(⟨$L_{A/V}$, α:{INDR.PL}⟩) = ⟨SR(X), α'⟩)
f_{syn}(⟨$L_{A/V}$, α:{INDR.PL}⟩) = ⟨A, α'⟩
f_{sem}(⟨$L_{A/V}$, α:{INDR.PL}⟩) = ⟨[QUALITY(x)[INDIRECLY PLURALIZE (y)]], α'⟩

In deriving $\overline{PA}$LU∼$\overline{PA}$LU_V and $\overline{PA}$∼$\overline{PA}$LU_V from $\overline{PA}$LU_V and $\overline{BO}$KO∼$\overline{BO}$KOLO_{ADV} and $\overline{BO}$∼$\overline{BO}$KOLO_A from $\overline{BO}$KOLO_A, the GPF for realizing ITER, FREQ, INTSV, and INDR.PL applies to the lexical entry of $\overline{PA}$LU and $\overline{BO}$KOLO in (84)-(87). The discussion of input-output processes is limited to *palu*∼*palu* and *pa*∼*palu*. Each is discussed in turn.

(84) *palu*∼ *palu* 'hit X repeatedly'
INPUT:
STEM(⟨HIT_V, α:{}⟩) = ⟨*palu*, α':{} ⟩
GPF(⟨HIT_V, α:{ITER}⟩) =
f_{form}(⟨HIT_V, α⟩) = ⟨*palu*∼*palu*, α'⟩
f_{syn}(⟨HIT_V, α⟩) = ⟨V, α'⟩
f_{sem}(⟨HIT_V, α⟩) = ⟨[EVENT (x), [MULTIPLY (x)]], α'⟩
OUTPUT: ⟨*palu*∼*palu*, α':{}⟩

The form realization of *palu*∼*palu* in (84) follows the realization rule in (83a) and may be explained as follows: the basic stem, *palu* ([ω]), is targeted entirely by the reduplication process and thus, is realized as *palu*∼*palu*, where the reduplicant is a full base [ω]. In terms of the function f_{syn}, there is no word class change in the lexicon; hence, the L_V is still realized as a VERB. Regarding the function f_{sem}, the semantic representation of the realization is defined as [EVENT (x) [MULTIPLY (x)]] which may be interpreted to mean that the event of hitting is multiplied/repeated due to the entire reduplication of [ω]. Finally, the Iterative Reduplication Rule generates the output ⟨*palu*∼*palu*, α'⟩, where alpha α' contains {ITER}.

(85) *pa*∼*palu* 'hit X frequently'
INPUT:
STEM(⟨HIT_V, α:{}⟩) = ⟨*palu*, α':{}⟩
GPF(⟨HIT_V, α:{FREQ}⟩) =
$f._{form}$(⟨HIT_V, α⟩) = ⟨*pa*∼*palu*, α'⟩
$f._{syn}$(⟨HIT_V, α⟩) = ⟨V, α'⟩
$f._{sem}$(⟨HIT_v, α⟩) = ⟨[EVENT (x) [MULTIPLY (x)]], α'⟩
OUTPUT: ⟨*pa*∼*palu*, α':{}⟩

The form, *pa*∼*palu* (85), is realized by the rule in (83b). The penultimate syllable of the basic stem, *palu* [$\sigma_1\sigma_2$]ω, is targeted in the reduplication process since it is assigned stress

$\overline{\sigma_1}$ and thus yields *pa*∼ *palu* [$\overline{\sigma_1}$]. In terms of the function f_{syn}, there is no word class change in the lexicon. Regarding the function f_{sem}, the semantic representation of the realization is defined as [EVENT (x) [MULTIPLY (x)]] which may be interpreted to mean that the event of hitting is multiplied/repeated due to the process of reduplicating the stressed penult [$\overline{\sigma_1}$] of the basic stem *palu* [$\overline{\sigma_1}\sigma_2$]ω. Finally, the Frequentative Reduplication Rule generates the output ⟨*pa*∼*palu*, α:{}⟩, where alpha α' contains {FREQ}.

(86) *boko*∼*bokolo* 'getting bigger'
INPUT:
STEM⟨SMALL $_{ADJ}$, α:{}⟩) = ⟨*bokolo*, α'⟩
GPF(⟨L_A, α:{INTSV}⟩) =
$f._{form}$(⟨L_A, α⟩) = ⟨*boko*∼*bokolo*, α'⟩
$f._{syn}$(⟨L_A, α⟩) = ⟨ADV, α'⟩
$f._{sem}$(⟨L_A, α⟩) = ⟨[INTENSITY[QUALITY(x), [INTENSIFY(x)]]], α'⟩
OUTPUT: ⟨*boko*∼*bokolo*, α':{}⟩

(87) *bo*∼*bokolo* 'big (INDR. PL)'
INPUT:
STEM⟨SMALL $_{ADJ}$, α:{}⟩) = ⟨*bokolo*, α':{}⟩
GPF(⟨L_A, α:{INDR. PL}⟩) =
$f._{form}$(⟨L_A, α⟩) = ⟨*bo*∼*bokolo*, α'⟩
$f._{syn}$(⟨L_A, α⟩) = ⟨A, α'⟩
$f._{sem}$(⟨L_A, α⟩) = ⟨[QUALITY(x)[INDIRECTLY PLURALIZE (y)]], α'⟩
OUTPUT: ⟨*bo*∼*bokolo*, α':{}⟩

The analysis above demonstrates that (G)PFM straightforwardly accounts for the issues in Kodi reduplication, especially the mismatch between forms and semantics of Kodi reduplication, which is complex and not trivial. Additionally, it provides a detailed analysis of the reduplicant's construction of meaning.

Conclusion

In this paper, it has been argued that prosodic units of verbal/adjectival/numeral bases that are the target of copying in the Kodi reduplication process are a stressed syllable or a strong foot. It has been shown that the architecture of (G)PFM allows us to incorporate the phonological constraints discussed in the description of the forms of reduplication. Phonological constraints are handled within (G)PFM by defining the Kodi reduplication process as functions, which are then invoked in the (G)PFM realizational rules in which they occur. In another sense, to account for the stress effect on the reduplication process within (G)PFM, a set of pre-defined operations are used: SR(X), FR(X), and WR(X)

rules and their prosodically defined stems, $FORM_1$, $FORM_2$, and $FORM_3$. This is to guarantee the precise formal outputs of the reduplication process determined by stress when they are modelled by (G)PFM realization rules.

It has also been argued that the issue of the reduplication processes triggered by semantic contexts can be accounted for in a strikingly straightforward way in (G)PFM. The possibility of accounting for semantic triggering is explained by explicitly mapping one-to-many relations between meaning and form as functions. Furthermore, the mapping results are inputs for (G)PFM realizational rules, which then spell out the realization of Kodi reduplication processes.

Regarding the vagueness of the form-meaning correlation, (G)PFM solves this theoretical issue. By capturing the specification of the base lexemes and the reduplicative realization of base lexemes from their triggering contexts, GPF successfully relates form and meaning, but independently of each other, to account for the complexity of form-meaning pairing in Kodi reduplication. For example, the independence of form and meaning allows us to more clearly capture the fact that $FORM_1$ and $FORM_2$ of SR Rule in (77) have the same phonological process, i.e., first syllable reduplication, but are triggered by different featural contexts.This study provides evidence that the (G)PFM framework is a powerful model, which can be arguably extended to handle intricate reduplicative patterns beyond Kodi.

Finally, there are some issues identified in this study which have not been discussed in the interest of space, and which require future in-depth research. First is the reduplication pattern involving the syllable *yo*; more research is needed to determine its constraints. Second is the question of whether the reduplication processes are inflectional or derivational. And third is the issue of extrametricality and how a foot or syllable target of reduplication with an extrametrical consonant is constructed. This extrametricality issue requires an in-depth study of (prosodic) morphophonology in Kodi.

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