음성·음운·형태론 연구
Vol. 6 No. 2 (2000)
pp. 249∼305

The Flowering of Optimality Theory: Ponapean Nasal Substitution and the Problem of Intermediate Forms

Stuart Davis
(Indiana University)

한 국 음 운 론 학 회
The Phonology-Morphology Circle of Korea

The Flowering of Optimality Theory: Ponapean Nasal Substitution and the Problem of Intermediate Forms*

Stuart Davis
(Indiana University)

Davis, Stuart. 2000. The Flowering of Optimality Theory: Ponapean Nasal Substitution and the Problem of Intermediate Forms. *Studies in Phonetics, Phonology and Morphology* 6.2. 249-305. One of the challenges that has confronted Optimality Theory resides in Phenomena that seem to require reference to an intermediate form that is neither the underlying input nor some actual occurring output. Typically, in rule-based phonology, such phenomeana reflect opaque rule interaction involving counterfeeding or counterbleeding relationships. In order to account for such pheneomena in Optimality Theory, McCarthy(1997) Proposes that an Optimality-theoretic grammar can permit candidate-to-candidate faithfulness. In this paper I show that the incorporation of candidate-to-candidate faithfulness allows for an insightful analysis of the different patterns of nasal substitution found in reduplication and suffixation in Ponapean. The analysis offered here avoids the shortcomings of previous analyses, accurately captures the generalization as to when nasal substitution occurs, and offers striking evidence for the nature of opacity in Optimality Theory independent of rule-based notions like counterfeeding and counterbleeding. (Indiana University)

Keyword: Intermediate form, opacity, nasal substitution, Sympathetic faithfulaess.

1. Introduction

One of the challenges that has confronted Optimality Theory, especially Correspondence Theory, resides in phenomena that seem to require reference to an intermediate form that is neither the underlying input nor some actual occurring output.[1] In serial rule-based approaches, such phenomena typically involve two (or more) rules in a counterfeeding or counterbleeding relationship. Consider the example of the Tiberian Hebrew word [dešе] 'tender grass' reflecting underlying /deš?/ discussed by McCarthy 1997. In a rule-based approach, the derivation of [deše] from /deš?/ would consist of two rules like those stated in (1a) and (1b) with the derivation shown in (1c). Crucially, the two rules must apply in the order shown in (1c),

*The development of this paper owes much to the members of the phonology community at Indiana University and at University of California, Santa Cruz. Aspects of this paper were presented at colloquium talks given at the University of Utrecht and the University of Arizona in March 1997. Specifically, I would like to thank Diana Archangeli, Karen Baertsch, Jessica Barlow, Kenneth de Jong, Daniel Dinnsen, Nine Elenbaas, Beverly Goodman, Michael Hammond, René Kager, Daniel Karvonen, Motoko Katayama, John McCarthy, Jaye Padgett, Alan Prince, Adam Sherman, Seung-Hoon Shin, Philip Spaelti, Natsuko Tsujimura, Laura Wilbur, and Bushra Zawaydeh for contributing to this paper. All errors are my own responsibility.

1 Relevant discussion regarding this challenge can be found in Halle & Idsardi 1995, McCarthy 1995, Davis 1995, Archangeli & Suzuki 1996 and Idsardi 1996.

Epenthesis before ʔ-Deletion. As shown in (1d), if the two rules were to apply in the reverse order, ʔ-Deletion would bleed Epenthesis and a wrong output would result. Since the ordering of ʔ-Deletion before Epenthesis as shown in (1d) reflects a bleeding relationship, the correct ordering of Epenthesis before ʔ-Deletion reflects a counterbleeding relationship.

(1) a. Epenthesis -- Insert a vowel between the two consonant of a word-final cluster.
b. ʔ-Deletion --- A glottal stop deletes when not prevocalic.

c.		d.	
UR:	/dešʔ/	UR:	/dešʔ/
Epenthesis:	dešeʔ	ʔ-Deletion:	deš
ʔ-Deletion:	deše	Epenthesis:	------
PR:	[deše]	PR:	*[deš]

The epenthesis rule is considered opaque in the sense of Kiparsky 1973 since if we examine the surface output in (1c), [deše], it appears as if Epenthesis has applied in an environment where it should not have. That is, it seems to have applied after a word-final consonant and not between two consonants of a word-final cluster. It is the later rule of ʔ-Deletion that obliterates the original environment for the epenthesis rule. The output [deše] is opaque since the environment for the epenthetic vowel is no longer found on the surface. What is crucial in the approach in (1c) is that the opaque output, [deše], is dependent on the intermediate form <u>dešeʔ</u>, which is neither the underlying representation nor a possible surface output. On the other hand, the surface form in (1d) is not dependent on the intermediate form, but is simply derivable from the underlying representation by the application of ʔ-Deletion. Thus, the output *[deš] is transparent. The fact that the opaque output [deše] actually surfaces and that such counterbleeding relationships are quite common has been used to argue for the necessity of intermediate stages (cf. Bromberger & Halle 1989).

As discussed in detail in McCarthy 1997, the account of the counterbleeding type of opacity shown in (1c) has been problematic for optimality-theoretic analyses. This can be seen by considering an analysis of the same form, [deše], from the perspective of Correspondence Theory (McCarthy and Prince 1995, Benua 1995). Following McCarthy 1997, the relevant constraints for such an analysis are given in (2).[2]

[2] McCarthy uses the term Coda-Condition for the constraint in (2a) that prohibits glottals from coda position. I will refer to the constraint as *Coda-Glottal so as not to confuse it with the use of Coda-Condition elsewhere in this paper where it is used as a constraint that requires a coda consonant to share place of articulation features with a following onset consonant.

(2) a. *Coda-Glottal -- Glottals are prohibited from coda position.
b. Max_{IO} -- Every segment in the input has a correspondent in the output.
c. Dep_{IO} -- Every segment of the output has a correspondent in the input.

The constraint in (2a), *Coda-Glottal, disallows [ʔ] from surfacing in coda position. The two other constraints are familiar from work in Correspondence Theory as discussed by Benua 1995 and McCarthy & Prince 1995. The constraint in (2b) prohibits phonological deletion while (2c) prohibits epenthesis. McCarthy provides ranking arguments from Tiberian Hebrew to show that Dep_{IO} is the lowest ranking of these constraints and that *Coda-Glottal outranks Max_{IO}. The tableau in (3) evaluates the candidate set for the input /dešʔ/. I will particularly focus on the transparent candidate [deš] in (3c) and the opaque candidate [deše] in (3d). (The symbol ☹ before a candidate in the tableaux indicates an unintended winner.)

(3) /dešʔ/ -- [deše] 'tender grass'

/dešʔ/	*Coda-Glottal	Max_{IO}	Dep_{IO}
a. dešʔ	*!		
b. dešeʔ	*!		*
☹ c. deš (transparent candidate)		*	
d. deše (opaque candidate)		*	*!

As seen in (3), the constraint ranking wrongly selects the transparent candidate [deš] in (3c) as the winner. The actual output, however, is the opaque candidate [deše] in (3d). Both (3c) and (3d) violate Max_{IO} because of the deletion of underlying glottal stop; but (3d), in addition, violates Dep_{IO} because of the presence of the epenthetic vowel. A reranking of Dep_{IO} above Max_{IO} would clearly not alter the outcome.

The tableau in (3) is indicative of a difficulty for Optimality Theory that a surfacing opaque output presents (especially an opaque output that would be the result of a counterbleeding relationship in a serial rule-based approach). Following the intent of McCarthy 1997 the difficulty can be expressed as follows: The transparent candidate violates fewer constraints than the opaque candidate, but more crucially, the transparent candidate has a subset of the opaque candidate's violations. This means that the opaque candidate would always be the loser in tableaux like in (3) since it will necessarily have one additional constraint violation.

In response to the problem of opacity for Optimality Theory, McCarthy 1997 makes an intriguing proposal. He proposes that an opaque candidate like (3d) wins because it resembles a failed candidate in a way that the transparent candidate like (3c) does not. That is, there is faithfulness of one candidate to another in a single candidate set. As McCarthy (1997:5) puts it, "Through this candidate-to-candidate faithfulness, the actual output form is in sympathy with a particular failed candidate." This particular failed candidate can be referred to as the sympathetic candidate. McCarthy suggests that the sympathetic candidate cannot be any random failed candidate but one that obeys some designated faithfulness constraint. For the Hebrew example in (3), the sympathetic candidate is (3b), dešeʔ. Recall from the discussion above regarding the counterbleeding relationship in (1c) that dešeʔ was the intermediate form on which the actual output was based. From the perspective of Correspondence Theory, dešeʔ is a possible output candidate and it obeys a specific faithfulness constraint that both (3b) and (3c) violate, namely Align-R_{IO}(Root,σ). This constraint calls for the alignment of the right edge of the root with the right edge of the syllable. For the Hebrew analysis posited by McCarthy it is this constraint that is the designated faithfulness constraint that selects the sympathetic candidate. I show this in the partial tableau in (4) where the sympathetic candidate is indicated by the flower icon and the designated faithfulness constraint is set off to the right of the doubled lines.

(4) /dešʔ/ -- [deše] 'tender grass'

/dešʔ/	*Coda-Glottal	Max_{IO}	Dep_{IO}	$AlignR_{IO}$(Root,σ)
a. dešʔ	*!			√
✿ b. dešeʔ	*!		*	√
c. deš (transparent candidate)		*		*
d. deše (opaque candidate)		*	*!	*

The tableau in (4) is not yet complete.[3] It still does not select the opaque candidate in (4d) as the winning candidate. What is needed is a faithfulness constraint that relates the actual output to the sympathetic candidate. This constraint is termed the sympathetic faithfulness constraint by McCarthy. The sympathetic faithfulness constraint would be obeyed by the opaque candidate (4d) but violated by the transparent candidate (4c). For this constraint to select (4d) as the winner it has to be ranked higher than Dep_{IO} so as to eliminate (4c). A priori, one cannot know what the sympathetic faithfulness constraint will be, but is dependent on the phonological analysis. McCarthy 1997 posits that the sympathetic faithfulness constraint for the Tiberian Hebrew problem is Max✿. This constraint relates the output candidates to the sympathetic candidate. It is ranked above Dep_{IO} and as McCarthy shows it is ranked below *Coda-Glottal. As seen in (5), the tableau with Max✿ selects the opaque candidate [deše] as the winner.

(5) /dešʔ/ -- [deše] 'tender grass'

/dešʔ/	*Coda-Glottal	Max_{IO}	Max✿	Dep_{IO}	$AlignR_{IO}$ (Root,σ)
a. dešʔ	*!		*		√
✿ b. dešeʔ	*!			*	√
c. deš (transparent candidate)		*	**!		*
☞ d. deše (opaque candidate)		*	*	*	*

The tableau in (5) correctly evaluates the opaque candidate as the winner. Candidates (5a) and (5b) are eliminated because they each violate undominated *Coda-Glottal. The choice then is between (5c) and (5d).

[3] One question that arises from (4) is that if there is more than one candidate that meets the designated faithfulness constraint, how can it be determined which is the sympathetic candidate. Ito & Mester 1997 suggest that it is the one that best satisfies the rest of the constraint system. In the tableau in (4), both (4a) and (4b) satisfy the designated faithfulness constraint. This is indicated by the checkmark under the last column of the tableau. The candidate in (4a) though ends in a sequence of consonants. It thus violates the constraint *Complex. This has the effect of ruling out (4a) as the possible sympathetic candidate since (4b) does not violate this constraint. (4b) then better satisfies the rest of the constraint system.

Both (5c) and (5d) violate Max_{IO} because of the deletion of the underlying /ʔ/. The key constraint then is Max✿ which requires faithfulness to the sympathetic candidate, (5b). The opaque candidate (5d) has only one violation of Max✿ due to the lack of the final [ʔ]. On the other hand, the transparent candidate in (5c) violates this constraint twice because it lacks the last two phonemes of the sympathetic candidate. The second violation is the fatal one. Even though (5c) respects Dep_{IO} while (5d) does not, (5c) is still eliminated because of its fatal violation of the sympathetic faithfulness constraint, Max✿.

McCarthy's 1997 proposal to account for opacity is intriguing. It is able to deal with what is equivalent to a counterbleeding type relation in serial rule ordering without having an intermediate stage. Under his proposal, opacity is not defined in terms of rule relationships but is simply the influence of a designated failed candidate upon the output through sympathy. This sympathetic candidate is not any arbitrary candidate in the candidate set but one that maintains a critical faithfulness property of the input. Given this optimality-theoretic notion of opacity, one might find other motivation for sympathetic candidates beyond those that can be viewed as "translations" of the counterbleeding type relation illustrated by the Tiberian Hebrew example. In fact, one would expect to find such cases because this optimality-theoretic notion of opacity should be independent of rule-based notions like counterbleeding. If such cases can be motivated it would provide evidence for this new notion of opacity.

In the remainder of this paper we will consider the problem of nasal substitution in the Micronesian language Ponapean as well as the other alternations that occur in Ponapean CVC durative reduplication and suffixation. These alternations have presented a challenge for previous work in both lexical phonology and Correspondence Theory. For example, work within lexical phonology such as Blevins & Garrett 1992 and Lombardi 1996 have posited a lexical rule of nasal substitution for reduplication and a different post-lexical rule of nasal substitution for suffixation. However, since suffixation is lexical, an analysis that accounts for both types of nasal substitution in a unified way would be preferred. Analyses within Correspondence Theory such as Takano 1996 and Spaelti 1997 are able to account for both reduplication and suffixation in a unified manner, but their specific analyses of reduplication result in a ranking paradox. For example, Takano 1996 is unable to account for the reduplication of words like /sas/ 'stagger' and /tit/ 'build a wall' as [sansas] and [tintit], respectively. She notes that her analysis would predict the output [sasVsas] with an inserted vowel for the input /Red + sas/. Given McCarthy's 1997 proposal concerning opacity, that opacity involves the influence of a designated failed (sympathetic) candidate on the output, I will show that an analysis of Ponapean CVC reduplication that incorporates a sympathetic candidate not only accounts for the full range of alternations that appear in the CVC reduplication data but more accurately captures the generalization that lies behind these alternations. The analysis I offer also accounts for the suffixation data as well. The only difference between suffixation and reduplication is that there is no sympathetic candidate with suffixation.

The organization of the remainder of this paper is as follows. In Section 2 I will present and describe the full range of the CVC prefixal reduplication data in Ponapean and the various phonological phenomena that accompany it. Such phenomena include nasal substitution, total assimilation, and epenthesis. In Section 3 I present Takano's 1996 analysis couched within Correspondence Theory. While Takano's analysis is insightful and influential on my own analysis, it specifically fails to capture the reduplication of words like /sas/ 'stagger' and /tit/ 'build a wall' as [sansas] and [tintit], respectively. I will also briefly discuss the analysis of Spaelti 1997. In Section 4 I will offer a new analysis of Ponapean CVC reduplication that crucially involves opacity in which there is faithfulness to a sympathetic candidate. In Section 5 I show how my analysis accounts for the pattern of nasal substitution found with suffixation. Section 6 concludes with a summary of the paper.

2. Data.

Durative reduplication in Ponapean is marked by a prefixal reduplicant. The precise nature of the reduplicant varies depending on the nature of the base. The reduplicant sequence is sometimes realized as a light syllable and sometimes as a heavy syllable. If it is realized as a heavy syllable, it may surface with a long vowel or as CVC. Factors determining the nature of the reduplicant include whether the initial syllable of the base is light or heavy and whether the base begins with a consonant or vowel. In fact, Rehg & Sohl 1981 describes eleven different patterns for Ponapean durative reduplication.[4] A CVC reduplicant is found when the verbal base consists

---

[4] Much of the discussion in the phonological literature on Ponapean reduplication before the advent of Optimality Theory concerns the expression of a single reduplicative template for the durative aspect. Specific analyses can be found in Levin 1985, Clements 1985, and McCarthy & Prince 1986. Since the focus of the present paper is on the consonant alternations that occur when a CVC reduplicant is prefixed to a consonant-initial base, I only focus on cases where the reduplicant is CVC. Cases where the reduplicant is CV include monosyllabic words of the shape CVV(C). Typically, words where the initial syllable of the base is bimoraic take a monomoraic CV reduplicant (e.g., /pei/ -- [pe-pei] 'fight'). Verbs with a bimoraic reduplicant have an initial base syllable that is light.

of a single CVC syllable or when it consists of an initial CV syllable followed by one or more syllables (and where the second syllable begins with a true consonant). My discussion focuses only on CVC reduplication since that is where the phonological phenomena of theoretical interest occur such as total assimilation, vowel epenthesis and the interesting pattern of nasal substitution.[5]

When a CVC reduplicant is prefixed to a consonant-initial base, various phenomena can occur in the contact situation between the reduplicant-final consonant and the base-initial consonant. Depending on the nature of these two consonants, there may be assimilation, nasal substitution, vowel epenthesis (between the two consonants), or no change at all. First, consider the Ponapean CVC reduplication data in (6) where, for descriptive purposes, the column marked 'Faithful Reduplication' reflects a phonemically faithful CVC reduplicant and not the underlying /Red + Base/ posited in Correspondence Theory.[6]

(6) Reduplication with total assimilation

	Base	Faithful Reduplication	Surface Reduplication	Consonant Alternation	Gloss
a.	lirooro	lir-lirooro	[lil.lirooro]	r.l ---> l.l	protective
b.	nur	nur-nur	[nun.nur]	r.n ---> n.n	contract
c.	linenek	lin-linenek	[lil.linenek]	n.l ---> l.l	oversexed

The examples in (6) illustrate the situation where the final consonant of the CVC reduplicant totally assimilates to the following base-initial consonant creating a geminate. Total assimilation mainly occurs when the two consonants in contact are both sonorants made at the same place of

McCarthy & Prince 1986 refer to this as quantitative complementarity. Data with a light CV reduplicant, though, are not considered in this paper because they do not show the alternations that occur in data like (6)-(11) where the reduplicant is heavier.

5 I use the term nasal substitution to refer to the phenomenon whereby the first member of a consonant sequence surfaces as a nasal, even though there is no nasal in the input sequence. For example, in the Ponapean data to be discussed, sequences such as /r+s/ and /t+t,/ which are realized as [ns] and [nt], respectively, involve nasal substitution since no nasal is underlyingly present; but the realization of /r+n/ as [nn] reflects total assimilation rather than nasal substitution. The type of nasal substitution phenomenon discussed here is different from the nasal substitution phenomenon discussed by Pater 1999 whereby a nasal-plus-voiceless stop sequence is realized on the surface as a nasal consonant (e.g., /N+p/ --> [m]).

6 The Ponapean data cited in this paper come from Rehg & Sohl 1981, Rehg 1984, Blevins & Garrett 1992, and Takano 1996. In the reduplication examples shown in (6)-(11), I specifically indicate the consonant alternation, if any. The period shown between the two consonants indicates 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, based on universal syllable principles, along the lines of Prince & Smolensky 1993, an intervocalic consonant would syllabify as the onset of the syllable with the following vowel.

articulation.[7] In such a situation, the first consonant assimilates to the second.

Now consider the reduplication data in (7) and (8).

(7) Reduplication with nasal substitution (not involving geminates)

	Base	Faithful Reduplication	Surface Reduplication	Consonant Alternation	Gloss
a.	tar	tar-tar	[tan.tar]	r.t ---> n.t	strike (of fish)
b.	sar	sar-sar	[san.sar]	r.s ---> n.s	fade
c.	tilep	til-tilep	[tin.tilep]	l.t ---> n.t	mend a roof
d.	sɛl	sɛl-sɛl	[sɛn.sɛl]	l.s ---> n.s	tied

(8) Reduplication with nasal substitution (involving geminates)

	Base	Faithful Reduplication	Surface Reduplication	Consonant Alternation	Gloss
a.	tit	tit-tit	[tin.tit]	t.t ---> n.t	build a wall
b.	sas	sas-sas	[san.sas]	s.s ---> n.s	stagger
c.	kak	kak-kak	[kaŋ.kak]	k.k ---> ŋ.k	able
d.	pap	pap-pap	[pam.pap]	p.p ---> m.p	swim

The data in (7) and (8) show examples of nasal substitution. There are two situations in which nasal substitution occur. In (7), nasal substitution occurs when a non-nasal sonorant consonant is followed by a homorganic obstruent. In such a case the non-nasal sonorant surfaces as a nasal consonant. In (8), one would expect a sequence of identical obstruents (that is, a geminate) to surface if there were no alternation with CVC reduplication. Contrary to this expectation, a geminate obstruent does not surface. Rather, the first part of the geminate surfaces as a homorganic nasal consonant. What is interesting about the data in (7) and (8) is that nasal substitution occurs even though there is no triggering nasal consonant in the input. Thus nasal substitution does not involve assimilation. In terms of a descriptive generalization concerning the situation in which nasal substitution occurs, if we assume that the first of

7 One other situation in which total assimilation occurs is when the two consonants in contact are a non-coronal obstruent followed by a homorganic nasal, as exemplified in (i). However, if the two consonants involved in the contact are a coronal obstruent and a homorganic nasal then vowel insertion occurs as shown in (ii)

	Base	Underlying Reduplication	Surface Reduplication	Consonant Alternation	Gloss
i.	m^wop^w	$/m^wop^w$-$m^wop^w/$	$[m^wom^w.m^wop^w]$	$p^w.m^w$ ---> $m^w.m^w$	out of breath
ii.	net	/net-net/	[ne.tV.net]	t.n ---> tV.n	smell

The difference between labial sequences and coronal sequences of this type has been discussed by Takano 1996 and Spaelti 1997. I offer an analysis of this based on their work at the end of Section 4.

the two consonants in the contact situation should be a coda and the second one an onset, then nasal substitution occurs when the coda consonant is part of a geminate obstruent, as in (8), or when a (non-nasal) sonorant is followed by a homorganic obstruent, as in (7).

In (6)-(8) the final consonant of the reduplicant undergoes an alternation. There are some cases of CVC reduplication, however, where there is no alternation whatsoever. Examples are given in (9).

(9) Reduplication with no consonant alternation

	Base	Faithful Reduplication	Surface Reduplication	No Consonant Alternation	Gloss
a.	nenek	nen-nenek	[nen.nenek]	n.n ---> n.n	do adultery
b.	rer	rer-rer	[rer.rer]	r.r ---> r.r	tremble
c.	mem	mem-mem	[mem.mem]	m.m --> m.m	sweet
d.	lal	lal-lal	[lal.lal]	l.l ---> l.l	make a sound
e.	tune	tun-tune	[tun.tune]	n.t ---> n.t	tie together
f.	sinom	sin-sinom	[sin.sinom]	n.s ---> n.s	sink in
g.	kaŋ	kaŋ-kaŋ	[kaŋ.kaŋ]	ŋ.k --> ŋ.k	eat

There are two situations illustrated by the data in (9) in which CVC reduplication is transparent with no alternations. The first situation reflected by (9a-d) is when the final consonant of the reduplicant and the following base-initial consonant are identical sonorants. There is no alternation and the output is a geminate sonorant. The second situation as seen by (9e-g) is when the first consonant of the sequence is a nasal and the second a homorganic obstruent.

In briefly summarizing the data in (6)-(9) from the perspective of Correspondence Theory, we would say that for (9) the phonemes or features of the CVC reduplicant are completely faithful to their corresponding base phonemes; whereas in the data (6)-(8) there is not exact featural identity between the final consonant of the reduplicant and the corresponding consonant in the base.

A final pattern of CVC reduplication witnesses an epenthetic vowel surfacing between the final consonant of the reduplicant and the initial consonant of the base. This is shown in (10) and (11) below. In (10), the epenthetic vowel occurs after an obstruent while in (11) it occurs after a sonorant. (The epenthetic vowel is represented as "V" throughout the paper. The discussion of the exact quality of the epenthetic vowel is beyond the scope of the current paper, but pertinent remarks regarding its nature can be found in Rehg & Sohl 1982 and McCarthy & Prince 1986:20.)

(10) Reduplication with an epenthetic vowel after an obstruent

	Base	Faithful Reduplication	Surface Reduplication	Epenthesis Location	Gloss
a.	net	net-net	[netVnet]	t.n ---> tV.n	smell
b.	lituii	lit-lituii	[litVlituii]	t.l ---> tV.l	serve as female servant
c.	roc	roc-roc	[rocVroc]	c.r ---> cV.r	dark
d.	lus	lus-lus	[lusVlus]	s.l ---> sV.l	jump
e.	rese	res-rese	[resVrese]	s.r ---> sV.r	saw
f.	set	set-set	[setVset]	t.s ---> tV.s	(food term)
g.	pet	pet-pet	[petVpet]	t.p ---> tV.p	be squeezed
h.	lop	lop-lop	[lopVlop]	p.l ---> pV.l	be cut

(11) Reduplication with an epenthetic vowel after a sonorant

	Base	Faithful Reduplication	Surface Reduplication	Epenthesis Location	Gloss
a.	$p^{w}il$	$p^{w}il$-$p^{w}il$	[$p^{w}ilVp^{w}il$]	l.p^{w} ---> lV.p^{w}	flow
b.	ker	ker-ker	[kerVker]	r.k ---> rV.k	flow
c.	par	par-par	[parVpar]	r.p ---> rV.p	cut
d.	marep	mar-marep	[marVmarep]	r.m ---> rV.m	blink

The data in (10) show that if the final consonant of the reduplicant is an obstruent and the initial consonant of the base is not identical (whether it be an obstruent or a sonorant), then a vowel is inserted between the two consonants.[8] Crucially, the two consonants have to be different, as the comparison between (10f) and (8b) shows. In (8b), the expected [s.s] sequence surfaces as [n.s] with nasal substitution, whereas in (10f) the expected [t.s] sequence surfaces as [tV.s] with vowel insertion. (11) should be compared with (6) and in (7). All these data are similar in that the first consonant in the sequence is a sonorant. However, the data in (11) are different in that the consonant following the sonorant is not homorganic with the sonorant. When the following consonant is homorganic, either assimilation or nasal substitution occurs, as in (6) and (7), respectively. When the following consonant is not homorganic, an epenthetic vowel surfaces between the two consonants as in (11).

In order to understand some of the alternations seen in (6)-(11), it is necessary to point out certain general restrictions found on coda consonants

[8] One exception where a vowel is not inserted between an obstruent and a non-identical consonant is /$m^{w}op^{w}$-$m^{w}op^{w}$/ 'out of breath' which is realized as [$m^{w}om^{w}.m^{w}op^{w}$] with total assimilation as shown in (i) in footnote 7. Following Takano 1996 and Spaelti 1997 I will account for such a form by a high-ranking *Place/Labial constraint. This will be presented at the end of Section 4.

in Ponapean. There is a clear distinction between word-final and word-internal codas in Ponapean. Essentially, there are no significant restrictions on the nature of a word-final coda consonant. Any consonant can end a word. Moreover, words can end with a homorganic nasal-plus-obstruent cluster. Examples include [emp] 'coconut crab', [mand] 'tame', [leŋk] 'acrophobic', and [kens] 'to ulcerate'. Consequently, the word-final consonant can be considered extraprosodic in Ponapean and not part of a syllable coda. (Henceforth, my use of the word coda with reference to Ponapean will not include word-final consonants.)[9]

With respect to word-internal codas in Ponapean, they are restricted on the surface in two well-known ways. First, a word-internal coda in Ponapean can only be [+sonorant]. This reflects two constraints: a constraint requiring a coda to be moraic (cf. Hammond 1997) and a constraint disallowing moraic obstruents (cf. Goodman 1995, Zec 1995). The result of these two constraints is that a (word-internal) coda must be both moraic and [+sonorant]. Second, a word-internal coda in Ponapean obeys the Coda Condition in its classical sense (Ito 1986), which means that it has to share place features with a following onset consonant. As a result, a coda consonant must either be the first part of a geminate or the first part of a partial geminate (i.e., a nasal that is placed linked to a following consonant). Given that coda consonants must obey the Coda Condition and that a coda consonant must be a sonorant, the only type of consonant that can surface as a geminate in Ponapean is a sonorant consonant. With this as background we turn to the optimality-theoretic analysis of Takano 1996.

3. Ponapean CVC Reduplication.

In this section I will present the relevant aspects of Takano's 1996 analysis of Ponapean CVC reduplication and then briefly discuss Spaelti's 1997 analysis. I focus on Takano's analysis since it is more detailed than Spaelti's and because I will incorporate various aspects of it into my own analysis in Section 4. In detailing these analyses we will see that, though

9 Additional evidence for the extraprosodicity of the final consonant comes from vowel lengthening in monosyllabic nouns. Rehg & Sohl (1981:117-118) note that many monosyllabic nouns of the shape CVC undergo vowel lengthening. However, monosyllabic nouns that end in two consonants (such as /keŋk/ 'type of coconut') do not undergo lengthening. The clearest analysis of the lengthening in CVC monosyllables as opposed to the lack of it in CVCC monosyllables is that a final consonant is extraprosodic and that lengthening cannot result in a trimoraic syllable. Thus a monomoraic CVC form can undergo lengthening resulting in a bimoraic output, but a CVCC form would already be bimoraic (with the vowel and the immediately following consonant each contributing a mora) and so fails to undergo lengthening.

they account for much of the CVC reduplication data, they are unable to account for the lack of parallelism witnessed in the reduplication of a form like /tit/ as [tintit] and /net/ as [netVnet]. Takano's analysis predicts that /tit/ should wrongly reduplicate as [titVtit] while Spaelti's analysis wrongly predicts that /net/ should reduplicate as [nennet]. It is these forms that motivate an analysis in terms of opacity and sympathetic candidates that I offer in Section 4.

Takano 1996 couches her analysis of Ponapean reduplication within Correspondence Theory, as developed in McCarthy & Prince 1994, 1995. In Correspondence Theory, the underlying form for reduplication is not what is shown in (6)-(11) under the column indicated as 'Faithful Reduplication'. Rather, it is simply the reduplicant morpheme, RED, plus the base: /RED + base/. Examples of this from the first word in each of (6)-(11) are shown in (12).

(12) Representation of reduplicated forms in Correspondence Theory

Base	Underlying Reduplication	Surface Reduplication	Consonant Correspondence	Gloss
a. lirooro	/RED + lirooro/	[lil.lirooro]	Base /r/ - Red [l]	protective
b. tar	/RED + tar/	[tan.tar]	Base /r/ - Red [n]	strike (fish)
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

Given the underlying reduplicative forms shown in (12), a specific challenge for a correspondence theory analysis is to account for the data in (12c)-(12e) in a unified way. There is an interesting lack of parallelism between the output of (12c) and (12e). In (12c), 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. Thus, the correspondent of the base-final /t/ surfaces as [n]. On the other hand, (12e) 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 (12e) [nen.net], especially since a geminate nasal is possible as seen by the output of (12d) and since a base-final /t/ can have [n] as a correspondent as in (12c)? That is, why doesn't the base-final /t/ in (12e) have the correspondent [n] in the reduplicant like the form in (12c)? Or, to put it the other way around, why isn't the output for (12c) [titVtit] with an epenthetic vowel, parallel to (12e)?

Takano's 1996 correspondence theory analysis fails to account for the lack of parallelism between the surface output of (12c) and (12e). As Takano herself notices (p. 125), her analysis accounts for forms like (12d) and (12e) but wrongly predicts the output [titVtit] for a form like (12c).[10] To see this, we will consider Takano's correspondence theory analysis of Ponapean CVC reduplication. Takano offers the following relevant constraints in (13) for the analysis.

(13) 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=$\sigma_{\mu\mu}$ 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 (13a) 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 (13a) is inviolable (undominated) in Ponapean. The other three constraints in (13) are not undominated. The two Ident constraints in (13b) and (13d) assure featural identity between corresponding segments in the base and reduplicant. The two constraints are similar in that a violation of (13d) entails a violation of (13b). However, the reverse is not true: a violation of (13b) does not entail a violation of (13d). The constraint in (13c), 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.[11] Even though Takano 1996 refers to the

10 It seems quite reasonable that the lack of vowel epenthesis in the output of (12c) 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 4 is that the correct output of a form like (12c) 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.

11 Such constraints would include Max-BR and NoCoda as well as RED=Affix. This follows Prince 1997 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

constraint in (13c) as RED=$\sigma_{\mu\mu}$, for purposes of clarity I will refer to it as RED=CVC. A form like that in (12e) 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 (13c) on the interpretation that the reduplicant in (12e) surfaces as two syllables.[12]

Given the constraints in (13), we can consider the constraint ranking and tableaux for the forms in (12c)-(12e). I show how Takano's analysis fails to account for the lack of parallelism
between (12c) and (12e) resulting in a ranking paradox in the evaluation of candidates for these forms.

First, consider the tableau for (12d), which is the reduplicated form of /nenek/. The tableau shows the four constraints in (13).

(14) /nenek/ --- [nen-nenek] 'do adultery' (12d)

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

In (14), the actual output [nen-nenek], (14a), is shown with the two competitors in (14b) and (14c). (14a) does not violate any of the constraints in (13), unlike the other two candidates. Thus, (14a) surfaces as the winner. (14a) displays perfect identity with respect to features between the phonemes of the CVC reduplicant and the corresponding phonemes in the base. (14b) violates RED=CVC while (14c) violates undominated *μ[-son] among other constraints. Since the actual candidate, (14a), does not violate any of the relevant constraints, the tableau in (14) does not provide crucial evidence for the ranking among the constraints since there is no constraint conflict. Any ranking of the four constraints in (14) would result in (14a) being the winning candidate. Still, it is assumed that *μ[-

CVC reduplicant as optimal.

12 An interesting question arises as to whether epenthetic segments can be considered part of the reduplicant in light of McCarthy & Prince's (1993:21) claim that epenthetic segments from GEN are excluded from morphological affiliation. My analysis crucially assumes that such epenthetic segments are part of the reduplicant so that a form like [netVnet] violates RED=CVC. Clear evidence for this comes from verbal reduplication in the Bantu language SiSwati discussed by Kiyomi & Davis 1992 and Downing 1994. The reduplicant in SiSwati verbal reduplication is bisyllabic. When monosyllabic verb stems reduplicate they surface with an epenthetic syllable between the reduplicant and the base. For example, /wa/ 'fall' reduplicates as [wayiwa]. Both Kiyomi & Davis 1992 and Downing 1994 view epenthesis as occurring so as to meet the requirement that the reduplicant must be bisyllabic.

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 consideration of the reduplication of (7d), /sɛl/ 'tied', in the tableau in (15).

(15) /sɛl/ --- [sɛn-sɛl] 'tied' (7d)

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

(15) shows a conflict between RED=CVC and Ident-BR(nasal). Candidate (15a) 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, (15b) respects Ident-BR(nasal) but violates RED=CVC since the reduplicant surfaces with an epenthetic vowel. Given that (15a) is the winner, then RED=CVC must outrank Ident-BR(nasal) as shown in (16).

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

One realistic candidate not shown in the tableau in (15) 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 Ito, 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.[13]

Given the ranking in (16), let us now consider the ranking between Ident-BR(sonorant) and RED=CVC in Takano's analysis. The crucial example is /net/ in (12e). Tableau (17) shows the constraint evaluation for the possible reduplicated forms.

[13] In the analysis I offer in Section 4, [sɛl-sɛl] is ruled out because it violates the undominated constraint CodaCon in the sense of Ito 1986 whereby a coda consonant must share place features with a following onset in order to surface. The cluster [l.s] in Ponapean cannot share place features. See Footnote 18 for further discussion.

(17) /net/ --- [netVnet] 'smell' (12e)

/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 (17a) is eliminated because it violates the undominated constraint *μ[-son]. The competition then is between (17b) and (17c). If the Ident-BR(sonorant) constraint were ignored in Tableau (17), the expected winner would be (17c) given the ranking shown in (16). However, (17c) is not the winner. This means that there must be some constraint that (17c) violates that is higher ranking than the RED=CVC constraint which (17b) violates. According to Takano, the relevant constraint that (17c) violates is Ident-BR(sonorant). (17c) violates this constraint since the sonorant [n] of the reduplicant corresponds with the nonsonorant [t] of the base. (17b) respects the Ident-BR(sonorant) constraint. Given the ranking established in (16), Ident-BR(sonorant) and RED=CVC are in conflict. The fact that (17b) is the winner constitutes a ranking argument that the constraint it violates, RED=CVC, must be lower ranked than Ident-BR(sonorant) which (17c) violates. Thus the ranking in (18) is motivated.

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

Given the constraint ranking established in (16) and (18), an interesting problem arises for Takano's analysis when we consider the evaluation of candidates for forms like that in (12c), /RED + tit/. As shown by the tableau in (19), the ranking in (18) selects an incorrect output (indicated by ☹ in the tableau).

(19) /tit/ --- [tintit] 'build a wall' (12c)

/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 (19a) is eliminated because it violates undominated *µ[-son]. The choice then is between (19b) and (19c). Given the ranking established in (18), the candidate in (19b) is wrongly predicted as the winning candidate since it violates only lower-ranked RED=CVC. The tableau in (19) makes clear the lack of parallelism between the data in (12c) and (12e). 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 >> Ident-BR(sonorant) were reversed, as in (20).

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

The tableau in (21) shows how this ranking results in the correct output for the reduplication of /tit/.

(21) /tit/ --- [tintit] 'build a wall' (12c)

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

But this results in a ranking paradox. The reduplicative output for /tit/ seems to require the ranking in (20) while the reduplicative output for /net/ requires the opposite ranking in (18). Even if we put Ident-BR(sonorant) and RED=CVC in the same constraint block (along the lines of Ní Chiosaín 1995) and passed the outcome on to lower ranking Ident-BR(nasal), a wrong candidate would be predicted, as seen in (22).

(22) /tit/ --- [tintit] 'build a wall' (12c)

/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 (12c) and (12e) is problematic for Takano's (1996) correspondence theory analysis of Ponapean reduplication.[14]

Spaelti 1997 has a somewhat different analysis of Ponapean reduplication but he too is unable to account for the lack of parallelism between (12c) and (12e), the latter of which he does not discuss. For the analysis of the reduplication of a form like (12c), /tit/, Spaelti makes use of the two crucial constraints *Place/Coronal and Ident-BR(nasal) ranked in that order. His analysis for (12c) would be as in (23). (He does not consider a candidate like [tit.tit], so it is not shown.)

[14] With respect to (19), if we add the constraint DEP-BR and ranked it higher than Ident-BR(sonorant), then (19c) would correctly be selected as the winner. However, this ranking would wrongly predict that for the tableau in (17), the candidate [nennet] in (17c) should be the winner.

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 (17) and (19). Given the ranking shown in (18), we can account for the problematic case of [tintit] in the tableau in (19) 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)

(i) RED=CVC & DEP-BR
(ii) RED=CVC & DEP-BR >> Ident BR(son) >> RED=CVC (>> DEP-BR)

The candidate [titVtit] in (19b) violates the high-ranking conjoined constraint since it violates both RED=CVC and DEP-BR. The candidate [tintit] in (19c) 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/.

(23) /tit/ --- [tintit] 'build a wall' (12c)

	/RED + tit/	*Place/Coronal	Ident-BR(nasal)
☞	a. tin.tit	***	*
	b. ti.tV.tit	****!	

On Spaelti's analysis, the reason why /tit/ reduplicates as [tin.tit] is because in comparison with the alternative [ti.tV.tit], the candidate [tin.tit] has one fewer violations of the constraint *Place/ Coronal. The consonant sequence [n.t] in (23a) involves just one coronal articulation while the sequence [tV.t] in (23b) involves two separate coronal articulations. Altogether, (23a) would have three violations of *Place/Coronal whereas (23b) has four. Thus, (23a) is the winner because it better satisfies higher-ranking *Place/Coronal despite its violation of Ident-BR(nasal) which is not fatal.

Spaelti's analysis, however fails to account for the reduplication of a form like /net/ in (12e). This is shown in the tableau in (24). (Again, a candidate like [net.net] is not considered by Spaelti and so is not shown in the tableau.)

(24) /net/ --- [netVnet] 'smell' (12e)

	/RED + net/	*Place/Coronal	Ident-BR(nasal)
☹	a. nen.net	***	*
	b. ne.tV.net	****!	

Given the explanation for (23) involving minimizing the number of coronal articulations, Spaelti's analysis incorrectly predicts (24a) to be the winner. An additional high-ranking constraint ruling out geminate nasals would be highly problematic for Spaelti's analysis given the form in (6b) where /nur/ 'contract' reduplicates as [nun.nur] and (12d) where /nenek/ 'do adultery' reduplicates as [nen.ne.nek]. Thus, we see that the ranking established in (23) is unable to account for the reduplication of /net/ in (24). In fact, (24) suggests that the constraints should have the reverse ranking. However, this would result in a ranking paradox. Spaelti's analysis then is unable to account for (12c) and (12e) in a uniform way.

In this section I have shown that the lack of parallelism between (12c) and (12e) has been problematic for Takano's 1996 and Spaelti's 1997 correspondence theory analysis of Ponapean CVC reduplication. Data like that in (12c) undergo nasal substitution while data like that in (12e) have vowel epenthesis instead. Both analyses predict parallel behavior for these forms. Takano (1996:125) explicitly notes the problem that data like (12c) pose for her otherwise insightful analysis and leaves the issue for future research. In the following section, I will offer a new analysis on Ponapean CVC reduplication that builds on Takano's work but makes use of sympathetic candidates and a sympathetic faithfulness constraint along the lines of McCarthy 1997 as discussed in Section 1.

4. Nasal Substitution and the Sympathetic Candidate

In this section I offer an analysis of Ponapean CVC reduplication in which I show that the actual output in reduplication is faithful to a sympathetic candidate which maintains featural faithfulness between the base and the CVC reduplicant. The key to the solution of the Ponapean reduplication problem is to understand why nasal substitution occurs when it does. The importance of this can be seen from the discussion in Section 3 where it was shown that Takano's analysis fails to account for nasal substitution in the reduplication of such forms as /tit/ and /sas/. I will contend that there is a single generalization for when nasal substitution occurs in reduplication, and the generalization crucially makes reference to the prosodic properties of the sympathetic candidate.

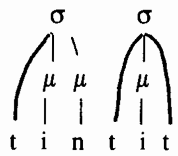
In determining the generalization regarding nasal substitution let us first consider the data in (8) which is repeated in modified version in (25). Specifically, in (25) a distinction is shown between 'Underlying Reduplication' and 'Faithful Reduplication'. The latter refers to the expected output of CVC reduplication if the CVC reduplicant were phonemically faithful (or, more precisely, faithful in terms of features).

(25) Reduplication with nasal substitution

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. tit	/RED + tit/	tit.tit	[tin.tit]	Base [t] - Red [n]	build a wall
b. sas	/RED + sas/	sas.sa	[san.sas]	Base [s] - Red [n]	stagger
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

In the surface reduplication forms in (25) the final obstruent of the base corresponds to a nasal in the reduplicant. This nasal is moraic as can be seen by the syllabification of the form in (25a), shown in (26).

(26) Surface reduplication of /tit/ (25a) prosodified



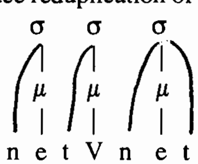
Thus the base-final nonmoraic [t] corresponds to moraic [n] in the reduplicant. Typically, though, an obstruent in the base does not have a correspondent that is nasal nor does it have one that is moraic. This is seen from data like that in (10) presented in (27).

(27) Reduplication without nasal substitution

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. net	/RED + net/	net.net	[ne.tV.net]	Base [t] - Red [t]	smell
b. lus	/RED + lus/	lus.lus	[lu.sV.lus]	Base [s] - Red [s]	jump
c. rese	/RED + rese/	res.rese	[re.sV.re.se]	Base [s] - Red [s]	saw
d. set	/RED + set/	set.set	[se.tV.set]	Base [t] - Red [t]	(food term)

In (27) there is exact correspondence between the last consonant of the base and the reduplicant (with an epenthetic vowel surfacing after the final consonant of the reduplicant). The syllabification of (27a), [netVnet], is shown in (28).

(28) Surface reduplication of /net/ (27a) prosodified



The question that arises is what distinguishes the data in (25) from (27) such that a moraic nasal is forced to occur in the reduplication of (25) as exemplified in (26), but no moraic nasal can occur in the reduplication of (27) as exemplified in (28). The factor that distinguishes (25) from (27) is that the two consonants in the initial CVC of the base in (25) are identical obstruents. The importance of this observation becomes clear if we view the reduplication process derivationally. From a derivational perspective, a form like (25a) would go through steps like that in (29) in order to realize the surface form.

(29) a. Underlying Representation: /tit/

b. Reduplication: tit-tit

c. Prosodic Structure Assignment:
```
μ μ   μ
| |   |
t i t. t i t
```

d. Nasal Substitution:
```
μ μ   μ
| |   |
t i n. t i t
```

e. Epenthesis: (does not apply)

f. Phonetic Representation: [tin.tit]

In the analysis shown in (29), nasal substitution occurs in (29d) so as to preserve the geminate or moraic nature of the coda consonant shown in (29c) while being able to respect surface constraints on codas such as *μ[-son] and the Coda-Condition mentioned at the end of Section 2. The geminate consonant in (29) prosodifies as moraic as in (29c) given such works as Hayes 1989, Sherer 1994, and Davis 1994, 1999, the latter two of whom specifically argue for the moraicity of geminate consonants even in languages where CVC syllables are normally light.[15]

We should compare (29) to the derivation of the reduplicated forms in (27). (30) shows the derivation of the form in (27a).

(30) a. Underlying Representation: /net/

b. Reduplication: net-net

c. Prosodic Structure Assignment:
```
 μ     μ
 |     |
n e t. n e t
```

[15] More discussion regarding the moraicity of geminates can be found later in this section. As for the matter of the exact representation of geminate consonants, I do not take a specific position in this paper other than that they must be moraic. One can view them as having two root nodes as in Selkirk 1990 or two C-slots or X-slots as in Clements and Keyser 1983. For purposes of clarity, I represent geminates as shown in (29c), although it should be understand that, in terms of articulation, a geminate involves a single gesture rather than two separate identical articulations.

d. Nasal Substitution: (does not apply)

e. Epenthesis:

μ μ μ
| | |
n e. t V. n e t

f. Phonetic Representation: [ne.tV.net]

In (30), nasal substitution does not occur because the coda consonant (of the first syllable) in (30c) is not moraic. It is not moraic since it is neither a sonorant nor a geminate. (Epenthesis occurs in this form because the prosodification in (30c) violates the syllable contact constraint which will be discussed later.)

By comparing the forms in (29) and (30) derivationally, it is posited that nasal substitution occurs so as to preserve the moraic nature of a coda while respecting the other constraints on coda consonants. Further evidence regarding this view of nasal substitution comes from the data in (7) which too display nasal substitution. These are shown below in (31).

(31) Reduplication with nasal substitution (not involving geminates)

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. tar	/RED + tar/	tar.tar	[tan.tar]	Base [r] - Red[n]	strike (fish)
b. sar	/RED + sar/	sar.sar	[san.sar]	Base [r] - Red [n]	fade
c. tilep	/RED + tilep/	til.tilep	[tin.ti.lep]	Base [l] - Red [n]	mend roof
d. sɛl	/RED + sɛl/	sɛl.sɛl	[sɛn.sɛl]	Base [l] - Red [n]	tied

If we consider the reduplication in (31) from a derivational perspective, we see that nasal sub-stitution occurs in the same environment as in (29). This is shown in (32) with the form in (31a).

(32) a. Underlying Representation: /tar/

b. Reduplication: tar-tar

c. Prosodic Structure Assignment:

$\mu\mu$ μ
|| |
t a r. t a r

d. Nasal Substitution:

μ μ μ
| | |
t a n. t a r

e. Epenthesis: (does not apply)

f. Phonetic Representation: [tan.tar]

In (32), the /r/ in the coda of the first syllable would be moraic since it is a sonorant. Nasal substitution then occurs so as to preserve the moraic character of the coda while at the same time respecting both the constraints Coda Condition and *μ[-son]. This is the same reason that nasal substitution occurs in (29).

The derivational analysis above allows us to capture in a straight forward fashion the reduplication of /tit/ as [tin.tit] and /net/ as [ne.tV.net]. This is significant in light of the fact that both Takano 1996 and Spaelti 1997 were unable to account for these forms within Correspondence Theory as discussed in Section 3.

The presentation of the derivational analysis in (29), (30), and (32) helps on the one hand to clarify the difference in reduplication between the data in (25) and (27) and on the other hand gives a unified account for the nasal substitution pattern shown by the data in (25) and (31). What is crucial in the derivational analysis is the role of the fully prosodified form in (29c), (30c), and (32c) which is neither an underlying input nor an occurring output. The nasal substitution rule is sensitive to the moraic nature of this form.

As mentioned at the very beginning of this paper, phenomena that seem to require reference to an intermediate form that is neither an input nor an occurring output has been a challenge for Optimality Theory. In taking on this challenge, McCarthy 1997 has proposed that cases of opacity (such as the Tiberian Hebrew counterbleeding problem discussed in Section 1) can be analyzed within Optimality Theory in terms of candidate-to-candidate faithfulness. McCarthy (1997) shows how an apparent counterbleeding rule relation for Tiberian Hebrew given in (1) which seems to make reference to an intermediate form, really involves the influence of a designated candidate on the output through sympathy. The Ponapean CVC reduplication case can be understood in exactly the same way, though it does not involve counterbleeding as an examination of the derivations in (29), (30), and (32) would show.

In Ponapean reduplication the sympathetic candidate would be forms like in (29c), (30c) and (32c) which are fully prosodified with a CVC reduplicant that is featurally faithful to the base. By being fully prosodified, the sympathetic candidate is a possible output candidate, and by having a CVC reduplicant that is featurally faithful to the base it can be characterized by a designated faithfulness constraint. Specifically, it can be characterized by Ident-BR which requires feature identity between the phonemes of the base and the corresponding phonemes of the reduplicant. Given this, we can now state the generalization on nasal substitution as (33).

(33) Generalization of Nasal Substitution
Nasal substitution occurs in order to preserve the consonantal moraic structure of the sympathetic candidate.[16]

This generalization captures why nasal substitution occurs in (25) and (31) and why it fails to occur in (27).

In the remainder of this section, I will show that by reference to the sympathetic candidate a nonderivational correspondence theory analysis can account for all the Ponapean CVC reduplication data without any ranking paradox. Moreover, in Section 5 I will show that the same constraint ranking required for reduplication can also handle the somewhat different pattern of nasal substitution found with suffixation without reference to rules or levels. I now turn to the details of the "sympathetic" analysis of Ponapean reduplication. I address issues regarding moraic structure and the determination of the sympathetic candidate as they arise.

In presenting the sympathetic analysis of Ponapean CVC reduplication, I first consider the reduplication of /tar/ 'strike' in (31a). As mentioned, the sympathetic candidate in Ponapean CVC reduplication always is a fully prosodified form with a CVC reduplicant that is featurally faithful to the base. The designated faithfulness constraint that selects the sympathetic candidate is Ident-BR. This constraint requires that the features of corresponding segments in the base and reduplicant be identical. In the tableau in (36), which shows the reduplication of /tar/ as [tantar] involving nasal substitution, the designated faithfulness constraint (Ident-BR) is set off to the right of the doubled lines and the sympathetic candidate in (36a), with its prosodic structure, is indicated with the flower icon.[17]

[16] Because of data like that in (11), where, for example, /par/ 'cut' 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 a high-ranking Ident-BR(place) constraint which will be discussed later in this section.

[17] An issue arises that was mentioned in Footnote 3 concerning what happens if more than one candidate meets the designated faithfulness constraint. As indicated in (36) by the checkmarks, both (36a) and (36d) respect the designated faithfulness constraint, Ident-BR. While (36a) clearly meets this constraint, (36d) is viewed here as respecting it too under the interpretation that an epenthetic segment does not incur an Ident violation. This seems to be implicit in McCarthy & Prince (1995:265) where they state, "[M]appings other than outright segmental insertion or deletion typically involve violations of IDENT rather than MAX/DEP." Later in Section 4 I discuss in more detail how the sympathetic candidate is determined when more than one respects the designated faithfulness constraint. It should be noted, however, that the actual sympathetic candidate for Ponapean reduplication will always have a CVC reduplicant. That is, it must respect the constraint in (13c), RED=Affix, which has the effect of restricting the reduplicant to a single syllable. The role of this constraint is not surprising, given that reduplication in Ponapean is a type of affixation and not compounding. Consequently, while all candidates meeting the designated faithfulness constraint will be indicated with a checkmark in the tableaux, only one with a CVC reduplicant can be the sympathetic candidate. Alternatively, one can think of the designated faithfulness constraint as being Ident-BR(CVC) rather than just Ident-BR; or one can follow Lombardi 1995 in viewing that the insertion (or deletion) of a segment results in an Ident-Feature violation in which case candidate (36d) would not satisfy the designated faithfulness constraint, Ident-BR.

In addition to the designated faithfulness constraint, we need to posit a sympathetic faithfulness constraint that relates the actual output to the sympathetic candidate. Given the generalization on nasal substitution in (33), the sympathetic faithfulness constraint is one that requires preservation of consonantal moraic structure between the sympathetic candidate and the output candidates. This constraint is stated below in (34) and I will refer to it as the flowered constraint.

(34) Max-μ_c❀ -- 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 3 and is reflected by the tableau in (17). For convenience I repeat this ranking in (35a) where only *μ[-son] is an undominated constraint. There are two other undominated constraints that I will refer to in my analysis. These are in (35b) and (35c).

(35) 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 (35b), as mentioned before, 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 (35c) has been proposed in Bat El 1996 and developed in Eulenberg 1996, Rose 1997, Davis & Shin 1997, and Shin 1997 based on Vennemann 1988. SyllCon disallows a sequence of rising sonority from 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 [tan.tar] 'strike) 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 (25) and (26) involving nasal substitution. The tableau in (36) shows the reduplication of /tar/ as [tantar] in (31a). The candidates are shown with their moraic structure. The sympathetic candidate is shown with the flower icon in (36a). Regarding the flowered constraint, the tableaux below will show it is ranked above Ident-BR(sonorant) but below the undominated constraints.

(36) /tar/ --- [tan-tar] 'strike' (31a)

/RED + tar/	*μ[-son] CodaCon SyllCon	Max-μ_c❀	Ident-BR (son)	RED= CVC	Ident-BR (nas)	Ident-BR
μ μ μ ❀ a. t a r. t a r	*!					√
μ μ μ ☞ b. t a n. t a r					*	*
μ μ μ c. t a t .t a r	*!		*			*
μ μ μ d. t a.r V. t a r		*!		*		√

The tableau in (36) does not show the critical ranking of the flowered constraint, Max-μ_c❀. It does correctly select [tantar] in (36b) as the winner since it only violates low-ranking Ident-BR(nasal). The completely faithful candidate in (36a) is eliminated because it violates undominated CodaCon.[18] Candidate (36c) violates undominated *μ[-son] as well as

18 An interesting issue arises in Ponapean as to which clusters respect or violate CodaCon. In Ponapean, clusters consisting of a liquid (/l/ or /r/) followed by another (non-identical) coronal do not obey CodaCon. This assumes that liquids cannot be place-linked to a following (non-identical) consonant. The 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 the /r/ and /t/ in (36a) are both coronal, they cannot share the same Place Node since /r/ would have a specification for the feature [lateral] under the Coronal Node while /t/ would not. Similarly, a potential cluster like /l+t/ as in the 'faithful reduplication' column of (31c) would also have a violation of CodaCon. Relatedly, the reduplication of /sar/ 'fade' as [sansar] in (31b) is interesting because it assumes that the sequence [ns] obeys CodaCon sharing the Coronal Node. Padgett 1994 points out that nasal consonants frequently do not form a place linked cluster with a following fricative so that

Ident-BR(sonorant) and so is eliminated. Candidate (36d) violates the flowered constraint since the moraic consonant of the sympathetic candidate in (36a) has no moraic correspondent in (36d). However, since (36d) 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 in (15) to be higher-ranked than Ident-BR(nasal), which (36b) violates. Candidate (36b) which respects the flowered constraint thus emerges as the winner since it violates only low-ranked Ident-BR(nasal).[19]

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 is seen in the tableau in (19). 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❀ plays a crucial role. This is shown in the tableau in (37).

In the tableau in (37), the sympathetic candidate (37a) is eliminated because it violates undominated *μ[-son] while (37c) is eliminated because it violates undominated CodaCon. The choice then is between (37b) and (37d). If the flowered constraint were not there, (37d) would be the expected winner, as is shown by the tableau in (19). This is because (37b) violates Ident-BR(sonorant) which is higher-ranked than the constraint violated by (37d), RED=CVC. Since (37b) is the actual winner, then there must be a constraint that (37d) violates that is higher-ranked than Ident-BR(sonorant). This constraint is the flowered constraint Max-μ_c❀. (37d) violates this constraint because the moraic consonant of the sympathetic candidate in (37a) has no consonantal moraic correspondent in (37d). On the other hand, (37b) respects it since it preserves the moraicity of the geminate consonant of the sympathetic candidate. Since (37b) is the winning candidate, the flowered constraint must be ranked higher than Ident-BR(sonorant).

the sequence [ns] would violate CodaCon. Rehg & Sohl (1981:32) specifically comment that assimilation occurs between the /n/ and the /s/ in [ns] clusters in Ponapean. They note that /n/ is normally dental while /s/ is alveolar and somewhat palatalized. They observe that the /n/ in an [ns] cluster is likewise palatalized. This suggests that the [ns] cluster in Ponapean does share the Place Node and thus reduplication of /sar/ as [sansar] does not violate CodaCon. This would be supportive of a view like that of Davis 1989 where it is argued that the feature [continuant] is not located under the Place Node, contrary to Padgett 1994. A full discussion of the problem of the location of both the features [continuant] and [lateral] in feature geometry is beyond the scope of this paper.

19 One candidate that is not considered in (36) is [tar.rar] where the /t/ 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 & Prince 1995. Consequently, I will not consider candidates that show an alternation in the base.

(37) /tit/ --- [tin-tit] 'build a wall' (25a)

/RED + tit/	*μ[-son] CodaCon SyllCon	Max-μ_c❀	Ident-BR (son)	RED = CVC	Ident-BR (nas)	Ident-BR
μ μ μ ❀ a. t i t. t i t	*!					√
μ μ μ ☞ b. t i n. t i t			*		*	*
μ μ μ c. t i r .t i t	*!		*			*
μ μ μ d. t i. t V. t i t		*!		*		√

The use of the flowered constraint and the sympathetic candidate captures quite well why nasal substitution occurs for data like in (25) where one would expect a geminate obstruent if reduplication were faithful, as in the hypothetical [tittit] for the reduplication of /tit/. As mentioned in (33), nasal substitution occurs so as to preserve the moraic (i.e. geminate) nature of the consonant in the expected faithful reduplicative candidate without violating the undominated constraint against moraic obstruents. This is the key to understanding nasal substitution here. The actual output is dependent on the prosodified (featurally) faithful reduplicative candidate and the designated faithfulness constraint (Max-μ_c❀ for Ponapean reduplication) insightfully expresses this dependency.

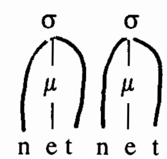
That reference to the consonantal moraic nature of the sympathetic candidate is of importance to the understanding of Ponapean CVC reduplication can be seen in data like in (27) repeated in (38) where the prosodified sympathetic candidate does not have a moraic consonant.

(38) Reduplication without nasal substitution

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. net	/RED + net/	net.net	[ne.tV.net]	Base [t] - Red [t]	smell
b. lus	/RED + lus/	lus.lus	[lu.sV.lus]	Base [s] - Red [s]	jump
c. rese	/RED + rese/	res.rese	[re.sV.re.se]	Base [s] - Red [s]	saw
d. set	/RED + set/	set.set	[se.tV.set]	Base [t] - Red [t]	(food term)

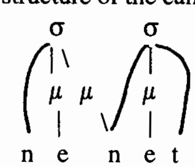
As mentioned in the discussion of (30) concerning the derivational account of these data, nasal substitution does not occur in the reduplication of a form like (38a) because the prosodified sympathetic candidate would not contain a moraic consonant. This is shown in (39).

(39) Faithful reduplication of /net/ (38a)



Here the final consonant of the reduplicant, at the end of the first syllable, cannot be moraic. It cannot be moraic because it is neither a sonorant nor a geminate. As a result, the possible reduplicative candidate, [nennet] shown prosodified in (40), where the base /t/ has the reduplicant correspondent [n] (parallel to the reduplication of /tit/ as [tintit]), does not have to surface because there is no consonantal mora in the sympathetic candidate (39) that requires sympathetic faithfulness.

(40) Prosodic structure of the candidate [nennet]



The constraint ranking already established will select the correct winner [netVnet] for the reduplica-tion of /net/ against alternatives like *[nennet] and *[netnet]. This is shown in the tableau in (41).

(41) /net/ --- [netVnet] 'smell' (38a)

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

Given that the sympathetic candidate contains no moraic consonant, the designated faithfulness constraint, Max-μ_c✿, then does not play any role. The other constraints, whose rankings have already been established, select [netVnet] in (41c) as most harmonic. (41b) is eliminated because it violates Ident-BR(sonorant) which outranks RED=CVC. The tableau in (41) shows the role of Syllable Contact in eliminating the sympathetic candidate (41a) as a possible winner. (41a) does not violate $*\mu$[-son] since the obstruents are not moraic. It also does not violate CodaCon since the cluster of [t.n] could be reasonably considered a place-linked cluster. Consequently, the undominated constraint that (41a) violates is SyllCon since there is rising sonority between [t] and [n] over the syllable boundary. (41c) 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 3 that both Takano and Spaelti were unable to account for both these forms. As seen in the tableaux in (17) and (19) Takano's analysis predicts that /tit/ should reduplicate as [ti.tV.tit] while Spaelti's analysis shown in the tableaux in (23) and (24) predicts that /net/ should reduplicate as [nen.net]. 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 (33), that nasal substitution occurs to preserve the mora structure of the candidate that has a CVC reduplicant that is featurally faithful to the base. The analyses discussed in Section 3 falter in that they do not consider the

moraic structure of the reduplicant. Such structure is actually quite important in Ponapean reduplication given the pattern of quantitative complementarity noted by McCarthy & Prince 1986 which accounts for verbs of the shape CVV (bimoraic monosyllable) having a reduplicant that is CV (as discussed in Footnote 4) while verbs that have bimoraic reduplicants (CVC as in (6-9) or CVCV as in (10-11)) have an initial base syllable that is light.

Before showing how my analysis applies to the rest of the CVC reduplication data, I need to discuss issues of moraic structure that my analysis assumes. Crucial for my analysis is the view that a sonorant consonant in coda position is moraic in Ponapean while a single obstruent cannot be. As mentioned at the end of Section 2, this reflects two constraints: a constraint requiring a coda to be moraic (cf. Hammond 1997) and a constraint requiring a moraic segment to be sonorant (cf. Zec 1995). The result of these two constraints is that a (word-internal) coda must be both moraic and [+sonorant]. Such a restriction on surface codas is not unusual given the work of Zec 1988, 1995.

What might strike one as controversial in my analysis on Ponapean is the moraification that I provide for the sympathetic candidates, especially those with obstruents in coda position. First, I assume that a single obstruent consonant in coda position in a sympathetic candidate like in (41a) is represented as being nonmoraic as illustrated in (39) while a sonorant coda of a sympathetic candidate is moraic as shown in (36a).[20] However, this is exactly like what is found for Lithuanian as documented by Zec 1988, 1995 where both obstruents and sonorants can be syllable-final but only the latter contribute weight. Nonetheless, one could contend that the sympathetic candidate in (41a) should be shown with the final [t] of the initial syllable being moraic. In other words, why is the sympathetic candidate the one shown below in (42a) and not that in (42b)?

[20] Consequently, a possible sympathetic candidate for the reduplication of /tar/ shown in (i) would be eliminated because it violates the undominated constraint on coda sonority which is respected by the actual sympathetic candidate in (ii).

(i) μ μ — t a r. t a r (ii) $\mu\mu$ μ — t a r. t a r

Furthermore, the difference between (i) and (ii) also reflects that the general constraints on prosody in Ponapean outrank constraints on BR-prosody since the [r] of the base in [tar] is not moraic though its correspondent in the reduplicant is. That general prosodic constraints outrank constraints on BR-prosody in Ponapean is also clear from other examples like /tune/ 'tie together' in (9e) which reduplicates as [tun.tu.ne] where the moraic coda of the reduplicant corresponds to an onset in the base.

(42)

```
      μ     μ                 μ μ   μ
      |     |                 | |   |
(a) n e t. n e t        (b) n e t. n e t
```

The choice between the two possible sympathetic candidates in (42a) and (42b) is complicated by the fact that each violates an undominated prosodic constraint. (42a) violates the undominated constraint requiring codas to be moraic, but (42b) violates undominated *μ[-son]. Given Ito and Mester's 1997 proposal mentioned in Footnote 3, that the sympathetic candidate not only satisfies the designated faithfulness constraint but also best satisfies the normal constraint ranking of the language, it may be somewhat unclear what actually chooses (42a) over (42b) as the sympathetic candidate. One possibility is that some undominated constraints are more important than others in determining the sympathetic candidate. On this view, the satisfaction of *μ[-son] is more important than the satisfaction of the constraint requiring codas to be moraic. Alternatively, one could view Ito & Mester's 1997 proposal as an initial hypothesis subject to change based on empirical findings. In any case, (42a) clearly has to be the sympathetic candidate for the tableau in (41); if the sympathetic candidate were (42b), the form in (41c), [nen.net] would wrongly be the predicted winner.

Secondly, as mentioned in the discussion regarding the derivations in (29) and (30), I have been distinguishing between a geminate obstruent which I consider to be moraic, as seen in (37a), as opposed to a single obstruent in the coda as in (41a) which is nonmoraic. Davis 1994, 1999 has provided a wide variety of evidence to argue that geminate consonants pattern as moraic even in languages where coda consonants do not normally add weight to the syllable.[21] Thus the distinction between (37a) and (41a) is not unfounded. The question concerning (37a) is why the sympathetic candidate has the structure where the geminate [t] is moraic shown in (43a) as opposed to one where it is not moraic shown in (43b), especially given the discussion above regarding [net.net] in (41a) where it was mentioned that a moraic [t] in [net.net] would violate the undominated constraint against moraic obstruents?

(43)

```
     μ μ   μ                  μ     μ
     | |   |                  |     |
a. t i t. t i t         b. t i t. t i t
```

The possible sympathetic candidate in (43a) violates the undominated constraint against moraic obstruents. On the other hand, the potential sympathetic candidate in (43b) violates two different undominated constraints, one requiring codas to be moraic and another requiring geminates to be moraic. As mentioned, Ito & Mester 1997 maintain that the actual sympathetic candidate should not only obey the designated faithfulness constraint, but it should best satisfy the rest of the constraint system of the language. Given that (43b) violates two relevant undominated constraints whereas (43a) violates only one, (43a) is the sympathetic candidate because it better satisfies the constraint system of the langauge.

Now, if we consider the overall pattern of moraicity that emerges in the sympathetic candi-dates, as can be seen by such forms as (43a), (42a), and (36a), where only a sonorant consonant or a geminate can be moraic, we find that such a system is not uncommon cross-linguistically. Inkelas & Cho 1993 document several languages where moraic consonants are those of high sonority or an obstruent that is part of a geminate structure. Languages that have such moraic structure include Japanese, Hausa, and Italian. Thus, I consider the moraic structure shown by the sympathetic candidates in (43a), (42a), and (36a) to be well-motivated. The pattern of nasal sub-stitution as a single general phenomenon as expressed in (33) can only really be understood given this patterning of geminates and coda sonorant consonants together as moraic. In the remainder of the section I will consider the rest of the Ponapean CVC reduplication data and exemplify how they too can be accounted for with the sympathetic candidate and the designated faithfulness constraint.

In (6)-(11) of Section 2 of this paper, I presented virtually the full range of Ponapean CVC reduplication. With respect to my analysis above, the data in (7) involving the nasal substitution of a sonorant consonant would all be handled like /RED + tar/ as shown in the tableau in (36); the data in (8) involving nasal substitution of a geminate obstruent would all be handled like /RED + tit/ as shown in the tableau in (37), and the data in (10) involving vowel epenthesis between and obstruent and a sonorant

---

[21] As an example of the type of evidence that Davis 1999 uses to distinguish geminates from corresponding singleton consonants consider the pattern of genitive allomorphy in Sinhala as seen by the data in (i).

(i)

	Nominal roots	Genitive	Gloss
a.	mudəl-	mudəl-e	the fund's
b.	pot-	pot-ee	the book's
c.	mal-	mal-ee	the flower's
d.	paar-	paar-e	the street's
e.	pawl-	pawl-e	the family's
f.	pætt-	pætt-e	the side's
g.	mull-	mull-e	the corner's

Based on these data, the generalization that emerges regarding genitive allomorphy is clear according to Davis. The genitive is realized as [-ee] if the nominal root is monomoraic; otherwise, the genitive surfaces as [-e]. In nominal roots with a final geminate, (f)-(g), the geminate must be contributing a mora or else such roots would be expected to take the genitive allomorph [-ee]. Thus, the geminate /t/ in (f) contributes a mora while the singleton /t/ in (b) does not.

consonant would all be handled like /RED + net/ as in the tableau in (41). The data sets in (6), (9), and (11) still need to be accounted for. Each of these brings up an interesting point for the analysis. Let us consider the data in (6) as presented in (44).

(44) Redupllication with total assimilation

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. lirooro	/RED+lirooro/	lir.lirooro	[lil.li.roo.ro]	r.l ---> l.l	protective
b. nur	/RED+nur/	nur.nur	[nun.nur]	r.n ---> n.n	contract
c. linenek	/RED+linenek/	lin.linenek	[lil.li.ne.nek]	n.l ---> l.l	oversexed

The data in (44) reflect the case where there is total assimilation between the actual surface output and the sympathetic (segmentally faithful) reduplicative form. Total assimilation occurs when the two adjacent consonants in the sympathetic candidate are both 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. In this way, it is interesting to compare (44) with the words in (38). In an example like /net/ shown in (38a) and (41), total assimilation based on the sympathetic candidate [net-net] essentially does not occur since Max-μ_c❀ is not of importance given that the sympathetic candidate lacks a moraic consonant. On the other hand, for the data in (44) total assimilation is the only way to respect Max-μ_c❀ without violating any of the undominated constraints. The sympathetic candidates for the data in (44), 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. This candidate would violate either undominated CodaCon or SyllCon. Thus total assimilation, like nasal substitution, preserves the mora structure of the sympathetic candidate. The example of /linenek/ in (44c) is shown in the tableau in (45).

(45) /linenek/ --- [lil-linenek] 'oversexed' (44c)

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

The sympathetic candidate in (45a) 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 (45c) violates the flowered constraint Max-μ_c❀ because the consonantal mora of the sympathetic candidate has no moraic correspondent in (45c). (45b), the winning candidate, obeys this constraint.

Now let us consider the reduplication data in (9) as presented in (46).

(46) Reduplication with no consonant alternation

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Correspondence	Gloss
a. nenek	/RED+nenek/	nen.nenek	[nen.ne.nek]	n.n ---> n.n	do adultery
b. rer	/RED + rer/	rer.rer	[rer.rer]	r.r ---> r.r	tremble
c. mem	/RED + mem/	mem.mem	[mem.mem]	m.m --> m.m	sweet
d. lal	/RED + lal/	lal.lal	[lal.lal]	l.l ---> l.l	make sound
e. tune	/RED + tune/	tun.tune	[tun.tune]	n.t ---> n.t	tie together
f. sinom	/RED + sinom/	sin.sinom	[sin.si.nom]	n.s ---> n.s	sink in
g. kaŋ	/RED + kaŋ/	kaŋ.kaŋ	[kaŋ.kaŋ]	ŋ.k --> ŋ.k	eat

The data in (46) are interesting because they represent a case where the sympathetic candidate as reflected under the column 'Faithful Reduplication' is the actual surfacing candidate. This situation arises when the two adjacent consonants in the 'Faithful Reduplication' are either identical sonorant consonants (46a-d) or a nasal homorganic with a following obstruent (46e-g). The example of /tune/ in (46e) is shown in (47) where the only two realistic candidates are the sympathetic candidate in (47a) and the candidate with an epenthetic vowel.

(47) /tune/ --- [tun-tune] 'tie together' (46e)

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

The sympathetic candidate (47a) is the winner because it violates none of the relevant constraints shown in the tableau. The alternative candidate in (47b) violates Max-μ_c❀ 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.

Given the above tableau, we see then that in the analysis of Ponapean CVC reduplication as involving opacity in the sense of McCarthy 1997 it is possible for the sympathetic candidate to actually surface, if the phonemes of the reduplicant can be incorporated into the moraic structure of the language without violating any crucial constraints. Opacity in Ponapean reduplication is thus different than the "counbterbleeding" type opacity case in Tiberian Hebrew discussed in Section 1. In that case, the sympathetic candidate with a word-final glottal stop could never be the actual winning candidate since it violates an undominated constraint that disallows syllable-final glottal stops. This difference should not be surprising since opacity has a new meaning under McCarthy's proposal. Opacity is the influence of a designated candidate upon the output through sympathy. While this candidate will frequently be a failed candidate, as in McCarthy's Hebrew example, or as in most of the Ponapean CVC reduplication data discussed here, it need not be. Opacity now takes on a different set of cases than in the traditional notion as in Kiparsky 1973, though "counterbleeding" type cases like the Tiberian Hebrew example in Section 1 are opaque both in the sense of Kiparsky 1973 and McCarthy

1997. That opacity under McCarthy's definition does take on a different range of case is apparent from Ito & Mester 1997 who examine German truncation as a case of the influence of a designated candidate on the output through sympathy; this too is not a case of opacity in the sense of Kiparsky 1973. Moreover, that the designated candidate in opacity may surface as the winning candidate is noted independently by Karvonen & Sherman 1997 in their analysis of glide deletion and u-epenthesis in Icelandic.

Now let us consider the reduplication data in (11) as presented in (48).

(48) Reduplication with an epenthetic vowel after a sonorant

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Corres.	Gloss
a. p^wil	/RED + p^wil/	p^wil.p^wil	[p^wi.lV.p^wil]	l.p^w --> lV.p^w	flow
b. ker	/RED + ker/	ker.ker	[ke.rV.ker]	r.k ---> rV.k	flow
c. par	/RED + par/	par.par	[pa.rV.par]	r.p ---> rV.p	cut
d. marep	/RED + marep/	mar.marep	[ma.rV.ma.rep]	r.m ---> rV.m	blink

The surfacing reduplicated forms in (48) present an interesting problem. The data in (48) are like that in (31) in that the sympathetic candidate has a first syllable that ends in a sonorant consonant (a liquid) and thus would be moraic. However, the actual output candidate in (48), unlike in (31), has an epenthetic vowel and so would not preserve the moraicity of the sonorant consonant. That is, the actual output in (48) violates the flowered constraint Max-μ_c❀. Crucially, there is an important difference between the two consonants in cntact in (31) and in (48). In (31) the two consonants in contact are both coronal. Though the sonorant liquid has a nasal correspondent in the reduplicant in (31), the coronal place of articulation is nonetheless preserved; the result in (31) then is a linked structure where the two consonants in contact share place of articulation. In (48), on the other hand, the two consonants in contact have different primary articulators. Thus, for the liquid consonant of the reduplicant in (48) to be realized as a moraic sonorant, not only would it have to be realized as a nasal as in (31), it would also have to change its place of articulation to that of the following consonant so as not to violate CodaCon. The consonant of a reduplicant never changes its primary place of articulation. This suggest that there is an undominated constraint, Ident-BR(place), requiring that corresponding segments in the base and reduplicant have an identical primary place of articulation.[22] It is the need to satisfy the undominated constraints Ident-BR(place) and CodaCon that compels the violation of the flowered constraint Max-μ_c❀. This is shown by the tableau in (49) with the reduplication of /par/ 'cut' from (48c).

(49) /par/ --- [parVpar] 'cut' (48c)

/RED + par/	*μ[-son] CodaCon SyllCon Ident-BR (place)	Max-μ_c❀	Ident-BR (son)	RED = CVC	Ident-BR (nas)	Ident-BR
μ μ μ | | | ❀ a. p a r. p a r	*!					√
μ μ μ | | | b. p a n. p a r	*!				*	*
μ μ μ | | | c. p a m .p a r	*!				*	*
μ μ μ | | | ☞ d. pa.rV.par		*		*		√

The tableau in (49) shows that the winning candidate can violate the flowered constraint if all the alternatives violate some undominated constraint. This means that the flowered constraint is not undominated,

22 I state this as a constraint on identity between the base and reduplicant only. This is because place assimilation changing the primary articulator does occur in other contexts in Ponapean but not in a reduplicant. Spaelti (1997:60) does posit a high-ranking constraint Ident(Place) and uses it to account for the lack of nasal substitution for the reduplicated form of /set/ which is [setVset]. Spaelti rules out the possible candidate [sen.set] by suggesting that the [n] in the reduplicant would violate Ident(Place) because it would have to acquire the [continuant] feature of the following [s]. Spaelti views the [continuant] feature as being under the Place Node, following Padgett 1994. However, Spaelti's explanation would fail to account for the reduplication of /sɛl/ as [sɛn-sɛl] where there would be a similar Ident(Place) violation on his account. On my analysis, the difference between these two forms is that in the reduplication of /sɛl/, the sympathetic candidate (i.e., sɛl-sɛl) has a moraic coda while the sympathetic candidate of /set/ (i.e., [set-set]) does not. Furthermore, given the observation of Rehg & Sohl 1981 that the dental /n/ assimilates in place to /s/ which is palatalized, the constraint that I posit, Ident-BR(place), crucially refers to the primary place articulators labial, coronal, and dorsal.

but it has to be higher-ranked than Ident-BR(sonorant) as shown in (37). Thus the tableaux in (47) and (49) bring out two interesting points for a detailed analysis involving sympathy. The tableau in (47) shows that there are cases where the sympathetic candidate is the winning candidate and the tableau in (49) shows that a winning candidate can violate the sympathetic constraint when all the alternatives are worst.

The analysis so far, making use of the notion of sympathy, insightfully captures the main generalization driving nasal substitution in Ponapean CVC reduplication, that nasal substitution occurs so as to preserve the consonantal moraic structure of the sympathetic candidate without violating undominated constraints such as CodaCon and *μ[-son]. Interesting support for this analysis comes from the reduplication of /m^wop^w/ 'out of breath' briefly mentioned in Footnotes 7 and 8. Consider the comparison between (50a) and (50b) 'smell'. The case in (50b) reflects what happens when the 'Faithful Reduplication (sympathetic candidate) has a coronal obstruent followed by a homorganic sonoranat. The winning candidate has an epenthetic vowel. This has already been analyzed in (41). On the other hand, as shown in (50a) when the two consonants in contact are a non-coronal obstruent followed by a homorganic nasal then total assimilation occurs.

(50)

Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Corres.
a. m^wop^w	/RED+m^wop^w/	$m^wop^w.m^wop^w$	[$m^wom^w.m^wop^w$]	$p^w.m^w$ --> $m^w.m^w$
b. net	/RED + net/	net.net	[ne.tV.net]	t.n ---> tV.n

Both Takano 1996 and Spaelti 1997 analyze the difference between (50a) and (50b) by a high-ranking *Place/Labial constraint and a low-ranking *Place/Coronal constraint. Since *Place/Labial is high-ranking, the surface output [$m^wom^w.m^wop^w$] in (50a) is preferred over the competitor with an epenthetic vowel, [$m^wo.p^wV.m^wop^w$], given that [$m^wom^w.m^wop^w$] has fewer violations of *Place/Labial. This is because the consonants in contact [$m^w.m^w$] have only one violation of *Place/Labial (i.e., there is only one labial articulation for the geminate) in comparison to the competitor with [$p^wV.m^w$] which would have two violations of *Place/Labial. To obtain the right output for (50a), the constraint *Place/Labial would have to be ranked higher than Ident-BR(sonorant). The tableau for (50a) is given in (51). (The Labial Node "L" is shown under labial consonants. The dotted line between the constraints Max-μ_c❀ and *Place/Labial marks a noncritical ranking between them.)

(51) /mʷopʷ/ --- [mʷomʷ-mʷopʷ] 'out of breath' (50a)

/RED + mʷopʷ/	*μ[-son] CodCon SyllCon	*Place/ Labial Max-μ_c✿	Ident-BR (son)	RED = CVC	Ident-BR (nas)	Ident-BR
μ μ | | ✿ a. mʷopʷ.mʷopʷ | \/ | L L L	*!	***				√
μ μ μ |	| ☞ b. mʷomʷ.mʷopʷ | \/ | L L L		***	*		*	*
μ μ μ |	| c. mʷo.pʷV.mʷopʷ |		| L L L L		****!		*		√

As shown in (51), the winning candidate (51b) displaying place assimilation better satisfies *Place/Labial than the main competitor with vowel insertion in (51c). Given that (51b) is the actual winner, *Place/Labial must be higher-ranked than Ident-BR(sonorant) since the reverse ranking would wrongly predict that (51c) would be the winner.

On the other hand, the reduplication of /net/ in (50b) as [ne.tV.net] indicates that *Place/ Coronal must be low-ranked, at least lower-ranked than Ident-BR(sonorant). This is shown by the tableau in (52) which is exactly like the earlier tableau for /net/ in (41) but with the constraints *Place/Coronal and *Place/Labial shown. Since *Place/Coronal is low ranking and *Place/Labial is irrelevant for this form, the addition of these constraints does not affect the original account of this form in (41). (The Coronal Node "C" is shown under coronal consonants. The exact ranking of *Place/Coronal is not of concern here as long as it is ranked below Ident-BR(sonorant).) For reasons of space we do not show the designated faithfulness constraint Ident-BR, though candidate (a) is the sympathetic candidate as shown.

(52) /net/ --- [net-net] 'smell' (50b)

/RED + net/	*μ[-son] CodaCon SyllCon	*Place/ Labial Max-μ_c✿	Ident-BR (son)	RED = CVC	Ident-BR (nas)	*Place/ Coronal
μ μ | | ✿ a. n e t.net | V | C C C	*! SyllCon					***
μμ μ || | b. nen.net | V | C C C			*!		*	***
μ μ μ |	| ☞ c. ne.tV.net |	|| C C CC				*		****

As shown in the tableau in (52), candidate (52b) with coronal place assimilation is not the winning candidate even though it better satisfies the constraint *Place/Coronal compared to its main competitor in (52c). Candidate (52b) fatally violates the higher ranked Ident-BR(sonorant) which the winning candidate in (52c) respects. Thus, the tableaux in (51) and (52) establish the critical ranking in (53) which is also made explicit by Takano (1996:124) in her analysis.

(53) *Place/Labial >> Ident-BR(son) >> *Place/Coronal

The complete ranking shown in the tableau in (52) handles CVC reduplication in Ponapean in a uniform way without a ranking paradox. The key insight of my analysis is that reduplication invovles a candidate-to-candidate faithfulness mediated through the sympathetic faithfulness constraint. This allows us to capture the nasal substitution in (25) and (31) as a single generalization expressed in (33). Nasal substitution can be understood by reference to the moraic structure of the fully prosodified featurally faithful reduplicative candidate. As a consequence, the reduplication of /tit/ in (37) is different from the reduplication of /net/ in (41) since the moraic structure of the faithful candidate for /RED + tit/ in (37a) is different from that of /RED + net/ in (39a). In the next section, evidence for the analysis of reduplication comes from the different pattern of nasal substitution found in suffixation.

5. Nasal Substitution in Suffixation.

Given the final ranking for the constraints involved in reduplication shown in (52) with a focus on the specific ranking shown in (53), interesting evidence that the reduplication analysis does crucially make use of the notion of sympathy comes from the pattern of consonant alternations that occur with suffixation. As noted by researchers such as Rehg 1984, Blevins & Garrett 1992, and Lombardi 1996 among others, the pattern of consonant alternation that is witnessed over a suffix boundary is somewhat different than what occurs in reduplication. Consider the data in (54) involving two coronals over a suffix boundary and (55) involving two identical noncoronals over a suffix boundary. Nasal substitution fails to occur in (54) but does occur in (55). (In addition to the underlying and phonetic forms in (54) and (55), I also indicated a nonoccurring alternative form that might be expected to occur. "V" indicates an epenthetic vowel.)

(54) Suffixation with two coronals in contact

	Underlying Representation	Phonetic Representation	Non-occurring Alternative	Gloss
a.	/pɔt + ti/	[pɔtVti]	[pɔnti]	plant downwards
b.	/lus + saŋ/	[lusVsaŋ][23]	[lunsaŋ]	jump from
c.	/sɛl + saŋ/	[sɛlVsaŋ]	[sɛnsaŋ]	tied from

(55) Suffixation with two identical noncoronals in contact

	Underlying Representation	Phonetic Representation	Non-occurring Alternative	Gloss
a.	/isik + ki/	[isiŋki]	[isikVki	burn with
b.	/sarep + pene/	[sarempene]	[sarepVpene]	scrape together

Previous researchers have commented on the lack of nasal substitution in (54) when two coronals come together over a suffix boundary. This

[23] Both Rehg & Sohl 1982 and Lombardi 1986 note the optional pronunciation of [lussaŋ] without the epenthetic vowel. I follow Lombardi 1996 in viewing this variability as having some kind of separate account since optionality does not occur with the other related phenomena under consideration. The analysis that I present captures the variant [lusVsaŋ] as well as the other data in (54) and (55).

absence of nasal substitution in (54) is unexpected given its occurrence in the reduplicated forms in (25) and (31), relevant examples of which are repeated in (56).

(56) Reduplication with nasal substitution (involving coronals)

	Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Corres.	Gloss
a.	tit	/RED + tit/	tit.tit	[tin.tit]	Base [t] - Red [n]	build wall
b.	sas	/RED + sas/	sas.sas	[san.sas]	Base [s] - Red [n]	stagger
c.	sɛl	/RED + sɛl/	sɛl.sɛl	[sɛn.sɛl]	Base [l] - Red [n]	tied

On the other hand, nasal substitution among identical noncoronals in (55) is exactly like what was found in reduplication as the data in (57) show.

(57) Reduplication with nasal substitution (identical noncoronals)

	Base	Under. Redup.	Faith. Redup.	Surface Redup.	Consonant Corres.	Gloss
a.	kak	/RED + kak/	kak.kak	[kaŋ.kak]	Base [k] - Red[ŋ]	able
b.	pap	/RED + pap/	pap.pap	[pam.pap]	Base [p] - Red [m]	swim

The question that arises is why nasal substitution occurs between coronals in reduplication as in (56) but not between them in suffixation. Research in a rule based approach has taken one of two strategies, namely, explicit reference to boundaries in the rules or reference to lexical versus post-lexical phonology. Rehg 1984 formulates two different rules of nasal substitution where reference is made to different boundary symbols which distinguish reduplication from suffixation. Blevins & Garrett 1992 also posit two different rules of nasal substitution. The one accounting for nasal substitution in reduplication is stated generally to include coronals and is viewed as being a lexical rule. The other nasal substitution rule accounting for suffixation does not include coronals and is viewed as being a postlexical rule. Both these types of analyses can be criticized, Rehg for explicit reference to boundaries in rules, and Blevins & Garrett 1992 for viewing suffixation as being postlexical.[24] Moreover, both analyses make

[24] Evidence that suffixation is not postlexical comes from the fact that there is actually a slightly different pattern of alternations that occurs over a word boundary. For example, when one word ends in a coronal obstruent and the next word begins with an identical coronal obstruent, there is no nasal substitution or vowel epenthesis. On the other hand, when one word ends in a noncoronal obstruent and the next word begins with the identical noncoronal obstruent, nasal substitution can occur. Given that the phonology between words is different than what is found within words as reflected by suffixation and reduplication, I assume that it would be preferable for an analysis to account for both suffixation and reduplication in a unified manner, since these both involve phonology that

explicit reference to rule ordering.

As seen by comparing suffixation in (54) and (55) with reduplication in (56) and (57) there is a different pattern of nasal substitution. The specific difference is that between (56) and (54). Recall from the analysis of reduplication that nasal substitution of a coronal in (56) only occurs when the sympathetic candidate (indicated by the column marked 'Faithful Reduplication') has a moraic coda. As discussed earlier and as seen from the tableaux in (36) and (37) nasal substitution occurs so as to maintain faithfulness to the consonantal moraic structure of the prosodified sympathetic candidate. That is, the actual output of reduplicated forms like that in (56) must respect the flowered constraint, Max-μ_C❀. If the sympathetic candidate does not have a moraic consonant then this constraint is not relevant as can be seen from the tableau in (52). Given this, the pattern of suffixation in (54) and (55) is expected on my analysis because suffixation does not involve a sympathetic candidate. This is because the designated faithfulness constraint, Ident-BR, is irrelevant for forms that do not have the reduplicative morpheme RED in the input. Suffixation does not include a reduplicative component so there is no sympathetic candidate. Consequently, the flowered constraint plays no role given the absence of a sympathetic candidate.

The constraint ranking that has been established for reduplication as seen by the tableau in (52), readily accounts for the suffixation pattern in (54) and (55). As mentioned, the evaluation for suffixal candidates would not include reference to a sympathetic candidate nor to a flowered constraint. Relevant tableaux for suffixation are provided in (58)-(60). The tableaux reflect the ranking shown in the tableau in (52) with the following minor modifications. The tableaux in (58)-(60) do not show the flowered constraint since there is no sympathetic candidate; I have added reference to Dorsal to the constraint *Place/Labial since labials and velars clearly pattern together with respect to this constraint (cf. Lombardi 1996); finally, I have added the relevant constraint Ident-IO(sonorant) and have grouped it with the constraint Ident-BR(sonorant). Both these constraints must be dominated by *Place/Labial and *Place/Dorsal. (In the tableaux, output candidates are shown with their moraic structure and their consonantal place nodes; the moraic structure of the input is shown. Also, I have not shown the constraint Ident-BR (nasal) for space reasons since it is not relevant for the evaluation.)

occurs within words. If there is something that is equivalent to postlexical phonology in Optimality Theory it would probably only be motivated by looking at the phonology that holds over word boundaries or the phrasal phonology. This issue remains for further research within Optimality Theory.

(58) /isik + ki/ --- [isiŋki] 'burn with' (55a)

μ μ μ 			 /i s i k + k i/	*μ[-son] CodaCon SyllCon	*Place/ Dorsal *Place/ Labial	Ident- BR (son)	Ident- IO (son)	RED = CVC	*Place/ Coro- nal
μ μ μ μ |		| a. i.si k.k i | V C D	*! *μ[-son]	* (Dor)				*
μ μ μ μ |		| ☞ b. i.si ŋ.ki | V C D		* (Dor)		*		*
μ μ μ μ |		| c. i.si.kV.ki |	| C D D		**! (Dor)				*

The tableau in (58) shows the suffixation case of (55) where there is two identical noncoronals over a suffix boundary. In this situation, as seen by the tableau in (58), the candidate with nasal substitution surfaces. In (58), the candidate that is phonemically faithful to its input, (58a) is eliminated because it violates undominated *μ[-son].[25] The choice then is between (58b) with nasal substitution or (58c) with vowel epenthesis. (58b) violates Ident-IO(sonorant) which (58c) respects. However, (58b) better satisfies the higher ranked constraint *Place/Dorsal since it only has one violation of it whereas (58c) has two violations of it. Nasal substitution occurs in this form in order to satisfy *Place/Dorsal. Consequently, (58b) is the winning candidate.

The following tableau in (59) shows the suffixation case of (54a) where

[25] If there were a candidate like (58a) but without the geminate being moraic, this would violate an undominated constraint requiring geminates to be moraic.

there are two identical coronal consonants over a suffix boundary.[26]

(59) /pɔt + ti/ --- [pɔtVti] 'plant downwards' (54a)

μ μ /p ɔ t + t i/	*μ[-son] CodaCon SyllCon	*Place/ Dorsal *Place/ Labial	Ident-BR (son)	Ident-IO (son)	RED = CVC	*Place/ Coro-nal
μμ μ a. p ɔ t. t i L C	*! *μ[-son]	* (Lab)				*
μ μ μ b. p ɔ n. t i L C		* (Lab)		*!		*
μ μ μ ☞ c. pɔ. tV.ti L C C		* (Lab)				**

As shown in the tableau in (59), the candidate with nasal substitution, (59b) does not win. Because *Place/Coronal is low-ranked, the better satisfaction of this constraint by (57b) is not relevant. (57b) fatally

26 An important point to remember regarding the nature of the input is that input sequences are not fully syllabified. This is a standard assumption in Optimality Theory. The only prosodic structure of input morphemes would be their lexical moraic structure. Specifically, following Hayes 1989 an input short vowel would have one mora, a long vowel two moras, and a geminate consonant a single mora. Input forms for /isik + ki/ 'burn with' and /pòt + ti/ 'tied from' are shown in the upper lefthand corner of (58) and (59) respectively and are repeated in (i) and (ii) below.

μ μ μ μ μ
(i) /i s i k + k i/ (ii) /p ɔ t + t i/

Since the input is not a fully prosodified output, the sequence /k + k/ in (i) and /t + t/ in (ii) are not represented as being moraic. This is different than the sympathetic candidate in (37a) where the geminate is shown as being moraic. But since a sympathetic candidate is a possible output it is necessarily syllabified. The input to (37), though, is also not syllabified. The standard assumption that input sequences are not fully syllabified is critical for the analysis in this paper and thus argues against the intuitive view of Golston (1996) where all input forms are syllabified.

violates Ident-IO(sonorant) which is higher-ranked than *Place/Coronal. It violates this constraint because the [n] of the output corresponds to /t/ in the input. The winning candidate in (59c) does not violate this constraint. (59c) is the winning candidate despite its multiple violations of low ranked *Place/Coronal.

The tableau in (60) shows the suffixation case of (54c) where the input sequence has a lateral followed by an /s/ over the suffix boundary. The winning candidate has an inserted vowel between the lateral and the [s]. Nasal substitution does not occur. This suggests that an additional constraint plays a role in this form, namely Ident-IO(liquid). The constraint is shown along with the Ident-IO(sonorant) constraint in the tableau.

(60) /sɛl + saŋ/ --- [sɛlVsaŋ] 'tied from' (54c)

μ μ /s ɛ l + s a ŋ/	*μ[-son] CodCon SyllCon	*Place/ Dorsal *Place/ Labial	Ident-BR (son)	Ident-IO (son)/ (liq)	RED = CVC	*Place/ Coro-nal
μ μ μ a. s ɛ l.s a ŋ C C D	*! CodCon	* (Dor)				**
μ μ μ b. s ɛ n.s a ŋ C C D		* (Dor)		*!		**
μ μ μ ☞ c. sɛ.lV.saŋ C C C D		* (Dor)				***

The tableau in (60) is very similar to (59). Even though (60b) with nasal substitution better satisfies *Place/Coronal, it nonetheless loses out to because it violates the higher ranking Ident-IO(liquid) constraint which the winning candidate respects.

As a final observation regarding suffixation, the analysis above correctly predicts that if there is an input sequence of /n + s/ or /n + t/ the sequence would surface faithfully as [ns] or [nt], respectively. An example is /cen + saŋ/ 'congealed from' which is realized as [censaŋ]. The tableau for this form is provided in (61).

(61) /cen + saŋ/ --- [censaŋ] 'congealed from'

μ μ | | /c e n + s a ŋ/	*μ[-son] CodCon SyllCon	*Place/ Dorsal *Place/ Labial	Ident- BR (son)	Ident- IO (son)/ (liq)	RED = CVC	*Place/ Coro- nal
μ μ μ | | | ☞ a. c e n.s a ŋ | V | C C D		* (Dor)				**
μ μ μ | | | b. c e. n V.s a ŋ | | | | C C C D		* (Dor)				***!

In the tableau in (61) both candidates obey the relevant faithfulness constraints. Since neither of the candidates fatally violate any of the higher-ranked constraints, the candidate with the assimilated coronal cluster in (61a) is preferred because it better satisfies low ranked *Place/Coronal.

Thus, the constraint ranking established for reduplication in (52), readily extends to cases of suffixation. The difference between the two demonstrates the crucial role of the sympathetic candidate for reduplication. The presence of a sympathetic candidate is the only difference between reduplication and suffixation in Ponapean. The flowered constraint requiring faithfulness to the sympathetic candidate with respect to consonantal moraic structure is critical. It is this constraint that selects, for example, the output [tin.tit] for the reduplication /tit/ 'build a wall' rather than [ti.tV.tit] which would be predicted based on the suffixation pattern in (54a). The consonantal mora that is preserved in an output like [tin.tit] does not come from the input but is a property of the prosodified sympathetic candidate. Suffixation involves the same constraint ranking as reduplication except that there is no sympathetic candidate since suffixation does not involve the reduplicative affix RED. The analysis offered here is

superior to previous ones. It is superior to the analyses of Takano 1996 and Spaelti 1997 in that it handles all the reduplication data without any ranking paradox, and it is superior to the analyses sketched in Blevins & Garret 1992 and Lombardi 1996 in that it uniformly handles both reduplication and suffixation without reference to levels or rules.[27]

6. Summary and Conclusion.

This paper began by presenting McCarthy's 1997 proposal for handling data that in rule-based approaches involved opaque rule interactions such as counterbleeding. Such data have been problematic for Optimality Theory since they seem to require reference to an intermediate form that is neither the underlying input nor an occurring output. McCarthy's proposal for such cases redefines opacity as the influence of a designated candidate on the output through sympathy. In other words, there is candidate-to-candidate faithfulness between the designated (or sympathetic) candidate and the other candidates. A specific designated faithfulness constraint that is ranked amongst the other constraints relates the output candidates to the sympathetic candidate. It was shown in Section 1 how McCarthy's proposal is able to handle the equivalent of counterbleeding rule interaction in Optimality Theory.

Given McCarthy's optimality theoretic definition of opacity as the influence of a designated candidate upon the output, one would expect to find cases of opacity that are not just "translations" of the counterbleeding type relation of rule-based approaches. One would necessarily expect to find such cases since an optimality-theoretic notion of opacity should be independent of rule-based notions like counterbleeding. The purpose of this paper was to show that Ponapean CVC reduplication is just such a case.

---

27 One analysis of Ponapean reduplication and suffixation that I have not mentioned is the government phonology analysis sketched in Rice & Avery 1987. Their analysis is similar to the analysis that I offer only in that it takes into consideration moraic structure. In their derivations, Rice & Avery assign a mora to all word-internal codas. Thus, in the reduplication of /net/ 'smell' as [netVnet] there is an intermediate stage net.net in which the internal coda would be moraic. This is different from the sympathetic candidate in (41) where the internal coda would not be moraic because it is neither a sonorant nor a geminate. In Rice & Avery's analysis, whether or not an internal coda surfaces as moraic depends on if it is governed by the following onset. If it is governed then it surfaces as moraic (with no epenthesis). For the following onset to govern the coda, the onset must not have more sonority than the coda and it must be made at the same place of articulation. While Rice & Avery's analysis is quite insightful, it does have a couple of shortcomings. One problem is that it requires somewhat different licensing conditions for reduplication and suffixation in order to account for the difference in nasal substitution (or lack of it) between reduplication as in (56) and suffixation as in (54). A second problem is that the reduplication of /m^{w}op^w/ 'out of breath' as [m^{w}om^w.m^{w}op^w] is unexpected given that in the intermediate form of the derivation, *m^{w}op^w.m^{w}op^w*, the internal coda would not be governed by the following onset since that onset is more sonorous than the coda.

The Ponapaean problem is a well-studied one. Earlier analyses made reference to boundaries of lexical phonology to distinguish reduplication from suffixation. More recent studies within Optimality Theory such as Takano 1996 and Spaelti 1997 are able to handle reduplication and suffixation together, but are unable to account for the different patterns found within reduplication. As discussed in Section 3, particularly problematic for these analyses is the distinction between the reduplication of /net/ 'smell' as [ne.tV.net] and /tit/ 'build a wall' as [tin.tit]. The unexpected case in Takano's analysis is the latter since a base phoneme /t/ is not expected to have a nasal correspondent in the reduplicant. The basic insight of the analysis that I offer in Section 4 comes from the generalization that the base phoneme /t/ only corresponds to [n] if in a featurally faithful reduplication it would be a geminate. A featurally faithful reduplication of /tit/ would be [tit.tit] while that of /net/ would be [net.net]. Given the evidence that geminates are moraic, the output of the reduplication of /tit/, namely [tin.tit], is able to preserve the moraic character of the geminate while at the same time respecting the high-ranking constraint that a coda cannot be an obstruent. The generalization makes reference to a prosodified form (e.g., [tit.tit]) that is neither the underlying input nor an actual output, yet it crucially influence the actual output. Thus, the main proposal of this paper is that Ponapean reduplication constitutes a case where there is candidate-to-candidate faithfulness through sympathy. There is no need for an intermediate form or derivational steps. Ponapean reduplication constitutes an example of optimality-theoretic opacity in the sense of McCarthy 1997 though, as discussed in Section 4, it does not translate into a counterbleeding relation in a rule-based approach. This provides evidence that the notion of opacity developed by McCarthy 1997 is independent of rule-based notions.

In Section 4 I showed how the analysis involving opacity is able to account for all the CVC reduplication data without getting entangled into the ranking paradoxes that beset the analyses of Takano 1996 and Spaelti 1997. Specific issues arose in the presentation of the analysis that called for discussion. One issue involved determining the exact nature of the designated or sympathetic candidate that effects the output. While the criteria put forward by Ito & Mester 1997, that the sympathetic candidate should be one that both matches the sympathetic faithfulness constraint and best satisfies the rest of the constraint system, an uncertainty arose regarding the sympathetic candidate for the reduplication of /net/. Specifically, in the sympathetic form [net.net], should the coda [t] at the end of the first syllable be moraic or not? Either choice would involve a violation of an undominated constraint. This suggests that certain details on how sympathetic candidates are selected still need to be worked out.

Another important issue that arose out of the analysis that I presented concerned the issue of consonantal moraic structure. As discussed at the end of Section 2, the actual surface data in Ponapean is quite clear as to what consonants can be moraic. Since only sonorant consonants can appear in codas (ignoring a word-final consonant), it would seem natural that only sonorant elements can be moraic in Ponapean. Such sonority restrictions on moraic structure are not unexpected given work in moraic phonology such as that of Zec 1988, 1995. Given this, the problem of the moraification of the sympathetic candidate [tit.tit] for the reduplication of /tit/ is quite interesting. A major observation of the paper is that such forms act as if the consonant is moraic. However, we have just observed that obstruents are not moraic in Ponapean. This, though, seems to be superceded by a requirement that geminates must be moraic. Such a requirement is interesting in light of the dispute on geminate consonants. Sherer 1994 and Davis 1994, 1999 argue for their moraicity. Tranel 1991 argues against it. The Ponapean reduplicative pattern reflected by the reduplication of /tit/ as [tin.tit] constitutes an interesting argument for the moraicity of geminates because it requires that in the sympathetic candidate, [tit.tit], the geminate [t] be moraic. By referring to the sympathetic candidate, we see that the reduplicative output of [tin.tit] is being faithful to the moraic structure of the geminate while at the same time satisfying the undominated constraint that surface obstruents cannot be moraic. There is no need for an intermediate stage in a derivation like in (29).

Finally, in Section 5, I show how the analysis developed for reduplication readily extends unproblematically to the cases of suffixation. The only difference between reduplication and suffixation is that suffixation does not involve opacity. That is, there is no sympathetic candidate in suffixation and, consequently, the sympathetic constraint that relates output candidates to the sympathetic candidate plays no role. This is seen by the example of the input /pɔt+ti/ 'plant downwards' which surfaces as [pɔtVti] with an epenthetic vowel rather than as *[pɔnti]. In /pɔt+ti/ there is no geminate consonant in the input morphemes, nor is there a sympathetic candidate like [pɔt.ti] which would be fully prosodified with a geminate (i.e., moraic) consonant. As shown in (59), the output [pɔtVti] results from the normal constraint ranking of the language. No sympathetic candidate is involved in suffixation. In conclusion, the analysis offerred here not only accounts for the varied patterns of Ponapean CVC reduplication and suffixation in a unified manner, it also provides striking evidence for McCarthy's proposal regarding the nature of opacity in Optimality Theory.

References

Agbayani, Brian, and Naomi Harada (eds.) 1996. Proceedings of the south western optimality theory workshop. (*UCI Working Papers in Linguistics*, 2.) Irvine CA: Irvine Linguistics Student Association.

Archangeli, Diana, and Keiichiro Suzuki. 1996. Yokuts templates: Correspondence neither to input nor output. In Agbayani and Harada 1996, 17-28.

Bat-El, Outi. 1996. Selecting the best of the worst: The grammar of Hebrew blends. *Phonology* 13, 283-328.

Beckman, Jill, Laura Walsh, and Suzanne Urbanczyk (eds.) 1995. Papers in optimality theory (*University of Massachusetts Occasional Papers*, 18.) Amherst, MA: Graduate Linguistic Student Association.

Benua, Laura. 1995. Identity effects in morphological truncation. In Beckman et al. 1995, 77-136.

Blevins, Juliette. 1994. A place for lateral in the feature geometry. *Journal of Linguistics* 30, 301-348.

Blevins, Juliette, and Andrew Garrett. 1992. Ponapean nasal substitution: New evidence for rhinoglottophilia. *Berkeley Linguistics Society* 18, 2-20.

Bromberger, Sylvain and Morris Halle. 1989. Why phonology is different. *Linguistic Inquiry* 20, 51-70.

Clements, George N. 1985. The problem of transfer in nonlinear phonology. *Cornell Working Papers in Linguistics* 7, 1-36.

Clements, George N., and Samuel J. Keyser. 1983. *CV Phonology*. Cambridge, MA: MIT Press.

Davis, Stuart. 1989. The location of the feature [continuant] in feature geometry. *Lingua* 78, 1-22.

Davis, Stuart. 1994. Geminate consonants in moraic phonology. *West Coast Conference on Formal Linguistics* 13, 32-45.

Davis, Stuart. 1995. Some matters regarding the derivational residue. Paper presented at the Conference on the Derivational Residue in Phonology, Tilburg University.

Davis, Stuart. 1999. On the moraic representation of underlying geminates: evidence from prosodic morphology. In Van der Hulst et al. 1999, 39-61.

Davis, Stuart, and Seung-Hoon Shin. 1997. Is there a syllable contact constraint? Poster paper presented at the Hopkins Optimality Workshop, Baltimore.

Downing, Laura. 1994. SiSwati verbal reduplication and the theory of generalized alignmnent, *Northeastern Linguistic Society* 24, 81-95.

Eulenberg, Alex. 1996. Sonority constraints on Kazakh affixes. Bloomington, IN: Indiana University, MS.

Golston, Chris. 1996. Direct optimality theory: Representation as pure markedness. *Language* 72, 713-748.

Goodman, Beverly. 1995. Features in Ponapean phonology. Ithaca, NY: Cornell University dissertation.

Halle, Morris, and William Idsardi. 1995. /r/, hypercorrection and the elsewhere condition. Paper presented at the Workshop on Derivations and Constraints in Phonology, University of Essex.

Hammond, Michael. 1997. Vowel quantity and syllabification in English. *Language* 73, 1-17.

Hayes, Bruce. 1989. Compensatory lengthening in moraic phonology, *Linguistic Inquiry* 20, 253-306.

Idsardi, William. 1996. Maximizing a "minimalist" argument. Newark, Delaware: University of Delaware, MS.

Inkelas, Sharon and Young-mee Yu Cho. 1993. Inalterability as pre-specification, *Language* 69, 529-574

Ito, Junko. 1986. Syllable theory in prosodic phonology. Amherst, MA: University of Massachusetts dissertation.

Ito, Junko, and Armin Mester. 1997. Prosodic interludes and sympathy effects: Examples from Germanic phonology. Paper presented at the Hopkins Optimality Theory Workshop, Baltimore.

Ito, Junko, Armin Mester, and Jaye Padgett. 1995. Licensing and under-specification in optimality theory. *Linguistic Inquiry* 26, 571-613.

Karvonen, Daniel, and Adam Sherman. 1997. Opacity in Icelandic revisited: A sympathy account.Santa Cruz, CA: University of California at Santa Cruz, MS.

Kiparsky, Paul. 1973. Abstractness, opacity, and global rules. *Three Dimensions of Linguistic Theory*, ed. by Osamu Fujimura, 1-136. Tokyo: Taikusha.

Kiyomi, Setsuko and Stuart Davis. 1992. Verb reduplication in Swati. *African Languages and Cultures* 5, 113-124.

Levin, Juliette. 1985. A metrical theory of syllabicity. Cambridge, MA: MIT dissertation.

Lombardi. Linda. 1995. Positional faithfulness and the phonology of voicing in optimality theory. College Park, MD: University of Maryland, MS.

Lombardi, Linda. 1996. Postlexical rules and the status of privative features. *Phonology* 13, 1-38.

McCarthy, John. 1995. Remarks on phonological opacity in optimality theory. Amherst, MA: University of Massachusetts, MS.

McCarthy, John. 1997. Sympathy and phonological opacity. Paper presented at the Hopkins Optimality Theory Workshop, Baltimore.

McCarthy, John, and Alan Prince. 1986. Prosodic morphology. Amherst, MA and Waltham, MA: University of Massachusetts and Brandeis University, MS.

McCarthy, John, and Alan Prince. 1993. Prosodic morphology 1. Amherst, MA and New Brunswick, NJ: University of Massachusetts and Rutgers University, MS.

McCarthy, John, and Alan Prince. 1994. Prosodic morphology: An overview. Paper presented at the OTS/HIL Workshop on Prosodic Morphology. University of Utrecht.

McCarthy, John, and Alan Prince. 1995. Faithfulness and reduplicative identity. In Beckman et al. 1995, 249-384.

Ní Chiosáin, Máire. 1995. Prosodic well-formedness and sonority constraints: Epenthesis in Irish. Paper presented at Holland Institute of Linguistics, Phonology (HILP) 2, Amsterdam.

Padgett, Jaye. 1994. Stricture and nasal place assimilation. *Natural Language and Linguistic Theory* 12.465-513

Pater, Joe. 1999. Austronesian nasal substitution and other NC effects. In Van der Hulst et al. 1999, 310-343.

Prince, Alan. 1997. Endogenous constraints on optimality theory. Paper presented at the Hopkins Optimality Theory Workshop, Baltimore.

Prince, Alan, and Paul Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. New Brunswick, NJ and Boulder CO: Rutgers University and University of Colorado, MS.

Rehg, Kenneth. 1984. Nasal substitution rules in Ponapean. *Studies in Micronesian Lingusistics*, ed. by Byron Bender, 317-337. Canberra: Australian National University.

Rehg, Kenneth, and Damian Sohl. 1981. *Ponapean Reference Grammar.* Honululu: University of Hawaii Press.

Rice, Keren, and Peter Avery. 1987. Underspecification and reduplication in Ponapean. Paper presented at the Annual Meeting of the Linguistic Society of America, San Francisco.

Rose, Sharon. 1997. Epenthesis and syllable contact: Pooling violations. Paper presented at the Southwest Workshop on Optimality Theory 3, UCLA, Los Angeles.

Selkirk, Elisabeth. 1990. A two root theory of length. Papers in Phonology (*University of Massachusetts Occasional Papers*, 14), ed. by Elaine Dunlap and Jaye Padgett, 123-171. Amherst, MA: Graduate Linguistic Student Association.

Sherer, Timothy. 1994. Prosodic phonotactics. Amherst, MA: University of Massachusetts dissertation.

Shin, Seung-Hoon. 1997. Constraints within and between syllables: Syllable licensing and contact in optimality theory. Bloomington, IN:

Indiana University dissertation.

Smolensky, Paul. 1997. Constraint interaction in generative grammar II: Local conjunction or random rules in universal grammar. Paper presented at the Hopkins Optimality Theory Workshop, Baltimore.

Spaelti, Philip. 1997. Dimensions of variation in multi-pattern reduplication. Santa Cruz, CA: University of California at Santa Cruz dissertation.

Takano, Michie. 1996. Coronal consonants in Ponapean revisited. In Agbayani and Harada 1996, 113-127.

Tranel, Bernard. 1991. CVC light syllables, geminates and moraic theory. *Phonology* 8, 291-302.

Van der Hulst, Harry, René Kager, and Wim Zonneveld (eds.) 1999. *The Prosody-Morphology Interface*. Cambridge: Cambridge University Press.

Vennemann, Theo. 1988. *Preference Laws for Syllable Structure.* Berlin: Mouton de Gruyter.

Zec, Draga. 1988. Sonority constraints on prosodic structure. Stanford, CA: Stanford University dissertation.

Zec, Draga. 1995. Sonority constraints on syllable structure. *Phonology* 12, 85-129.

Department of Linguistics
Memorial Hall 322
1021 East Third Street
Indiana University
Bloomington, Indiana 47405
USA