Reduplicant Shape Alternations in Ponapean

Sam Zukoff, Princeton University
samzukoff@gmail.com • https://scholar.princeton.edu/samzukoff

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1 Introduction

⋆ This paper analyzes a set of reduplicant shape alternations in Ponapean (or Pohnpeian; Austronesian; Rehg & Sohl 1981), and examines the ramifications that this pattern has on the architecture of the reduplicative grammar.

- Ponapean exhibits a partial reduplication pattern which predictably alternates in **length** between one and two moras.
  - → The two-mora reduplicants also predictably alternate in terms of their **segmental composition**.

(1) Ponapean reduplication

	Base length			
	1-mora base	**2-mora base**	**3-mora base**	**4-mora base**
1-mora reduplicant		*du-duup* *la-laud* *ke-kens*		*to-tooroor* *lu-luum^{w}uum^w* *so-soupisek*
2-mora reduplicant	*paa-pa* *tepi-tep* *don-dod*	*dun-dune* *sipi-siped* *rer-rere*	*duu-duupek* *mee-meelel* *lil-linenek*	*rii-riaala* *lil-lirooro* *lidi-liduwii*

- I argue that the **length** alternation can be derived *solely* through the interaction of stress and phonotactics (refining the analysis in Kennedy 2002), using constraints whose **domain of evaluation spans the base and reduplicant**.

- In order for this analysis to work, the module of grammar where the length/shape of the reduplicant is calculated must have the following properties:

(2) a. It must have *access* to the **surface properties** of the base.
b. It must have *access* to the reduplicant's **position** relative to the base.

- This poses a potential problem for a theory like Morphological Doubling Theory (MDT; Inkelas & Zoll 2005), where reduplicant shape is (typically) calculated without access to the base.

- I show that MDT *can* actually accommodate this sort of analysis, as long as reduplicative truncation is located in the "Mother Node" — i.e. the stage of the derivation where "base" and "reduplicant" are concatenated.

→ This does however require that, in such a case, the phonology that applies to the reduplicant must be the same as the phonology that applies to the base.

⋆ Preliminary investigation (in the Appendix) into the reduplicant *shape* alternations and the pattern of "nasal substitution" (Rehg 1984) suggests that this is the case, and thus that this pattern is *consistent with a Mother-Node-based MDT analysis*.

2 Phonological Preliminaries

2.1 Consonant phonotactics

- There are no complex onsets, and there are no restrictions on *word-final* consonants.

⋆ However, *word-medial* codas are tightly restricted (Rehg & Sohl 1981:56–64):

(3) *Licit medial coda-onset sequences* (and word-final complex codas)
  a. Homorganic nasal-obstruent sequences *mp, $m^w p^w$, nt, nd, ns, ŋk*
  b. Geminate nasals and liquids *mm, $m^w m^w$, nn, ŋŋ, rr, ll*

→ The static phonotactics largely match alternations from reduplication and affixation. This will factor heavily into the theoretical ramifications of the reduplication patterns to be discussed.

2.2 Stress/accent

- Following Rehg (1993:29), the Ponapean stress system works as follows:[1]

(4) *Stress pattern*
  a. Primary stress on rightmost mora [STRESSR$_{\mu}$ (5a)]
  b. R→L alternating secondary stress by mora [*CLASH$_{\mu}$ (5b), *LAPSE$_{\mu}$ (5c)]

(5) *Stress constraints*
  a. **STRESSR$_{\mu}$**: Assign one violation mark * if the final mora is unstressed. (= $*\breve{\mu}\#$)
  b. ***CLASH$_{\mu}$**: Assign one violation mark * for each sequence of two adjacent *stressed* moras. (= $*\acute{\mu}\acute{\mu}$)
  c. ***LAPSE$_{\mu}$**: Assign one violation mark * for each sequence of two adjacent *unstressed* moras. (= $*\breve{\mu}\breve{\mu}$)

(6) *Consonant moraicity*
  a. Final consonants are non-moraic [$*C_{\mu}\#$]
  b. Medial coda consonants are moraic [WEIGHT-BY-POSITION]
  c. **Ranking:** $*C_{\mu}\# \gg$ WEIGHT-BY-POSITION

⋆ The strictly alternating rhythm means that the stress status of the *initial mora* of a root/base is directly dependent on the moraic length of the root/base:

(7) a. *Odd* mora count bases ⇒ **stress** on the initial mora
  b. *Even* mora count bases ⇒ **no stress** on the initial mora (stress on the peninitial mora)

→ This difference will be crucial in explaining the distribution of reduplicant length.

3 Reduplicant Length Alternation

- Ponapean has a prefixal partial reduplication pattern (Rehg & Sohl 1981:§3.3.4, also §2.9.5) which marks *durative/continuous* aspect on verbs (and adjectives, which seem to not be a distinct category from verbs).

- This pattern exhibits two types of (interdependent) alternations:

(8) a. **Length alternation**: one mora vs. two moras
  b. **Shape alternation**: bimoraic reduplicants have various shapes depending on the segmental composition of their base

- In this paper, I'll focus on describing and analyzing the *length alternation*, collapsing over the different segmental shapes of bimoraic reduplicants. [The *shape alternation* is discussed in **Appendix A**.]

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[1] Rehg's (1993:23) description is: "*High pitch occurs on the penultimate mora, while primary stress is on the final mora; secondary stress occurs on alternate preceding morae*". I will assume that we can scale up from his short description, but these facts should be verified by future fieldwork.

3.1 Data and Generalizations

- Building on McCarthy & Prince (1986), Kennedy (2002) shows that considerations of stress and syllable weight in the base factor into determining the length of the reduplicant (in moras).

⋆ I argue that reduplicant length can explained entirely by the **stress and weight of the *base-initial syllable***.

- We can begin to see this by arranging the data in terms of the *mora count of the base* and the *mora count of the reduplicant* (chart adapted from Kennedy 2002:225):

(9) Ponapean reduplication: length alternations

	ODD	EVEN	ODD	EVEN
	1-mora base	**2-mora base**	**3-mora base**	**4-mora base**
1-mora reduplicant		**dù**-duúp **là**-laúd **kè**-keńs		**tò**-toò.roór **lù**-luù.m^wuúm^w **sò**-soù.pi.sék
2-mora reduplicant	**pàa**-pá **tè.pi**-tép **dòn**-dód	**duǹ**-du.né **si.pì**-si.péd **reꞧ̀**-re.ré	**dùu**-dùu.pék **mèe**-mèe.lél **lìl**-lì.ne.nék	**rìì**-ri.àa.lá **liǹl**-li.ròo.ró **li.dì**-li.dù.wií

- Consider also the 6-mora base *waàn.tùu.ké*, which has a 1-mora reduplicant: *wà-waàn.tùu.ké*.

- There is a clear generalization immediately apparent when looking at the mora count of the base:

(10) a. **Odd** mora count bases always have **2-mora** reduplicants.
b. **Even** mora count bases may have either a **1-mora** reduplicant or a **2-mora** reduplicant.

- Recall that stress is strictly alternating from right to left by mora, which means that:
  - Odd mora count bases have initial-mora stress.
  - Even mora count bases have peninitial-mora stress.

- Therefore, this generalization about mora count can actually be reduced to stress:

(11) a. Bases with **initial-mora stress** always have **2-mora** reduplicants.
b. Bases with **peninitial-mora stress** may have either a **1-mora** reduplicant or a **2-mora** reduplicant.

- Among the even mora count / peninitial-mora stress bases, there is a consistent difference that determines which reduplicant length occurs:

(12) a. If it has an initial **light** syllable (i.e. CV̌), it always has a **2-mora** reduplicant.
b. If it has an initial (super)**heavy** syllable [better: *complex rhyme*], it always has a **1-mora** reduplicant.

- To leverage the stress facts, we need to take note of one further generalization (as pointed out by Kennedy 2002:226):

(13) All reduplicants bear a stress.

→ Looking at the forms in (9), we see that, regardless of the reduplicant shape or the base length, there is always exactly one stress on the reduplicant.

3.2 Components of the analysis

- We can boil the above generalizations down into an analysis with four component parts:

(14) a. A preference for shorter (i.e. monomoraic) reduplicants [Align-Root-L$_\mu \gg$ Max-BR]
b. A requirement that the reduplicant bear stress [Stress-to-Red]
c. A ban on moraic clash [*Clash$_\mu$]
d. A ban on adjacent identical light syllables [*Repeat(light)]

3.2.1 Preference for shorter reduplicants

- I implement the preference for shorter reduplicants (14a) using a "size restrictor" constraint (see Spaelti 1997, Gafos 1998, Hendricks 1999, Riggle 2006, Zukoff 2016, 2017, *a.o.*, on size restrictor constraints and the "a-templatic" approach to reduplication generally), specifically Align-Root-L$_\mu$:[2]

(15) **Align-Root-L$_\mu$:** Assign one violation mark * for each mora which intervenes between the left edge of the root and the left edge of the word.

∗ N.B.: The μ in this constraint name references the unit that alignment is calculated over, not either of the arguments of the alignment constraint.

- To effectuate the preference for shorter reduplicants, Align-Root-L$_\mu$ must outrank Max-BR (or Max-IO in the MDT approach):

(16) a. **Max-BR:** Assign one violation mark * for each segment in the base which lacks a correspondent in the reduplicant.
b. **Ranking:** Align-Root-L$_\mu \gg$ Max-BR

3.2.2 Reduplicant stress requirement

- The requirement that reduplicants bear a stress (14b) could be implemented in any number of ways. I will not try to offer any deep explanation, and simply enforce this via constraint:

(17) **Stress-to-Red:** Assign one violation mark * for each reduplicant without a stressed mora.

The last two components in (14) are the most substantive parts of the analysis. These are what will motivate overriding the preference for short reduplicants to yield 2-mora reduplicants in the non-basic cases:

3.2.3 Ban on moraic clash

- The ban on moraic clash (14c) — implemented with *Clash$_\mu$ (5b), repeated here — motivates reduplicant extension for bases with initial stress (when coupled with the effect of Stress-to-Red).

(18) ***Clash$_\mu$:** Assign one violation mark * for each sequence of two adjacent *stressed* moras.

3.2.4 Ban on adjacent identical light syllables

- The ban on adjacent identical light syllables — encoded with the constraint *Repeat(light) (which I'll discuss further in Section 3.3.3) — motivates reduplicant extension for bases with initial light syllables.

(19) ***Repeat(light):** Assign one violation mark * for each sequence of two adjacent identical light syllables (i.e. $*[\mathrm{C}_\alpha\breve{\mathrm{V}}_\beta]_\sigma[\mathrm{C}_\alpha\breve{\mathrm{V}}_\beta]_\sigma$).

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[2] If one preferred to use templatic constraints, the same effect could be gotten using the ranking **Red = μ** $\gg$ **Red = 2μ** (Zukoff 2016). But note that this approach will ultimately be *incompatible* with MDT in this case.

3.3 Basic Analysis

3.3.1 Monomoraic reduplicants (the default case)

- When Stress-to-Red, *Clash$_\mu$, and *Repeat(light) can all be satisfied, the default preference for a monomoraic reduplicant is actualized. This happens only when:

(20) a. **The base has an even number of moras**, such that stress falls on the peninitial mora of the base.
b. **The base begins with a heavy or superheavy syllable**, such that a monomoraic reduplicant won't yield adjacent identical CV̆ syllables when concatenated with the base.

- The simplest such case is a monosyllabic base with a long vowel:

(21) Even mora count bases with initial heavy syllables yield 1μ reduplicants: *duup* → *dù-duúp*

/red, duup/			Stress-to-Red	*Clash$_\mu$	*Repeat(light)	Align-Root-L$_\mu$
a.	du-duúp	[0-01]	*!			*
b. ☞	dù-duúp	[2-01]				*
c.	duù-duúp	[02-01]				**!

- Candidate (21a) pointlessly violates Stress-to-Red by leaving the reduplicant unstressed (also *Lapse$_\mu$).
- Both candidate (21b), with a stressed monomoraic reduplicant, and candidate (21c), with a stressed (on the second mora) bimoraic reduplicant, satisfy all the high-ranked constraints:
  - Stress-to-Red, because they stress the reduplicant
  - *Clash$_\mu$, because there are no adjacent stressed moras
  - *Repeat(light), because there are no adjacent identical light syllables

→ This allows the choice to fall to lower-ranked Align-Root-L$_\mu$, which will prefer the shorter reduplicant in (21b) to the longer reduplicant in (21c).

- It is not just CVVC roots that behave this way. The same behavior can be observed with:

(22) a. **CVNC** roots: e.g. *keńs* 'to ulcerate' → *kè-keńs* (note the accented non-syllabic nasal)
b. **CV{i/u}** roots: e.g. *peí* 'to fight' → *pè-peí* (note that these contrast with **CV{j/w}** roots)
c. **CV{i/u}C** roots: e.g. *laúd* 'big/old' → *là-laúd*
d. Polysyllabic even mora count roots: e.g. *toò.roór* 'to be independent' → *tò-toò.roór*

3.3.2 Bimoraic reduplicants for odd mora count bases: *Clash$_\mu$

- For bases with an odd number of moras, the strictly alternating rhythm places a stress on the first mora of the base.
  - *Primary* stress in the case of monomoraic bases; *secondary* stress in the case longer odd mora count bases.
- This will make it impossible to simultaneously satisfy Stress-to-Red and *Clash$_\mu$ while maintaining a 1-mora reduplicant (i.e. optimizing Align-Root-L$_\mu$).

→ In order to satisfy those two high-ranked constraints, the reduplicant is extended to 2 moras:

(23) Odd mora count bases yield 2μ reduplicants: *dùupék* → *dùu-dùupék*

/red, duupek/			Stress-to-Red	*Clash$_\mu$	Align-Root-L$_\mu$
a.	du-dùu.pék	[0-201]	*!		*
b.	dù-dùu.pék	[2-201]		*!	*
c. ☞	dùu-dùu.pék	[20-201]			**

- Candidate (23a) has an *unstressed* monomoraic reduplicant.
  - ○ This avoids a clash and satisfies the preference for shorter reduplicants, but fatally violates STRESS-TO-RED.
- Candidate (23b) has a *stressed* monomoraic reduplicant.
  - ○ This also satisfies the preference for shorter reduplicants and now avoids the STRESS-TO-RED violation, but at the expense of creating a fatal clash.
- Winning candidate (23c) has a bimoraic reduplicant which stresses its first mora.
  - ○ This gives up on having a short reduplicant, but allows for the reduplicant to be stressed w/o causing a clash.

→ The reduplicant is extended to 2 moras in case it can optimize the stress pattern.

- Three additional candidates are considered in (24):

(24) Odd mora count bases yield 2μ reduplicants: *dùupék* → *dùu-dùupék*

/RED, duupek/		STRESSR$_\mu$	*LAPSE$_\mu$	ALIGN-ROOT-L$_\mu$
a. ☞ dùu-dùu.pék	[20-201]			**
b. dù-duú.pek	[2-010]	*!		*
c. dù-duu.pék	[2-001]		*!	*
d. duù.pe-dùu.pék	[020-201]			***!

- The fact that candidates (24b) and (24c) — which divert from the regular stress pattern in favor of a shorter reduplicant — are not optimal shows us that all the stress constraints outrank ALIGN-ROOT-L$_\mu$:

(25) **Ranking:** STRESSR$_\mu$, *LAPSE$_\mu$ ≫ ALIGN-ROOT-L$_\mu$

⋆ There are a wide range of attested base types in this category (see Appendix A.1).

3.3.3 Bimoraic reduplicants for bases with initial light syllables: *REPEAT(light)

- If stress were the only determining factor, we'd expect *all* even mora count bases to display 1-mora reduplicants...but this is not the case:
  - → Any even mora count base with an initial *light syllable* (i.e. $[C\check{V}]_\sigma$) instead has a 2-mora reduplicant.

- As introduced above, this effect can be captured with the constraint I call *REPEAT(light), inspired by Yip's (1995) more general *REPEAT constraint.

(26) ***REPEAT(light):** Assign one violation mark * for each sequence of two adjacent identical light syllables (i.e. $*[C_\alpha\check{V}_\beta]_\sigma[C_\alpha\check{V}_\beta]_\sigma$). [repeated from (19) above]

- While the precise nature of the problem is not completely clear (and I won't attempt to resolve it here), this seems like some sort of OCP/anti-repetition constraint over a slightly larger domain.

∗ It may be relevant that Hicks Kennard (2004) employs a version of this constraint (without the restriction to light syllables) in her analysis of durative reduplication in Tawala.

∗ Tawala is an Austronesian language related to Ponapean (both are in the Oceanic sub-group).

→ Given that the Ponapean reduplication pattern under discussion is indeed the durative, this serves as some suggestive comparative evidence for the use of such a constraint in the analysis.

- *REPEAT(light) will motivate extension to a 2-mora reduplicant in case the base begins in a light syllable:

(27) Even mora count bases with initial light syllables yield 2μ reduplicants: *dune* → *duǹ-duné*

/RED, dune/			STRESS-TO-RED	*REPEAT(light)	ALIGN-ROOT-L$_\mu$
a.	du-du.né	[0-01]	*!	*!	*
b.	dù-du.né	[2-01]		*!	*
c. ☞	duǹ-du.né	[02-01]			**

- Candidates (27a) and (27b) both have 1-mora reduplicants.
  - Regardless of whether that reduplicant is stressed (27b) or not (27a), this results in two *adjacent identical light syllables* (potentially differing in stress; (27b)), i.e. the reduplicant and the first syllable of the base.
  - This incurs a fatal violation of *REPEAT(light).
- Candidate (27c) extends the reduplicant out to 2 moras (in this case, by copying the following nasal as a coda).
  - This makes the reduplicant's syllable and the base-initial syllable no longer identical, satisfying *REPEAT(light).

→ The reduplicant is extended to 2 moras in case it can avoid a violation of this anti-repetition phonotactic constraint.

- *REPEAT(light) is equally applicable in *odd* mora count bases with initial light syllables. In these cases, *REPEAT(light) and *CLASH$_\mu$ will *both* advocate for extending the reduplicant to two moras:

(28) Odd mora count bases with initial light syllables yield 2μ reduplicants: *padaak* → *pàda-pàdaák*

/RED, padaak/			STRESS-TO-RED	*CLASH$_\mu$	*REPEAT(light)	ALIGN-ROOT-L$_\mu$
a.	pa-pà.daák	[0-201]	*!		*!	*
b.	pà-pà.daák	[2-201]		*!	*!	*
c. ☞	pà.da-pà.daák	[20-201]				**

- The operation of *REPEAT(light) in reduplication represents a case of *the emergence of the unmarked.* $[C_\alpha\check{V}_\beta]_\sigma[C_\alpha\check{V}_\beta]_\sigma$ sequences are indeed attested outside of reduplication, for example:

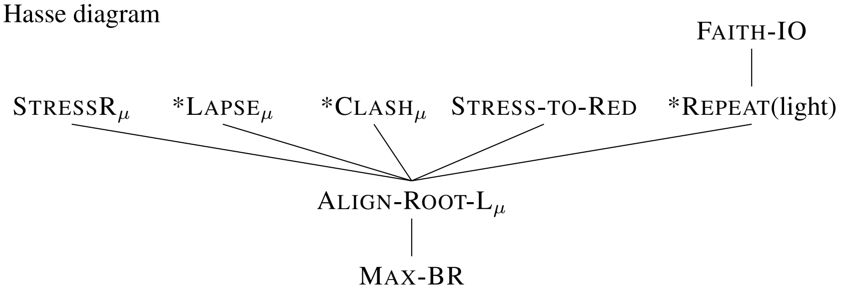
(29) *REPEAT(light) as TETU: ROOT *re.ré* 'to skin/peel' → DURATIVE *rer̀-re.ré* (Rehg & Sohl 1981:80)

/RED, padaak/			FAITH-IO	*REPEAT(light)	ALIGN-ROOT-L$_\mu$
a.	rè-re.ré	[2-01]		**!	*
b. ☞	rer̀-re.ré	[02-01]		*	**
c.	rèe-**rèe**.ré	[20-201]	*!		**

  - A candidate like (29c), which lengthens the first root vowel to eliminate all consecutive identical light syllables, is dispreferred to those where the base is faithful.

3.3.4 Ranking Summary

(30) Hasse diagram



4 Theoretical Ramifications: Morphological Doubling Theory

- The above analysis was implicitly couched in Base-Reduplicant Correspondence Theory (BRCT; McCarthy & Prince 1995), but only lightly so.

→ The analysis relies almost entirely on surface-oriented constraints (i.e. BR-correspondence is not relevant), so it is in theory compatible with any number of constraint-based approaches to reduplication.

⋆ There is, however, one aspect of BRCT that *is* crucial to the analysis: "**non-encapsulation**".

4.1 Non-encapsulation in the analysis of Ponapean reduplication

- The analysis hinges primarily on the operation of *CLASH$_\mu$ and *REPEAT(light). These are the constraints which motivate deviation from the default preference for a 1-mora reduplicant.
- For both of these constraints, the structural descriptions encompass *sequences* (of moras or syllables, respectively).

→ In the case at hand, the relevant sequences *span the base and the reduplicant*. That is to say, a 1-mora reduplicant is disallowed (and thus extended to 2 moras) if:

(31) a. There would be a **clash** across the reduplicant-base juncture.
b. There would be **identical light syllables** across the reduplicant-base juncture.

- And note that, while the weight of the base-initial syllable can be ascertained from the UR, the *stress* value of the base-initial mora is *grammatically assigned*, i.e. a **surface property** not an underlying property.

⋆ This means that the module in which reduplicant length is determined must have *access* to:

(32) a. The *surface* properties of the base
b. The reduplicant's position relative to the base

→ This tells us something about the architecture of the reduplicative grammar:

(33) *This is compatible with a grammar where:*
✓ The base is computed and then the reduplicant is computed (with the base visible), or
✓ The base and reduplicant are computed together

(34) *This is **not** compatible with a grammar where:*
✗ The reduplicant is computed and then the base is computed, or
✗ **The reduplicant and the base are computed separately** (and the base is invisible to the reduplicant)

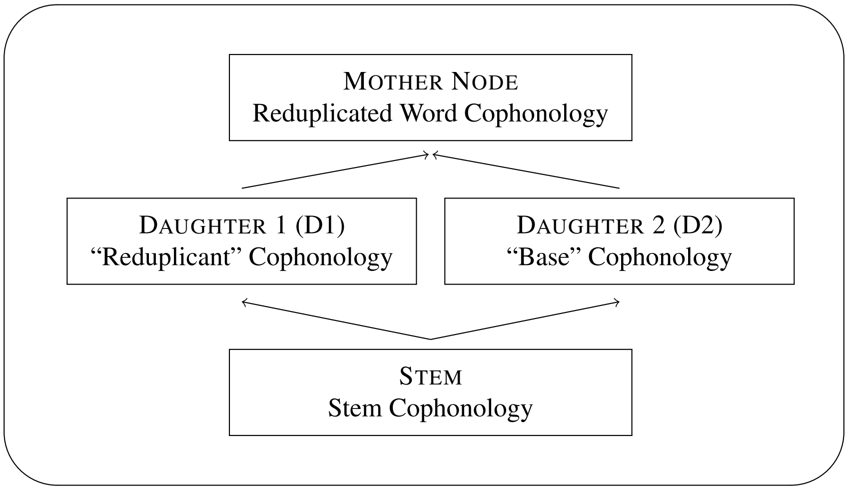
- Most theories of reduplication have an architecture of the type in (33), including BRCT, Stratal OT (Kiparsky 2010), Serial Template Satisfaction in Harmonic Serialism (McCarthy, Kimper, & Mullin 2012).

⋆ There is at least one notable theory of reduplication, however, whose architecture (on its face) would seem to be of the type in (34): *Morphological Doubling Theory* (MDT; Inkelas & Zoll 2005).

4.2 Encapsulation and partial reduplication in MDT

- The basic approach to reduplication in MDT can be schematized as follows:

(35) Reduplication in MDT



- A single stem is outputted to two *separate* derivational nodes (the "daughter" nodes), which are fully **encapsulated** from one another (i.e. there's *no information flow* between them).
  - One of these nodes calculates the "reduplicant" (here, D1), the other calculates the "base" (here, D2).
  - These two nodes may have completely distinct *cophonologies* (i.e. phonological grammars).
- The outputs of the daughter nodes then jointly form the input to a single derivational node (the "mother" node).
  - This node applies its own cophonology (which, again, may be completely distinct) to its input.
    - There is no explicit distinction in status between material from the respective daughter nodes.
    - i.e. no formal equivalent of "base" vs. "reduplicant"
  - The daughter outputs are concatenated according to this cophonology.

→ Typically, partial reduplication is the result of *truncation* phonology applying in one of the daughter nodes (i.e. the "Reduplicant" cophonology). **But this won't work for Ponapean.**

(36) a. Daughter 1 cannot see Daughter 2 (because they are fully encapsulated from one another).
b. Violations from *Clash$_{\mu}$ and *Repeat(light) can only be accrued when the output being evaluated contains (linearly ordered) material from both reduplicant (i.e. D1) and base (i.e. D2).
c. Therefore, the decision to truncate to one mora vs. two moras cannot be made in Daughter 1.

- To illustrate the problem, consider the following attempt to import the analysis into the typical MDT approach to partial reduplication.

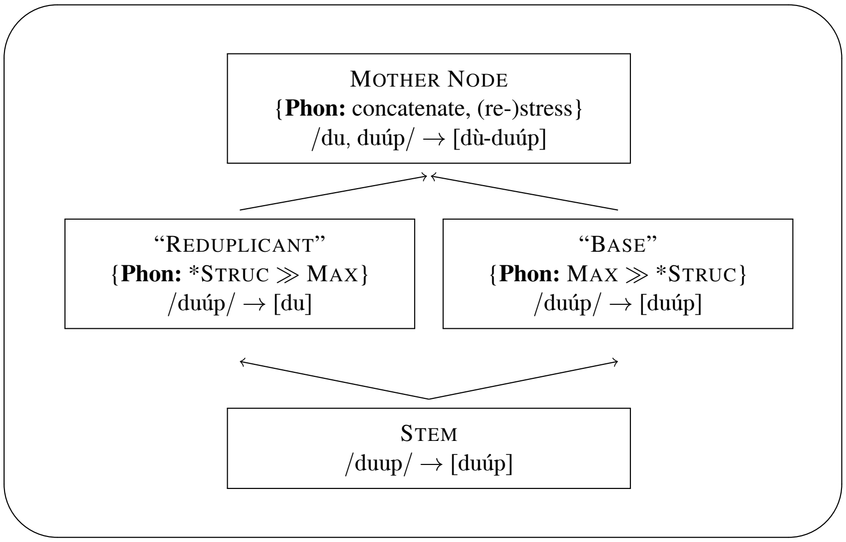
∗ Assume that the reduplicant cophonology truncates down to 1 mora by default (37), but is diverted to 2 moras just in case this would violate *CLASH$_\mu$ (i.e. in odd mora count bases).

∗ The derivation in (38) shows that truncation to 1 mora will *never actually violate* *CLASH$_\mu$ (since the clashing mora is contained in the fully encapsulated D2 node), so extension to 2 moras doesn't take place.

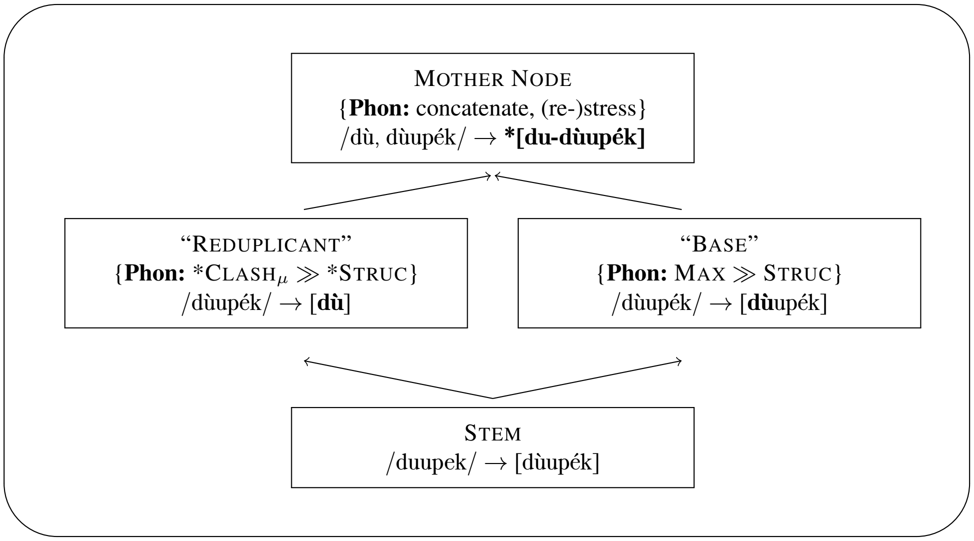
∗ It is not until the daughter nodes transmit their material to the mother node that the clash occurs, but it is now too late (under this approach) to copy a second mora.

  → It is not sufficient to say that there the reduplicant length is repaired in the mother node (e.g. by lengthening), because many stems obtain their second mora by copying a consonant.

(37) Derivation of *dù-duúp*



(38) **Failed** derivation of *dùu-dùupék*



4.3 Sidestepping encapsulation: everything's in the Mother Node

- ⋆ There is a way to make the analysis compatible with MDT: the decision to truncate to one mora vs. two moras happens *in the Mother Node*.
- → Truncation can be effectuated in the Mother Node by ascribing the "BRCT" analysis's constraint ranking to the Reduplicated Word Cophonology (assuming the Mother Node inherits two full copies of the stem).[3]

- This means that the reduplicant length alternations in Ponapean do not wholly preclude an MDT analysis.
- ⋆ However, it does have a further consequence: **the reduplicant and the base must be subject to the same phonological grammar.** In other words:

(39) The Reduplicated Word Cophonology must be able to derive the full range of bimoraic shape alternations in a way that is *consistent with the rest of the phonology of that node*.

4.4 Nasal Substitution

- In Appendix A, I lay out the facts of the bimoraic shape alternations. The bulk of the alternation is determined by the process of **nasal substitution** (Rehg 1984).
- The term "nasal substitution" encompasses *a set of alternations* — mostly conversion to nasal stops — that create licit coda-onset sequences (cf. (3) above), driven by a version of CODA CONDITION (Itô 1989):

(40) **CODA CONDITION:** Assign one violation mark * for each medial coda consonant which is not either:
  a. A nasal homorganic to a following obstruent
  b. The first member of a geminate sonorant

- The effects of nasal substitution can be seen across Ponapean's phonological grammar, applying (to one extent or another) both within morphemes and across most (perhaps all) morpheme boundaries.
  - ○ There do seem to be substantive differences across different kinds of boundaries — e.g., nasal substitution applies to coronals in reduplication but not at (most) suffixes boundaries.
  - ⋆ However, I have not yet been able to identify any discernible differences between the operation of nasal substitution in the reduplicant vs. its operation in the base of reduplication (≈ *morpheme-internally*).
- → Therefore, these patterns appear to be consistent with the phonology that applies throughout the mother node.

5 Conclusion

- Ponapean exhibits a reduplicant length alternation that can be explained straightforwardly using stress constraints and phonotactic constraints, namely, *CLASH$_\mu$ and *REPEAT(light).

- Importantly, these constraints' domain of application spans the base and the reduplicant.
- → This requires that (i) *the surface properties of the base* and (ii) *the reduplicant's position relative to the base* be visible to the stage of the derivation which computes reduplicant shape.

- If this analysis is to be adapted to MDT, it has to be located in the **mother node** (including truncation).
- This requires that the same phonology that applies to the reduplicant applies also to the base.

- ⋆ Using nasal substitution as a diagnostic, this does seem to be the case, meaning that this analysis can be made **compatible with MDT**.

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[3] This does specifically require the use of an alignment-based size restrictor constraint, as employed thus far. (Templatic constraints can't be used, because there's nothing in the output specified as a "reduplicant", and something like *STRUC can't be used, because all the material has the same status in terms of IO-faithfulness.) As long as this alignment constraint — ALIGN-ROOT-L$_\mu$ (or one referencing an equivalent constituent) — outranks MAX(-IO), it will succeed in deleting as much material as possible to the left of the material from D2.

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A Appendix: Reduplicant Shape Alternations and Nasal Substitution

- The aspect of Ponapean reduplication (and Ponapean phonology generally) which has received the most attention in the literature is its behavior with respect to the process of "nasal substitution" (described in Rehg & Sohl 1981, Rehg 1984, Goodman 1995; further analyzed in, e.g., Blevins & Garrett 1992, 1993, Davis 2003, Kurisu 2013).

→ This term encompasses *a set of alternations* that create licit coda-onset sequences, which I'll describe below.

- In order for the MDT analysis to hold up, the operation of nasal substitution in reduplication **must be compatible with the operation of nasal substitution in the base**.

⋆ Based on the evidence I have been able to assemble thus far, it does appear as though the two are consistent, which means that **the MDT analysis is viable**.

- I will first walk through the overall distribution of the bimoraic reduplicant shapes. [Note: there is no difference in shape depending on whether they are extended by $*\textsc{Clash}_{\mu}$ or by $*\textsc{Repeat}$(light).]
- And then I'll focus in on the workings of nasal substitution, in reduplication and more generally.

∗ I do not provide a full analysis of the nasal substitution processes. See Kurisu (2013) for a recent OT analysis.

A.1 Distribution of bimoraic reduplicant shapes

- Broadly speaking, there are 4 distinct shapes that the bimoraic reduplicants can have:

(41) Distinct bimoraic reduplicant shapes [V = short vowel, VV = long vowel or diphthong, R = sonorant C, N = nasal]
  a. **CVV**
  b. **CVR** (where R is the first member of a geminate sonorant)
  c. **CVN** (where N is homorganic to a following obstruent)
  d. **CVCV**

- Among these, the most straightforward shape is **CVV**. This shape occurs if:

(42) a. The first syllable of the base contains a long vowel or diphthong
  b. The base consists entirely of [CV] (this is essentially a last resort option)

- Examples of the type in (42a) are given in (43).[4]

(43) Odd mora count stems with first-syllable long vowels

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)		Page #
pehse	[peese]	'to be acquainted'	*pehpehse*	[pèe-pèesé]	80
duhpek	[duupek]	'starved'	*duhduhpek*	[dùu-dùupék]	79
mehlel	[meelel]	'true'	*mehmehlel*	[mèe-mèelél]	79
noahrok	[nɔɔrok]	'greedy'	*noahnoahrok*	[nɔ̀ɔ-nɔ̀ɔrók]	80
wahsek (var.)	[waasek]	'to enlarge an opening'	*wahwahsek*	[wàa-wàasék]	82

- When neither of the conditions in (42) hold, bimoraic reduplicants always surface as some version of **CVC(V)**.
  - ⋆ Which version surfaces depends on the operation of "nasal substitution" and associated rules/constraints (see Section A.1.2 below).

- The primary driver of the alternations is the restriction on what can appear as a medial coda-onset sequence.
  - ○ As mentioned in (3) above, the only possibilities are:

(44) Licit medial coda-onset sequences
  a. Homorganic nasal-obstruent sequences *mp, $m^w p^w$, nt, nd, ns, ŋk*
  b. Geminate nasals and liquids *mm, $m^w m^w$, nn, ŋŋ, rr, ll*

- I encode this directly using a version of CODA CONDITION (Itô 1989):

(45) **CODA CONDITION:** Assign one violation mark * for each medial coda consonant which is not either:
  a. A nasal homorganic to a following obstruent
  b. The first member of a geminate sonorant

  - ○ See Kurisu (2013) for further discussion of the underpinnings of this constraint in Ponapean.

- We can account for the distribution of the **CVC(V)** reduplicants according to the following conditions (where the base begins in an initial string of C_1VC_2):

(46) a. **Fully faithful copying of C_1VC_2** if C_2C_1 is a CODACOND-obeying coda-onset sequence.
  b. **Partially faithful copying of C_1VC_2** if C_2 *can* be legally modified to create a CODACOND-obeying coda-onset sequence with C_1.
  c. $\mathbf{C_1VC_2\boxed{+V}}$ if C_2 *can't* be legally modified to create a CODACOND-obeying coda-onset sequence with C_1.

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[4] Page numbers refer to the location of the example in Rehg & Sohl (1981). "(var.)" indicates that the root has more than one attested type of reduplicant. Variation is largely limited to glide-initial and vowel-initial roots, which will not be treated here.

A.1.1 Faithful CVC copying

- The following are the examples from Rehg & Sohl (1981) where faithful copying of CVC yields licit codas. In such cases, nothing further needs to be said.

(47) Faithful CVC reduplicants: homorganic nasals

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)		Page #
kang	[kaŋ]	‘to eat’	*kangkang*	[kàŋ-káŋ]	75
dune	[dune]	‘to attach in a sequence’	*dundune*	[duǹ-duné]	80
sinom	[sinom]	‘to sink in’	*sinsinom*	[siǹ-sinóm]	60
tenek	[tenek]	‘hung up’	*tentenek*	[teǹ-tenék]	60

(48) Faithful CVC reduplicants: geminate sonorants

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)		Page #
mem	[mem]	‘sweet’	*memmem*	[mèm-mém]	74
ngong	[ŋoŋ]	‘to bark’	*ngongngong*	[ŋòŋ-ŋóŋ]	60
lal	[lal]	‘to make a sound’	*lallal*	[làl-lál]	74
rer	[rer]	‘to tremble’	*rerrer*	[rèr-rér]	74
rere	[rere]	‘to skin/peel’	*rerrere*	[rer̀-reré]	80
nenek	[nenek]	‘to commit adultery’	*nennenek*	[neǹ-nenék]	60

A.1.2 Nasal substitution

- On the other hand, when base-C_2 does not form a licit coda-onset sequence with base-C_1, CODACOND will motivate a diversion from faithful CVC copying.
- There are certain modifications that C_2 is permitted to undergo (in the reduplicant).

- The one consistent thing that **cannot** be modified is *place of articulation*:

(49) No reduplicant consonant may differ in (major) place from its input/base correspondent (IDENT[place]-IO/BR)

- When C_1 and C_2 differ in place, there is no legal modification that can satisfy CODACOND.
  → Bases beginning in heterorganic CVC strings will always reduplicate with **CVCV**.

- The modifications that are permitted all have to do with changes in *manner of articulation*.

⋆ Underlying *sonorants* permit changes in [±nasal], [±continuant], and [±lateral]:

(50) Sonorants can change to any homorganic sonorant to create a geminate sonorant
/l/, /r/, /n/ → [l,r,n] / _l,r,n

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
nur	[nur]	‘contract’	*nunnur*	[nùn-núr]	(r → n)	58
lirohro	[lirooro]	‘protective’	*lillirohro*	[lil̀-liròoró]	(r → l)	58
linenek	[linenek]	‘oversexed’	*lillinenek*	[lìl-lìnenék]	(n → l)	60

(51) Liquids can change to homorganic nasals before obstruents
/l,r/ → [n] / _d,t,s (recall: <*t*> ≈ [ʧ], <*d*> ≈ [t])

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
dil	[dil]	'to penetrate'	*dindil*	[dìn-díl]	(l → n)	75
tal	[tal]	'to make a click'	*tantal*	[tàn-tál]	(l → n)	75
sel	[sel]	'to be tied'	*sensel*	[sèn-sél]	(l → n)	75
sile	[sile]	'to guard'	*sinsile*	[siǹ-silé]	(l → n)	81
dilip	[dilip]	'to mend thatch'	*dindilip*	[diǹ-dilíp]	(l → n)	81
dar	[dar]	'to strike (of a fish)'	*dandar*	[dàn-dár]	(r → n)	75
tir	[tir]	'narrowing'	*tintir*	[tìn-tír]	(r → n)	60
sar	[sar]	'to fade'	*sansar*	[sàn-sár]	(r → n)	75
sarek	[sarek]	'to uproot'	*sansarek*	[saǹ-sarék]	(r → n)	81

⋆ Underlying *obstruents* permit changes in [±nasal] and [±continuant], but there is an asymmetry by place (of the undergoer) with respect to the context:

(52) Non-coronal obstruents can change to homorganic nasals *before an obstruent or a nasal*
/k/ → [ŋ] / _k(, ŋ) , /p$^{(w)}$/ → [m$^{(w)}$] / _p$^{(w)}$, m$^{(w)}$

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
kak	[kak]	'able '	*kangkak*	[kàŋ-kák]	(k → ŋ / _k)	59
kik	[kik]	'to kick'	*kingkik*	[kìŋ-kík]	(k → ŋ / _k)	75
pap	[pap]	'to swim'	*pampap*	[pàm-páp]	(p → m / _p)	75
pepe	[pepe]	'to swim to'	*pempepe*	[pem̀-pepé]	(p → m / _p)	81
pwupw	[p^{w}up^{w}]	'to fall'	*pumpwupw*	[p^{w}ùm^{w}-p^{w}úp^{w}]	(p^{w} → m^{w} / _p^{w})	75
mwopw	[m^{w}op^{w}]	'to be out of breath'	***mwommwopw***	**[m^{w}òm^{w}-m^{w}óp^{w}]**	**(p^{w} → m^{w} / _m^{w})**	75

(53) Coronal obstruents can change to homorganic nasals *before an obstruent* (but not before a nasal)
/d,t,s/ → [n] / _d,t , /s/ → [n] / _s

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
dod	[dod]	'frequent'	*dondod*	[dòn-dód]	(d → n)	75
did	[did]	'to build a wall'	*dindid*	[dìn-díd]	(d → n)	59
tat	[tat]	'to writhe'	*tantat*	[tàn-tát]	(t → n)	75
sis	[sis]	'to speak with an accent'	*sinsis*	[sìn-sís]	(s → n)	75
sas	[sas]	'to stagger'	*sansas*	[sàn-sás]	(s → n)	59

- Regardless of place, obstruents don't become liquids before liquids.

A.1.3 CVCV reduplicants

- Just in case C_1VC_2 cannot be legally modified to satisfy CodaCond, the reduplicant appears with an additional vowel following reduplicant-C_2.

- The vowel which appears is *not* completely predictable.
  - Some look like they might be being copied from the base-second syllable
  - Some appear to be floating/latent/(quasi-)underlying (or at least historically underlying)
  - Others could be copy epenthetic vowels
  - Others seem to be default epenthetic vowels
  - ...and in some cases it isn't clear which is which

→ I won't try to adjudicate this here (see Rehg & Sohl 1981, Rehg 1984, Kurisu 2013 for discussion). All that is important is that some vowel appears just when C_2 can't satisfy CodaCond.

(54) Would-be *non-coronal–coronal* sequences

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
tep	[tep]	'to begin'	*tepitep*	[tèpi-tép]	(*pt)	75
tep	[tep]	'to kick'	*tepetep*	[tèpe-tép]	(*pt)	75
tepek	[tepek]	'to kick'	*tepetepek*	[tepè-tepék]	(*pt)	81
siped	[siped]	'to shake out'	*sipisiped*	[sipì-sipéd]	(*ps)	81
sopuk	[sopuk]	'?'	*sop(u)sopuk*	[sop(ù)-sopúk]	(*ps)	93
lop	[lop]	'to be cut'	*lopilop*	[lòpi-lóp]	(*pl)	75
taman	[taman]	'to remember'	*tamataman*	[tamà-tamán]	(*mt)	81
loange	[lɔŋe]	'to pass across'	*loang(i)loange*	[lɔŋ(ì)-lɔŋé]	(*ŋl)	81

(55) Would-be *coronal–non-coronal* sequences

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
ped	[ped]	'to be squeezed'	*pediped*	[pèdi-péd]	(*dp)	75
padahk	[padaak]	'?'	*padapadahk*	[pàda-pàdaák]	(*dp)	93
katohre	[katoore]	'to subtract'	*kat(i)katohre*	[kat(ì)-katòoré]	(*tk)	81
was (var.)	[was]	'obnoxious'	*wasawas*	[wàsa-wás]	(*sw)	81
wasas	[wasas]	'to stagger'	*wasawasas*	[wasà-wasás]	(*sw)	81
par	[par]	'to cut'	*parapar*	[pàra-pár]	(*rp)	75
pirap	[pirap]	'?'	*pir(i)pirap*	[pir(ì)-piráp]	(*rp)	93
pwil	[p^{w}il]	'to flow'	*pwilipwil*	[p^{w}ìli-p^{w}íl]	(*lp^{w})	75
ker	[ker]	'to flow'	*kereker*	[kère-kér]	(*rk)	75
kiles	[kiles]	'?'	*kil(i)kiles*	[kil(ì)-kilés]	(*lk)	93
ngalis	[ŋalis]	'?'	*ngal(i)ngalis*	[ŋal(ì)-ŋalís]	(*lŋ)	93

(56) Would-be *coronal–coronal* sequences that can't be legally modified

Base (spelling/phonetic)		Gloss	Reduplicated (spelling/phonetic)			Page #
sed	[sed]	'to artificially ripen breadfruit'	***sedesed***	**[sède-séd]**	**(*ds)**	R84:321
setisek	[setisek]	'to be quick in performing'	***setisetisek***	**[sèti-sètisék]**	**(*ts)**	R84:321
ned	[ned]	'to smell'	***nedened***	**[nède-néd]**	**(*dn)**	75
net	[net]	'to smell'	***netenet***	**[nète-nét]**	**(*tn)**	61
net	[net]	'to sell'	***netinet***	**[nèti-nét]**	**(*tn)**	61
liduwih	[liduwii]	'to be a female servant'	*lidiliduwih*	[lidì-lidùwií]	(*dl)	61
let	[let]	'to flick'	*letelet*	[lète-lét]	(*tl)	61
rot	[rot]	'dark'	*rotorot*	[ròto-rót]	(*tr)	61
lus	[lus]	'to jump'	*lusulus*	[lùsu-lús]	(*sl)	61
rese	[rese]	'saw'	*resirese*	[resì-resé]	(*sr)	61

A.2 Nasal substitution outside of reduplication

- The MDT analysis of the reduplicant length alternations requires that the phonology that applies to the reduplicant also applies to the base.
- Therefore, in order for the MDT analysis to be viable, nasal substitution must apply equivalently to the base as it does to the reduplicant.

⋆ Rehg (1984:325–326) suggests that there is a difference in the operation of nasal substitution between reduplication and some other areas of the grammar.

- Non-coronal stops always become nasals preceding homorganic stops, across any kind of boundary.
  - ○ All different affix boundaries, clitic boundaries, across word boundaries within phrases
- On the other hand, Rehg says that, outside of reduplication, *coronal-coronal* sequences don't get resolved by nasal substitution.
  - ○ Either they are resolved through vowel epenthesis (at affix and clitic boundaries), or
  - ○ They are tolerated (across word boundaries)

→ Based on Rehg's description, it is not clear to me whether the vowel that separates *coronal-coronal* sequences is epenthetic or underlying.

  - ○ If it is the latter, then that does not constitute evidence of different behavior of the sort that would be problematic for the MDT analysis.
  - ○ Also, MDT is actually well-equipped to handle different behavior across different boundary types, since each morpheme can have its own cophonology.

- The question thus really comes down to *morpheme-internal sequences*.
  - → It appears as though the sequences that are repaired through nasal substitution in reduplication *are not present* morpheme-internally.

⋆ This is enough to say that the MDT analysis appears to be **internally consistent**.