The interaction of nasal substitution and reduplication in Ponapean*

Stuart Davis
Indiana University
davis@indiana.edu

1 Introduction

The pattern of correspondence relations found between the reduplicant (i.e., the reduplicated affix) and the base in Ponapean prefixal CVC reduplication presents a challenge for Optimality Theory, and, specifically for the version of it known as Correspondence Theory which was originally developed by McCarthy & Prince (1995) for the analysis of reduplication. Consider the data in (1).[1]

(1) Correspondence Relations in Ponapean CVC reduplication

Base	Underlying *Reduplication*	Surface *Reduplication*	Consonant *Correspondence*	*Gloss*
a. linenek	/RED + linenek/	[lil.linenek]	Base /n/ -- Red [l]	'protective'
b. sɛl	/RED + sɛl/	[sɛn.sɛl]	Base /l/ -- Red [n]	'tied'
c. tit	/RED + tit/	[tin.tit]	Base /t/ -- Red [n]	'build a wall'
d. nenek	/RED + nenek/	[nen.nenek]	Base /n/ --Red [n]	'do adultery'
e. net	/RED + net/	[netVnet]	Base /t/ -- Red [t]	'smell'
f. setik	/RED + setik/	[setVsetik]	Base /t/ -- Red [t]	'quick'
g. tune	/RED + tune/	[tun.tune]	Base /n/ --Red [n]	'tie together'

Of particular interest in this paper are cases like (1b) and (1c) which illustrate the phenomenon of nasal substitution whereby a nasal occurs in the output (shown under 'Surface Reduplication') even though there is no triggering nasal in the input. Specifically, in (1b), [l]

* Acknowledgment: This paper develops an analysis of Ponapean reduplication first presented in Davis (1997); various aspects of it are also discussed in Davis (2000). A version of this paper was presented at the Graz Reduplication Conference in November 2002 and I would like to thank Laura Downing, John Frampton, Bernhard Hurch, Nicole Nelson, Patricia Shaw, and Cheryl Zoll for their comments at the conference, as well as Karen Baertsch, Jill Beckman, Daniel Dinnsen, Beverley Goodman, Anna Lubowicz, John McCarthy, Jaye Padgett, Philip Spaelti, and Rachel Walker for their comments on various aspects of this paper. The usual disclaimers apply.

1 The Ponapean data cited in this paper come from Rehg and Sohl (1981), Rehg (1984), Blevins and Garrett (1992), Goodman (1995), and Takano (1996). The reduplication marks the durative aspect, and the CVC prefixal data discussed in this paper represents only one subpattern of the durative reduplication process. In the reduplication examples in (1) and elsewhere in this paper I specifically indicate the consonant correspondence of the final consonant of the reduplicant. V indicates an epenthetic vowel whose surface quality depends on various factors. The period shown between the two consonants signifies a syllable boundary. In all the examples, the boundary between the reduplicant and the base is also a syllable boundary. If the base contains more than one syllable I do not show the syllabification of the base since it is not of direct relevance. However, given universal syllable principles, along the lines of Prince and Smolensky (1993), an intervocalic consonant would syllabify as the onset of the syllable with the following vowel.

is expected in the coda of the reduplicated prefix, but [n] is realized instead. Similarly, in (1c), [t] is expected in the coda of the reduplicated prefix, but [n] is realized in its place.

Now, given the underlying reduplicative forms shown in (1), a particular challenge for a correspondence theory analysis is to account for the data in (1c-e) in a unified way. There is an interesting lack of parallelism between the output of (1c) and (1d-e). In (1c), if the featural identity of the CVC reduplicant were a perfect reflection of the base, we would expect the output [tit.tit]. The actual output is [tin.tit] as shown with nasal substitution. Thus, the correspondent of the base-final /t/ surfaces as [n]. On the other hand, (1e) is quite different. If the featural identity of the CVC reduplicant were a perfect reflection of the base we would expect the output [net.net]. The actual surface output, however, has an inserted vowel, [netVnet]. The problem that is posed for a correspondence theory analysis is why isn't the surface form for (1e) [nen.net], especially since a geminate nasal is possible as seen by the output of (1d) and since a base-final /t/ can have [n] as a correspondent as in (1c)? That is, why doesn't the base-final /t/ in (1e) have the correspondent [n] in the reduplicant like the form in (1c)? Or, to put it the other way around, why isn't the output for (1c) [titVtit] with an epenthetic vowel, parallel to (1e)?[2] In order to see the difficulty that data like (1c) and (1e) present for Correspondence Theory, I will review in Section 2 the analysis of Takano (1996) which is unable to account for the lack of parallelism in these data. In Section 3 I will offer an analysis of Ponapean CVC reduplication that makes reference to a sympathetic candidate along the lines of the proposal of McCarthy (1997, 1999). While McCarthy's proposal has remained controversial, the analysis that I offer not only accounts for data like in (1c) and (1e) in a unified way, it also efficiently expresses the generalization regarding the occurrence of nasal substitution. In this way, sympathy theory provides insight into the analysis of Ponapean CVC reduplication.

2 Previous analysis

In this section I will present the relevant aspects of Takano's (1996) analysis of Ponapean CVC reduplication. I focus on Takano's analysis because it highlights the difficulty that an optimality theoretic analysis faces in accounting for Ponapean CVC reduplication. I also present her analysis since I will incorporate various aspects of it into my own analysis in Section 3.[3] In relating her analysis we will see that, though it accounts for much of the CVC reduplication data, it is unable to account for the lack of parallelism witnessed in the reduplication of a form like /tit/ as [tintit] in (1c) and /net/ as [netVnet] in (1e). Takano's analysis predicts that /tit/ should wrongly reduplicate as [titVtit]. The forms in (1c) and (1e) motivate an analysis that I offer in terms of a sympathetic candidate in Section 3.

Takano offers the following relevant constraints in (2) for the analysis of Ponapean CVC reduplication.

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2 It seems quite reasonable that the lack of vowel epenthesis in the output of (1c) might have to do with geminate integrity. However, given that the underlying reduplication, /RED + tit/, has no geminate, there is not necessarily a violation of geminate integrity in the output [titVtit]. A major facet of the correspondence theory analysis I will propose in Section 3 is that the correct output of a form like (1c) is faithful to a sympathetic candidate that is fully prosodified containing a geminate and a CVC reduplicant that is featurally faithful to its base, that is *tit.tit*.

3 Space limitations restrict me from discussing other analyses of Ponapean reduplication such as that of Spaelti (1997) and Kennedy (2002). Both these analyses encounter problems in dealing with the lack of parallelism between (1c) and (1e). See Davis (2000) for a discussion of Spaelti (1997).

(2) Constraints
- a. *μ[-son] -- Obstruents cannot be moraic.
- b. Ident-BR(son) -- A reduplicant correspondent of a base segment must have the same sonorant feature specification.
- c. RED=Affix (RED=□$_{\mu\mu}$ or RED=CVC) -- The reduplicant is an affix. (Other constraints will restrict the reduplicant to the size of a single CVC syllable.)
- d. Ident-BR(nasal) -- A reduplicant correspondent of a base segment must have the same nasal feature specification.

The constraint in (2a) has the effect of disallowing obstruents from being realized in coda position (cf. Goodman 1995, Zec 1995). With the exception of some loanwords and exclamations, (2a) is inviolable (undominated) in Ponapean. (This assumes that word-final consonants are extraprosodic. See Goodman 1997 and Davis 2000 for discussion.) The other three constraints in (2) are not undominated. The two Ident constraints in (2b) and (2d) assure featural identity between corresponding segments in the base and reduplicant with respect to the features [sonorant] and [nasal]. The constraint in (2c), RED=Affix, has been proposed by McCarthy & Prince (1994). This constraint restricts the size of a reduplicant to a single syllable because of another constraint noted by McCarthy & Prince that the phonological exponent of an affix cannot be longer than a syllable. The specific realization of the reduplicant as a heavy CVC syllable (as opposed to a CV syllable) would be due to the interaction of other relevant constraints, the full discussion of which is beyond the scope of this paper.[4] Even though Takano (1996) refers to the constraint in (2c) as RED=□$_{\mu\mu}$, for purposes of clarity I will refer to it as RED=CVC. A form like that in (1e) with an epenthetic vowel between the final consonant of the reduplicant and the initial consonant of the base is viewed as having a violation of (2c) on the interpretation that the reduplicant in (1e) surfaces as two syllables.

Given the constraints in (2), we can consider the constraint ranking and tableaux for the forms in (1c)-(1e). I show how Takano's analysis fails to account for the lack of parallelism between (1c) and (1e) resulting in a ranking paradox in the evaluation of candidates for these forms.

First, consider the tableau for (1d) in (3), which is the reduplicated form of /nenek/. The tableau shows the four constraints in (2).

(3) /nenek/ --- [nen-nenek] 'do adultery' (1d)

/RED+ nenek/	*μ[-son]	Ident-BR(son)	RED=CVC	Ident-BR(nas)
☞ a. nen-nenek				
b. nenVnenek			*!	
c. net-nenek	*!	*		*

In (3), the actual output [nen-nenek], (3a), is shown with the two competitors in (3b) and (3c). (3a) does not violate any of the constraints in (2), unlike the other two candidates. Thus, (3a) surfaces as the winner. (3a) displays perfect identity with respect to features between the phonemes of the CVC reduplicant and the corresponding phonemes in the base. (3b) violates

4 Such constraints would include Max-BR and NoCoda as well as RED=Affix. This follows McCarthy and Prince (1999) in the view that there are no constraints that specify a reduplicative template. The shape of the reduplicant emerges from the relevant ranking of constraints like those just mentioned. For clarity and ease of reference I will make use of RED=CVC, but this should be understood as a shorthand for a series of constraints that normally select a CVC reduplicant as optimal.

RED=CVC while (3c) violates undominated *μ[-son] among other constraints. Since the actual candidate, (3a), does not violate any of the relevant constraints, the tableau in (3) does not provide crucial evidence for the ranking among the constraints since there is no constraint conflict. Any ranking of the four constraints in (3) would result in (3a) being the winning candidate. Still, it is assumed that *μ[-son] is highest ranking since it is inviolable in Ponapean.

Takano (1996) shows the ranking between the constraints RED=CVC and Ident-BR(nasal) by considering the reduplication of (1b), /sɛl/ 'tied', in the tableau in (4).

(4) /sɛl/ --- [sɛn-sɛl] ‘tied’ (1b)

/RED + sɛl/	RED=CVC	Ident-BR(nasal)
☞ a. sɛn-sɛl		*
b. sɛl V sɛl	*!	

(4) shows a conflict between RED=CVC and Ident-BR(nasal). Candidate (4a) respects RED=CVC but violates Ident-BR(nasal) since the [n] of the reduplicant corresponds with the nonnasal [l] of the base. On the other hand, (4b) respects Ident-BR(nasal) but violates RED=CVC since the reduplicant surfaces with an epenthetic vowel. Given that (4a) is the winner, then RED=CVC must outrank Ident-BR(nasal) as shown in (5).

(5) RED=CVC >> Ident-BR(nasal)

One realistic candidate not shown in the tableau in (4) is the faithful candidate [sɛl-sɛl]. According to Takano (1996), this candidate is ruled out by the high-ranking constraint No-LC-Link which disallows a place-linked cluster of a liquid followed by a homorganic consonant. Takano proposes this constraint based on a constraint in Itô, Mester, & Padgett (1995) that disallows linked voicing between a sonorant segment and a following consonant. In Takano's analysis, No-LC-Link is higher ranked than Ident-BR(nasal) and so the faithful output [sɛl-sɛl] does not surface.[5]

Given the ranking in (5), let us now consider the ranking between Ident-BR(sonorant) and RED=CVC in Takano's analysis. The crucial example is /net/ in (1e). Tableau (6) shows the constraint evaluation for the possible reduplicated forms.

(6) /net/ --- [netVnet] ‘smell’ (1e)

/RED+ net/	*μ[-son]	Ident-BR(son)	RED=CVC	Ident-BR(nasal)
a. net-net	*!			
☞ b. netVnet			*	
c. nen-net		*!		*

The completely faithful candidate [net-net] in (6a) is eliminated because it violates the undominated constraint *μ[-son]. The competition then is between (6b) and (6c). If the Ident-BR(sonorant) constraint were ignored in Tableau (6), the expected winner would be (6c) given the ranking shown in (5). However, (6c) is not the winner. This means that there must be some constraint that (6c) violates that is higher ranking than the RED=CVC constraint

5 In the analysis I offer in Section 3, [sɛl-sɛl] is ruled out because it violates the undominated constraint Coda Condition (CodaCon) in the sense of Itô (1986) whereby a coda consonant must share place features with a following onset in order to surface. It is assumed that the cluster [l.s] in Ponapean cannot share place features.

which (6b) violates. According to Takano, the relevant constraint that (6c) violates is Ident-BR(sonorant). (6c) violates this constraint since the sonorant [n] of the reduplicant corresponds with the nonsonorant [t] of the base. (6b), according to Takano, respects the Ident-BR(sonorant) constraint. Given the ranking established in (5), Ident-BR(sonorant) and RED=CVC are in conflict. The fact that (6b) is the winner constitutes a ranking argument that the constraint it violates, RED=CVC, must be lower ranked than Ident-BR(sonorant) which (6c) violates. Thus the ranking in (7) is motivated.

(7) Ident-BR(sonorant) >> RED=CVC

Given the constraint ranking established in (5) and (7), an interesting problem arises for Takano's analysis when we consider the evaluation of candidates for forms like that in (1c), /RED + tit/. As shown by the tableau in (8), the ranking in (7) selects an incorrect output (indicated by ☛ in the tableau).

(8) /tit/ --- [tintit] 'build a wall' (1c)

/RED+ tit/	*μ[-son]	Ident-BR(son)	RED=CVC	Ident-BR(nasal)
a. tit-tit	*!			
☛ b. titVtit			*	
c. tin-tit		*!		*

The completely faithful candidate, [tit-tit], in (8a) is eliminated because it violates undominated *μ[-son]. The choice then is between (8b) and (8c). Given the ranking established in (7), the candidate in (8b) is wrongly predicted as the winning candidate since it violates only lower-ranked RED=CVC. The tableau in (8) makes clear the lack of parallelism between the data in (1c) and (1e). The constraint ranking of Ident-BR(sonorant) >> RED=CVC cannot account for the correct reduplication of /tit/. However, the correct output of [tintit] can be determined if the ranking of RED=Affix and Ident-BR(sonorant) were reversed, as in (9).

(9) RED=CVC >> Ident-BR(sonorant)

The tableau in (10) shows how this ranking results in the correct output for the reduplication of /tit/.

(10) /tit/ --- [tintit] 'build a wall' (1c)

/RED+ tit/	*μ[-son]	RED=CVC	Ident-BR(son)	Ident-BR(nasal)
a. tit-tit	*!			
b. titVtit		*!		
☞ c. tin-tit			*	*

This results in a ranking paradox. The reduplicative output for /tit/ seems to require the ranking in (9) while the reduplicative output for /net/ requires the opposite ranking in (7). Even if we put Ident-BR(sonorant) and RED=CVC in the same constraint block (along the lines of Ní Chiosáin 1995) and passed the outcome on to lower ranking Ident-BR(nasal), a wrong candidate would be predicted, as seen in (11).

(11) /tit/ --- [tintit] ‘build a wall’ (1c)

/RED + tit/	*μ[-son]	Ident-BR(son)	RED=CVC	Ident-BR(nasal)
a. tit-tit	*!			
☛ b. titVtit			*	
c. tin-tit		*		*!

Consequently, the lack of parallelism between (1c) and (1e) is problematic for Takano's (1996) correspondence theory analysis of Ponapean reduplication.[6] In the following section, I will offer an analysis of Ponapean CVC reduplication that builds on Takano's work but makes use of sympathetic candidates along the lines of McCarthy (1997. 1999).

3 A Sympathetic Analysis

One of the keys for solving the Ponapean reduplication problem in a uniform way without a ranking paradox is to understand why nasal substitution occurs when it does. Nasal substitution occurs in forms like (1b) and (1c). Data like that in (1b) and (1c) are shown in (12) and (13), respectively. In (12), the nasal substitutes for a sonorant and in (13) it substitutes for an obstruent.

(12) Reduplication with nasal substitution (similar to 1b)

	Underlying	Faithful	Surface	Consonant	
Base	*Reduplication*	*Redup.*	*Redup.*	*Correspondence*	*Gloss*
a. sɛl	/RED + sɛl/	sɛl.sɛl	[sɛn.sɛl]	Base [l] - Red [n]	‘tied’
b. tar	/RED + tar/	tar.tar	[tan.tar]	Base [r] - Red[n]	‘strike’
c. sar	/RED + sar/	sar.sar	[san.sar]	Base [r] - Red [n]	‘fade’
d. tilep	/RED + tilep/	til.tilep	[tin.tilep]	Base [l] - Red [n]	‘mend’

(13) Reduplication with nasal substitution (similar to 1c)

	Underlying	Faithful	Surface	Consonant	
Base	*Reduplication*	*Redup.*	*Redup.*	*Correspondence*	*Gloss*
a. tit	/RED + tit/	tit.tit	[tin.tit]	Base [t] - Red [n]	‘build’
b. sas	/RED + sas/	sas.sas	[san.sas]	Base [s] - Red [n]	‘stagger’

6 Even if we posit an analysis that makes use of constraint conjunction along the lines of Smolensky (1997), we would still not be able to account for the difference between (6) and (8). Given the ranking shown in (7), we can account for the problematic case of [tintit] in the tableau in (8) by conjoining two low ranking constraints that the candidate [titVtit] violates and ranking the conjoined constraint higher than Ident-BR(sonorant). Perhaps this conjoined constraint would be as in (i), though there may be some other relevant constraint involved instead of DEP-BR. The ranking of this constraint is shown in (ii)

a. RED=CVC & DEP-BR
b. RED=CVC & DEP-BR >> Ident BR(son) >> RED=CVC (>> DEP-BR)

The candidate [titVtit] in (8b) violates the high-ranking conjoined constraint since it violates both RED=CVC and DEP-BR. The candidate [tintit] in (8c) does not violate either conjunct of the high-ranking conjoined constraint and so would be correctly selected as the winner.

While the conjoined constraint with the ranking shown in (ii) unproblematically accounts for the reduplication of /tit/ as [tintit], the exact same constraint and ranking fails to account for the reduplication of /RED + net/. Here the candidate [netVnet] violates both conjuncts of the high-ranking conjoined constraint whereas the alternative candidate [nennet] respects the conjoined constraint violating lower-ranking Ident-BR(sonorant). Thus the conjoined constraint in (i) with the ranking in (ii) wrongly predicts that [nennet] should be the reduplicated form of /net/.

c. kak /RED + kak/	kak.kak	[kaŋ.kak]	Base [k] - Red[ŋ]	'able'
d. pap /RED + pap/	pap.pap	[pam.pap]	Base [p] - Red [m]	'swim'

Nasal substitution does not occur with data like (1e) or (1f), as shown in (14), even though there is nothing phonotactically wrong with a possible output like [nen.net] for (14a) or [sen.setik] for (14b), the latter of which clearly shows nasal substitution. (The possible output [nen.net] for (14a) could be viewed as involving the spreading of the feature nasal from the base. (14b) involves nasal substitution since there is no potential triggering nasal.)

(14) Reduplication without nasal substitution

Underlying *Base Reduplication*	Faithful *Redup.*	Surface *Redup.*	Consonant *Correspondence*	*Gloss*
a. net /RED + net/	net.net	[ne.tV.net]	Base [t] - Red [t]	'smell'
b. setik /RED + setik/	set.setik	[se.tV.setik]	Base [t] - Red [t]	'quick'

In order to understand when nasal substitution occurs it is necessary to make reference to the column marked 'Faithful Reduplication' in (12)-(14). This column shows what the reduplicated forms would be if the CVC reduplicant were completely faithful to the features of the base. If we assume that the forms under 'Faithful Reduplication' are prosodified, the forms in (12) and (13) are distinct from that in (14) in an interesting way. In (12) and (13) the first syllable of the faithful reduplicated form would end in a moraic consonant while that in (14) would not. Following Goodman (1995) and Takano (1996), syllable-final sonorant consonants can be considered moraic in Ponapean since these are the only type of syllable-final consonants that can surface in Ponapean. (Word-final consonants, though, are considered extraprosodic; see Goodman 1997.) For the forms under 'Faithful Reduplication' in (13), I assume that the coda consonant of the first syllable in these forms would also be moraic since they would be part of a geminate, even though geminate obstruents do not actually surface in Ponapean. The moraic nature of geminates has been specifically argued for in such works as Sherer (1994) and Davis (1994, 1999, 2003). On the other hand, the forms under 'Faithful Reduplication' in (14) would not have a moraic consonant at the end of the first syllable since that syllable ends in a consonant that is neither a sonorant nor part of a geminate.[7]

The proposal that I put forward in this paper is that the forms under 'Faithful Reduplication' in (12)-(14), fully prosodified, can be considered sympathetic candidates, given Sympathy Theory, as developed in McCarthy (1997, 1999), where it is maintained that there can be candidate-to-candidate faithfulness within a single tableau. That is, the form that surfaces (i.e., the winning candidate) aims to maintain some property of a selected failed candidate (referred to as the sympathetic candidate). The sympathetic candidate is fully prosodified since it is a possible output candidate. By positing that the forms under 'Faithful Reduplication' in (12)-(14) constitute sympathetic candidates, these can have an influence on the nature of the actual output. The sympathetic candidate is determined by a selector constraint. The specific selector constraint that picks out the sympathetic candidate for Ponapean CVC reduplication would be Ident-BR which requires feature identity between the phonemes of the base and the corresponding phonemes of the reduplicant. (See McCarthy 1997, 1999 and Itô and Mester 1997 for more details regarding the nature of the selector constraint and how it chooses the sympathetic candidate.) Given this, we can now state the generalization on nasal substitution in (15).

7 The restriction of moraic consonants to those of high sonority or to obstruents that are part of a geminate is not unusual and can be found in languages like Japanese, Hausa, and Italian.

(15) Generalization of Nasal Substitution

Nasal substitution occurs in order to preserve the consonantal moraic structure of the sympathetic candidate.[8]

This generalization captures why nasal substitution occurs in (12) and (13) but fails to occur in (14). As mentioned above, the first syllable of the 'Faithful Reduplication' (i.e. the sympathetic candidate) in (12) and (13) would end in a moraic consonant; the first syllable of the actual reduplicated form in (12) and (13) ends in a moraic nasal consonant through nasal substitution, thus preserving the consonantal mora structure of the sympathetic candidate. On the other hand, the first syllable of the 'Faithful Reduplication' in (14) does not end in a moraic consonant and neither does the actual surface reduplicant. In the remainder of this paper I will show that by reference to a sympathetic candidate a correspondence theory analysis can account for the Ponapean CVC reduplication data without any ranking paradox.

In presenting the sympathetic analysis of Ponapean CVC reduplication, I first consider the reduplication of /sɛl/ 'tied' in (1c) repeated in (12a). As proposed, the sympathetic candidate in Ponapean CVC reduplication is a fully prosodified form with a CVC reduplicant that is featurally faithful to the base. The selector constraint that chooses the sympathetic candidate is Ident-BR. This constraint requires that the features of corresponding segments in the base and reduplicant be identical.

In addition to the selector constraint, we need to posit a sympathy constraint that relates the actual output to the sympathetic candidate. Given the generalization on nasal substitution in (15), the sympathy constraint is one that requires preservation of consonantal moraic structure between the sympathetic candidate and the output candidates. This constraint is stated below in (16) and I will refer to it as the flowered constraint.

(16) Max-μ_c✿-O -- Every consonantal mora in the sympathetic candidate has a correspondent in the output candidate.

The ranking of this constraint is of importance. First, though, I still assume the constraints and their ranking for Ponapean that was established by Takano (1996). This was discussed in Section 2 and is reflected by the tableau in (6). For convenience I repeat this ranking in (17a) where only *µ[-son] is an undominated constraint. There are two other undominated constraints that I refer to in my analysis. These are given in (17b) and (17c)

(17) a. Constraint ranking based on Takano (1996)
*µ[-son] >> Ident-BR(son) >> RED=CVC >> Ident-BR(nasal)
b. Coda Condition (Coda-Con) -- A coda consonant must share the place of articulation features with a following onset consonant.
c. Syllable Contact (SyllCon) -- Avoid rising sonority over a syllable boundary.

The constraint in (17b) has the effect of requiring a coda consonant to share a place of articulation with the following onset consonant. The constraint Syllable Contact (SyllCon) in (17c) was proposed by Bat El (1996) and is further developed by Davis and Shin (1999), and Baertsch (2002) all of whom account for Vennemann's (1988) Syllable Contact Law from the perspective of Optimality Theory. SyllCon disallows a sequence of rising sonority from

[8] Because of data like /par/ 'cut' which reduplicates as [pa.rV.par], and not as [pam.par], the stated generalization on nasal substitution must be restricted so that nasal substitution only applies if the coda consonant has the same place articulator as the following onset. This reflects an undominated Ident-BR(place) constraint. (See Davis 2000 for discussion.)

occurring over a syllable boundary. This constraint is undominated in Ponapean. When a consonant cluster occurs over a syllable boundary there is either falling sonority from the first consonant to the second (as in [sɛn.sɛl] 'tied') or the same sonority in the case of geminates (as in [nen.ne.nek] 'do adultery'); there is never rising sonority.

Let us now consider tableaux showing data like that in (12) and (13) involving nasal substitution. The tableau in (18) shows the reduplication of /sɛl/ as [sɛnsɛl] from (12a). The candidates are shown with their moraic structure. The designated faithfulness constraint (Ident-BR) is set off to the right of the doubled lines. The sympathetic candidate is shown with the flower icon in (18a). Regarding the flowered constraint, the tableaux below will show it is ranked above Ident-BR(sonorant) but below the undominated constraints.[9]

(18) /sɛl/ --- [sɛnsɛl] 'tied' (12a)

/RED + sɛl/	*μ[-son] CodaCon SyllCon	Max- μ_c ✿-O	Ident- BR(son)	RED= CVC	Ident- BR(nasal)	Ident- BR
μ μ μ ✿ a. s ɛ l. s ɛ l	*! (CodaCon)					√
μ μ μ ☞ b. s ɛ n. s ɛ l					*	*
μ μ μ c. s ɛ.l V.s ɛ l		*!		*		*

The tableau in (18) does not show the critical ranking of the flowered constraint, Max-μ_c✿-O. It does correctly select [sɛnsɛl] in (18b) as the winner since it only violates low-ranked Ident-BR(nasal). The completely faithful candidate in (18a) is eliminated because it violates undominated CodaCon. This assumes that in Ponapean there cannot be a place-linked cluster between a liquid and a following (non-identical) consonant. This assumption is reasonable under the view that the relevant feature distinguishing the liquids, such as [±lateral], is located under the Place Node (cf. Blevins 1994). Thus, while /l/ and /s/ are both coronal, they cannot share the same Place Node since [s] cannot have the feature [lateral], given that there are no lateral obstruents in Ponapean. Candidate (18c) violates the flowered constraint since the moraic consonant of the sympathetic candidate in (18a) has no moraic correspondent in (18c). However, since (18c) also violates RED=CVC it does not provide crucial evidence for the ranking of the flowered constraint given that RED=CVC was shown by Takano (1996), as seen in (4), to be higher-ranked than Ident-BR(nasal), which (18b) violates. Candidate (18b) which respects the flowered constraint thus emerges as the winner since it violates only low-ranked Ident-BR(nasal).[10]

9 There is a technical issue as to whether the candidate in (18c) violates the selector constraint, given that the features of the epenthetic vowel do not surface in the base. That is, do inserted or deleted features between two corresponding strings constitute a violation of Ident-Feature constraints? Or, are Ident-Feature constraints only violated when there is a change of a feature between two strings (as opposed to an insertion or deletion)? Here I will assume that the insertion or deletion of a feature results in an Ident-Feature violation. Consequently, (18c) does not satisfy the selector constraint, Ident-BR.

10 One candidate that is not considered in (18) is [sɛllɛl] where the /s/ of the base totally assimilates to the final consonant of the reduplicant. In the Ponapean CVC reduplication data, the base consonants never undergo alternations; only reduplicant consonants do. I assume that this reflects the universal ranking of Ident-Root over Ident-Affix as discussed in McCarthy and Prince (1995). Consequently, I will not consider candidates that show an alternation in the base.

Crucial evidence for the ranking of the flowered constraint is provided by the evaluation of candidates for the reduplication of /tit/ ‘build a wall’. Recall that this form was problematic for Takano's analysis as seen in the tableau in (8). As shown there, Takano's analysis predicts that /tit/ should reduplicate as [titVtit] rather than the actual [tintit]. It is by eliminating [titVtit] that the flowered constraint Max-μ_c✿-O plays a crucial role. This is shown in the tableau in (19).

(19) /tit/ --- [tin-tit] ‘build a wall’ (13a)

/RED + tit/	*μ[-son] CodaCon SyllCon	Max-μ_c ✿-O	Ident- BR(son)	RED= CVC	Ident- BR(nasal)	Ident- BR
μ μ μ | | | ✿ a. t i t. t i t	*! (*μ[-son])					√
μ μ μ | | | ☞ b. t i n. t i t			*		*	*
μ μ μ | | | c. t i. t V. t i t		*!		*		*

In the tableau in (19), the sympathetic candidate (19a) is eliminated because it violates undominated *μ[-son]. The choice then is between (19b) and (19c). If the flowered constraint were not there, (19c) would be the expected winner. This is because (19b) violates Ident-BR(son) which is higher-ranked than the constraint violated by (19c), RED=CVC. Since (19b) is the actual winner, then the constraint Max-μ_c✿-O which (19c) violates must be higher-ranked than Ident-BR(son). (19c) violates Max-μ_c✿-O because the moraic consonant of the sympathetic candidate in (19a) has no consonantal moraic correspondent in (19c). On the other hand, (19b) respects it since it preserves the moraicity of the geminate consonant of the sympathetic candidate; it preserves it through nasal substitution. Since (19b) is the winning candidate, the flowered constraint must be ranked higher than Ident-BR(son).

The use of the flowered constraint and the sympathetic candidate captures quite well why nasal substitution occurs for data like in (13) where one would expect a geminate obstruent if reduplication were faithful, as in the hypothetical [tittit] for the reduplication of /tit/. Nasal substitution occurs so as to preserve the moraic nature of the consonant in the expected faithful reduplicative candidate without violating the undominated constraint against moraic obstruents. The actual output is dependent on the prosodified sympathetic candidate and the flowered constraint (Max-μ_c✿-O) insightfully expresses this dependency.

That reference to the consonantal moraic nature of the sympathetic candidate is of importance to the understanding of Ponapean CVC reduplication can be seen in data like (14) where the prosodified sympathetic candidate as reflected in (28a) does not have a moraic consonant. For example, in (28a) the coda [t] of the reduplicant is neither a sonorant nor the first part of a geminate. Consequently, nasal substitution does not occur in the reduplication of forms like in (14) because the prosodified sympathetic candidate would not contain a moraic consonant. This is shown in the tableau in (20).

(20) /net/ --- [netVnet] ‘smell’ (14a)

/RED + net/	*μ[-son] CodaCon SyllCon	Max-μ_c ✿-O	Ident-BR(son)	RED= CVC	Ident-BR(nasal)	Ident-BR
μ μ ✿ a. ne t. ne t	*! (SyllCon)					√
μ μ μ b. ne n. n e t			*!		*	*
μ μ μ ☞ c. n e.tV.net				*		*

Given that the sympathetic candidate in (20a) contains no moraic consonant, the designated faithfulness constraint, Max-μ_c✿-O, plays no role. The other constraints, whose rankings have already been established, select [netVnet] in (20c) as most harmonic. (20b) is eliminated because it violates Ident-BR(sonorant) which outranks RED=CVC. (20a) shows the role of SyllCon. This candidate does not violate *μ[-son] since the obstruent is not moraic. It also does not violate CodaCon since the cluster of [t.n] could be reasonably considered a place-linked cluster. The undominated constraint that (20a) violates is SyllCon since there is rising sonority between [t] and [n] over the syllable boundary. (20c) is the winner since it only violates lower ranked RED=CVC.

The analysis that I have presented is able to account for the difference between the reduplication of /tit/ as [tin.tit] and /net/ as [ne.tV.net]. Recall from Section 2 that Takano was unable to account for both these forms. As seen in the tableaux in (6) and (8) Takano's analysis predicts that /tit/ should reduplicate as [ti.tV.tit]. Thus, my analysis is superior empirically in being able to cover both these types of data. Moreover, I would maintain that the analysis with the sympathetic candidate and flowered constraint accurately captures the generalization regarding nasal substitution in (15), that nasal substitution occurs to preserve the mora structure of the candidate that has a CVC reduplicant that is featurally faithful to the base. Takano's analysis falters in that it does not consider the moraic structure of the reduplicant. Furthermore, my analysis extends readily to the complete range of the CVC reduplication data such as that in (1a) and (1g). It is these forms that I now consider.

Let us consider data like that in (1a) presented in (21).

(21)	Underlying	Faithful	Surface	Consonant	
Base	*Reduplication*	*Redup.*	*Redup.*	*Corresp.*	*Gloss*
a. linenek	/RED + linenek/	lin.linenek	[lil.linenek]	n.l → l.l	‘oversexed’
b. lirooro	/RED + lirooro/	lir.lirooro	[lil.lirooro]	r.l → l.l	‘protective’
c. nur	/RED + nur/	nur.nur	[nun.nur]	r.n → n.n	‘contract’

The data in (21) reflect the case where there is total assimilation between the actual surface output and the sympathetic (segmentally faithful) reduplicative form. This occurs when the two adjacent consonants in the sympathetic candidate are both (coronal) sonorants. Total assimilation in these forms allows for the preservation of the consonantal mora structure of the sympathetic candidate without violating any of the undominated constraints such as CodaCon and SyllContact. The sympathetic candidates for the data in (21) (reflected under the column 'Faithful Reduplication') would have a moraic coda at the end of the first syllable since the consonant at the end of that syllable is a sonorant. Total assimilation occurs so as to respect Max-μ_c✿-O; the sympathetic candidate would be eliminated from consideration since it would violate either inviolable CodaCon or SyllCon. Thus total assimilation, like nasal substitution is motivated by the preservation of mora structure of the sympathetic candidate. The example of /linenek/ in (21) is shown in the tableau in (22).

(22) /linenek/ -- [lil-linenek] 'oversexed' (21a)

/RED + linenek/	*μ[-son] CodaCon SyllCon	Max-μ_c ✿-O	Ident- BR(son)	RED= CVC	Ident- BR (nasal)	Ident- BR
μ μ μ μ μ ✿ a. l i n.l i. ne.nek	*! (SyllCon)					√
μ μ μ μ μ ☞ b. l i l.l i. ne.ne k					*	*
μ μ μ μ μ c. l i.nV. l i. ne.nek		*!		*		*

The sympathetic candidate in (22a) is eliminated because it fatally violates the undominated syllable contact constraint given that there is a rise of sonority between [n] and [l] over the syllable boundary. The candidate need not be interpreted as also violating CodaCon since hypothetically the nasal sound could be made with the lateral tongue position. The candidate in (22c) violates the flowered constraint Max-μ_c✿-O because the consonantal mora of the sympathetic candidate has no moraic correspondent in (22c). (22b), the winning candidate, obeys this constraint.

Now let us consider reduplication data like that in (1g) shown below in (23).

(23)	Underlying	Faithful	Surface	Consonant	
Base	*Reduplication*	*Redup.*	*Redup.*	*Corresp.*	*Gloss*
a. tune	/RED + tune/	tun.tune	[tun.tune]	n.t □ n.t	'tie together'
b. sinom	/RED + sinom/	sin.sinom	[sin.sinom]	n.s □ n.s	'sink in'
c. kaŋ	/RED + kaŋ/	kaŋ.kaŋ	[kaŋ.kaŋ]	ŋ.k □ ŋ.k	'eat'
d. nenek	/RED + nenek/	nen.nenek	[nen.nenek]	n.n □ n.n	'do adultery'
e. rer	/RED + rer/	rer.rer	[rer.rer]	r.r □ r.r	'tremble'
f. mem	/RED + mem/	mem.mem	[mem.mem]	m.m □ m.m	'sweet'
g. lal	/RED + lal/	lal.lal	[lal.lal]	l.l □ l.l	'make sound'

The data in (23) are interesting because they represent a case where the sympathetic candidate is the actual surfacing candidate. This situation arises when the two adjacent consonants in the 'Faithful Reduplication' are either identical sonorant consonants (23d-g) or a nasal homorganic with a following obstruent (23a-c). The example of /tune/ in (23a) is shown in (24) where the only two realistic candidates are the sympathetic candidate in (23a) and the candidate with an epenthetic vowel.

(24) /tune/ --- [tun-tune] 'tie together' (23a)

/RED + tune/	*μ[-son] CodaCon SyllCon	Max-μ_c ✿-O	Ident-BR(son)	RED= CVC	Ident-BR(nasal)	Ident-BR
✿ ☞ a. tu n. tu ne (μ μ μ μ)						√
b. tu.nV.tu.ne (μ μ μ μ)		*!		*		*

The sympathetic candidate (24a) is the winner because it violates none of the relevant constraints shown in the tableau. The alternative candidate in (24b) violates Max-μ_c✿-O because it does not respect the consonant mora structure of the sympathetic candidate; it also violates RED=CVC since the reduplicant surfaces with an epenthetic vowel. The tableau in (24) is interesting because it shows that the sympathetic candidate can be the winning candidate.

In summary, the sympathetic analysis of Ponapean CVC reduplication accounts for the entire range of CVC reduplication data.[11] The analysis is superior to that of Takano (1996) in that it does not entail any ranking paradox. Moreover, I would maintain that the analysis with the sympathetic candidate and flowered constraint accurately captures the generalization regarding nasal substitution in (15), that nasal substitution occurs in reduplication to preserve the mora structure of the sympathetic candidate. To see this, one need only compare the nasal substitution data in (1b) and (1c), repeated below in (25) to the nonreduplicative affixation data involving suffixation in (26).

(25) Reduplication with nasal substitution (between adjacent coronals)

	Base	Underlying *Reduplication*	Faithful *Redup.*	Surface *Redup.*	Consonant *Correspondence*	*Gloss*
a.	tit	/RED + tit/	tit.tit	[tin.tit]	Base [t] - Red [n]	'build'
b.	sɛl	/RED + sɛl/	sɛl.sɛl	[sɛn.sɛl]	Base [l] - Red [n]	'tied'

(26) Affixation with vowel insertion (between two adjacent coronals)

	Underlying Representation	*Phonetic Representation*	*Non-occurring Alternative*	*Gloss*
a.	/pɔt + ti/	[pɔtVti]	[pɔnti]	'plant downwards'
b.	/sɛl + saŋ/	[sɛlVsaŋ]	[sɛnsaŋ]	'tied from'

The comparison is instructive because the underlying consonantal sequence in (26a) and (26b) (/t + t/ and /l + s/, respectively) exactly parallels the consonantal sequence under the 'Faithful Reduplication' column in (25). However, in (26), unlike (25), there is no nasal substitution,

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11 The only type of CVC reduplication data not yet mentioned in this paper is a form like /m^wop^w/ 'out of breath' which reduplicates as [$m^wom^w.m^wop^w$]. This is surprising in that /net/ 'tied' reduplicates as [netVnet] and not as [nen.net]. For the analysis of this form, I follow Takano (1996) and Spaelti (1997) who posit that the output [$m^wom^w.m^wop^w$] reflects a high-ranking *Place/Labial constraint. Davis (2000) shows that by incorporating high-ranked *Place/Labial (and *Place/Dorsal), the constraint ranking posited for reduplication also unproblematically handles the somewhat different pattern of nasal substitution found in suffixation.

rather there is just vowel insertion. This is, in fact, what is predicted by the constraint ranking already established as shown by the tableau in (27) which evaluates candidates from the input (i.e., underlying) form of (26a). We add here a low-ranked constraint DEP which militates against inserted segments.

(27) /pɔt + ti/ --- [pɔtVti] ‘plant downwards’ (28a)

/pɔt + ti/	*μ[-son] CodaCon SyllCon	Max-μ_c ✿-O	Ident- BR(son)	RED= CVC	DEP	Ident-BR
μ μ μ a. p ɔ t ti	*! (*μ[-son])					
μ μ μ b. pɔ n t i			*!			
μ μ μ ☞ c. pɔ tV t i					*	

Since (27) does not involve reduplication, neither the selector constraint (Ident-BR) nor the flowered constraint plays a role. The constraint ranking favors candidate (27c) with an epenthetic vowel.[12] On the other hand, as argued, nasal substitution occurs in (25) so as to preserve the moraic structure of the faithfully reduplicated candidate. This is captured by the sympathy analysis. Previous analyses failed to recognize the role of mora structure in nasal substitution.

In conclusion, the analysis offered for Ponapean accounts for all the CVC reduplication data without having a ranking paradox. By incorporating the sympathetic candidate it accurately captures that the reduplicative output makes reference to a selected prosodified candidate. The ranking established for reduplication applies to the cases of suffixation in (26). There is no need for separate accounts for suffixation and reduplication or for a posible level ordered analysis as in Lombardi (1996). Crucial to the analysis presented here is the view that geminates are moraic as argued by Davis (1994, 1999). While McCarthy’s proposal for sympathy, where there is candidate to candidate faithfulness in optimality theory remains controversial, it seems to express precisely the generalization that nasal substitution occurs in Ponapean reduplication in order to preserve the mora structure of a faithfully reduplicated output.

12 It should be mentioned that low-ranked DEP would be irrelevant if it were included in previous tableaux such as (19) where nasal substitution occurs in the reduplicated form. In that tableau, the candidate that violates DEP, (19c), would be eliminated because of its violation of the higher-ranked flowered constraint. Also, in affixation involving identical noncoronals, nasal substitution occurs rather than vowel insertion. An example mentioned by Goodman (1995: 195) is /teelap + peseŋ/ which is realized as [teelam peseŋ] 'to get wider'. An analysis of such forms is presented in Davis (2000), but also see Spaelti (1998) regarding the different patterning of coronals and noncoronals as well as a different conceptualization of Ponapean nasal substitution.

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