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Syllable recycling reduplication:
A specific result of a comprehensive theory of infixing reduplication

Philip Spaelti

In some dialects of West Tarangan, many reduplicated forms have the reduplication incorporated into an existing syllable. This can be explained, without stipulation, by the theory of infixing reduplication proposed in Spaelti (1997). This explanation has the advantage of also providing an account, in terms of different constraint ranking, of the variation between dialects that show this pattern, and those that do not.

1. Introduction

A basic tenet of Prosodic Morphology is the following

(1) Prosodic Morphology Hypothesis (Prince & McCarthy1986)
Templates are defined in terms of the authentic units of prosody: mora (μ), syllable (σ), foot (Ft), prosodic word(Prwd)

The following type of data is problematic for this hypothesis:

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(2) *Rebi West Tarangan* (Nivens 1993)

ta'puran	**tar'puran**	'middle'
ta'puran	**tarpuran**	'middle'
du'bɛm-na	**dum'bɛm**	'seven'
bi'tɛm-na	**bim'tɛmna**	'small-3s'
ga-'let	**gat'let**	'relative-male' = 'bachelor'
***bi'nuk**	**bik'nuk**	'ankle'
ɛ-la'jir	**ɛlar'jir**	's-white'

(3)

gar'kɔwna	**garkɔw'kɔwna**	'orphaned-3s'
pay'lawa-na	**paylaw'lawana**	'friendly-3s'

A number of points to note here: the reduplication is infixing, it always places the reduplicant before the main stress, and in many forms the reduplicant consists of only a single consonant. This single consonant always forms the coda of the pre-stress syllable.

There are two problems for the hypothesis in (1):

— The reduplicant is not a prosodic constituent. It regularly combines with base material already present (syllable recycling)

— The size of the reduplicant varies. This variation is prosodically conditioned.

In this paper I will show that the prosodic theory of infixation proposed in Spaelti (1997, 1998) can explain this pattern straightforwardly. What's more it will also show how the difference between the pattern seen in Rebi, and that of closely related dialects of West Tarangan, can be explained as a simple change in constraint ranking.

2. A prosodic theory of infixing reduplication

2.1 Affix to the Optimal Word

The pattern of reduplication in Rebi WT belongs to a class of systems of reduplication where the reduplication is always found immediately before the main stressed syllable. This pattern has also been referred to as 'affix to foot' (Broselow & McCarthy 1983). One notable fact about this pattern is that, while it is very common with reduplication, it is virtually non-existent with regular affixation. This difference can be related to the fact that in reduplication the definition of the base is flexible in a way not seen with regular affixation. Thus reduplication seeks as its base, the 'Optimal Word' of the language (cf. the 'Minimal Word' of McCarthy & Prince 1986). As demonstrated in Spaelti (1997), this Optimal Word can be derived from the interaction of three conflicting demands on the base of reduplication. These three requirements, which make up the central parts of the analysis, are listed in (4).

(4) Affix to the Optimal Word (Spaelti 1997)

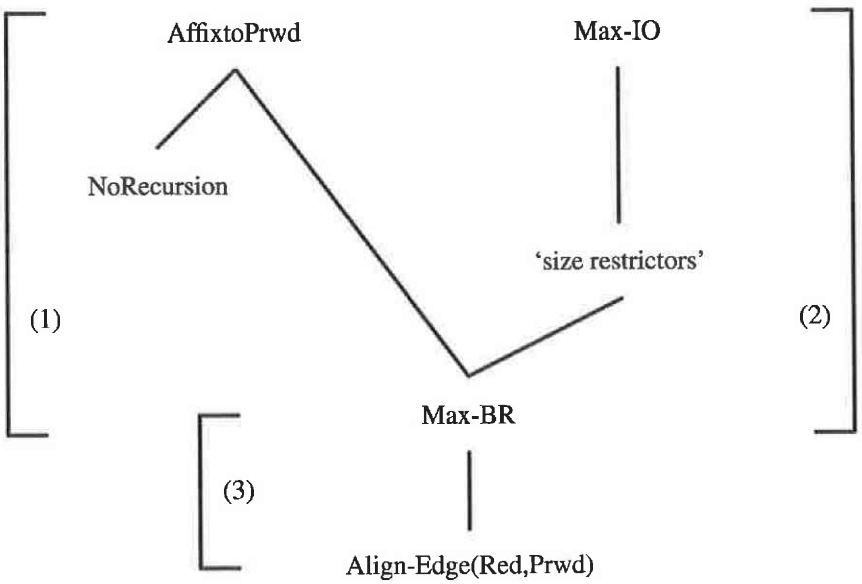
1. base = prosodic word
2. size restriction (imposed on the reduplicant)
3. base minimization

Each of these 3 parts can be explained through constraint interaction. The nexus of these interactions is the constraint Max-BR.

(5) Max-BR
'every element of the base must have a copy (in the reduplicant)'

The general effect of this constraint is to force total copying. However as McCarthy & Prince (1995) have shown, constraints on the reduplicant/base correspondence relation can also have 'back copying' effects. For Max-BR, this effect can be formulated as 'the base should only contain elements that are copied,' and this will result in as short a base as possible. In the general ranking schema (6) the three interacting parts have been marked.

(6) General Ranking Schema for 'Affix to Optimal Word'

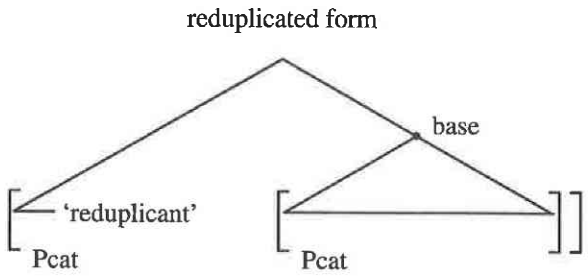


Sub-ranking (1) expresses the idea that the base must form a prosodic word. Since the base is dynamically defined by the action of Max-BR, AffixtoPrwd must outrank

Max-BR in order to guarantee its effect. Sub-ranking (2) captures the fact that the reduplication is partial. This ranking is an instantiation of the general 'Emergence of the Unmarked' ranking schema (McCarthy & Prince 1994). Sub-ranking (3) forms a balance between the base minimizing effect of Max-BR, and the requirement that the reduplication be peripheral. As long as Max-BR dominates the alignment constraint, base minimization wins out, and the reduplication is infixed.

The assumption about reduplication that is most important for this analysis is that reduplication is a prosodic phenomenon. In particular, this means that both the base, and the reduplicated form are prosodic constituents, and neither one of these necessarily matches a morphological constituent. In fact, typically, in infixing reduplication, they will not.

(7)



On the other hand, in contrast to much related work in OT, no particular assumptions are made about the status of the reduplicant, and I will henceforth assume that the reduplicant does not form a constituent of any kind.

2.2 Size restriction as Emergence of the Unmarked

A particularity of reduplication is that it is often subject to constraints not visibly operative in the regular phonology. The most notable of these in many systems are size restrictions which lead to partial reduplication (often called 'templates'). Elaborating on a general proposal by McCarthy & Prince (1994 et seq.), it is proposed in Spaelti (1997) that all special reduplication phonology can be analysed in terms of a single constraint ranking schema, known as 'Emergence of the Unmarked.' The instantiation of this schema which gives rise to partial reduplication is shown in (8).

(8) Max-IO $\gg$ 'size restrictors' $\gg$ Max-BR

This schema is still underspecified. We still need to know what 'size restrictors' are. The answer is that they are the constraints that determine the rhythmic pattern of

the language, i.e. the constraints responsible for footing and syllabification. There are a variety of possibilities, but the constraints that will figure in this analysis are given in (9), where they are categorized according to their notable effects.

(9) a. Minimizers:
Align-Edge(σ, Prwd) "AllσEdge" (Mester & Padgett 1994)

b. Delimiters:
Align-Edge(MCat, PCat)

The constraint in (9a) was first proposed in Mester & Padgett (1994) to account for directional syllabification. This constraint has a minimizing effect on prosodic structure, and, in the context of reduplication, it will favour forms where the reduplication is no larger than a syllable. The constraint family in (9b) I have called 'delimiters.' Constraints from this family ensure that the reduplicated form and the base are prosodically complete. To understand how they operate it is necessary to lay out in more detail my assumptions about alignment.

2.3 Vertical Alignment and the Prosodic Hierarchy

In OT alignment between categories is figured gradiently. Under standard assumptions the amount of misalignment is defined in terms of the segmental string constituting the categories. This type of alignment can be called HORIZONTAL ALIGNMENT. (McCarthy & Prince 1993).

An alternative proposal (Spaelti 1994; McCarthy & Prince 1994b) suggests that the amount of misalignment be defined in terms of the hierarchy of categories that constitute the category. We can call this type of alignment VERTICAL ALIGNMENT.

Let us assume the fairly standard hierarchy in (10). With this hierarchy we can now define alignment to the prosodic word through the harmonic scale in (11).

(10) Prosodic Hierarchy

(11) Align-Edge(Cat, Prwd) ≻ Align-Edge(Cat, Foot) ≻ Align-Edge(Cat, σ)

This harmonic scale can be read informally as: 'align to a prosodic word, if not a prosodic word then a foot, if not a foot...,' etc. But following Prince & Smolensky (1993), we know that a harmonic scale is equivalent to a constraint ranking. Thus the scale in (11) translates to the ranking in (12).

(12) Align-Edge(Cat, σ) ≫ Align-Edge(Cat, Foot) ≫ Align-Edge(Cat, Prwd)

The ranking in (12) is still only a schema. Following the logic of the argument so far we know that any category that is mapped to a prosodic word will be subject to an instantiation of (12). In the case of reduplication, there are two relevant categories: the base, and the reduplicated form, as seen in diagram (7) above. Thus we have the following two constraint hierarchies:

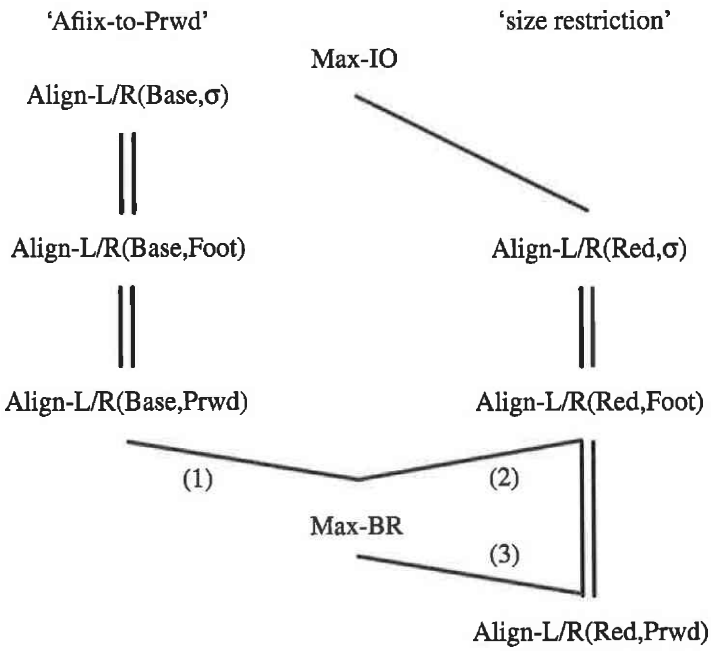
(13) 'Affix to Prwd' = Align the base to a prosodic word
Align-L/R(Base, σ) ≫ Align-L/R(Base, Foot) ≫ Align-L/R(Base, Prwd)

(14) 'reduplication-delimiter' = Align the reduplicated form to a prosodic word
Align-L/R(Red, σ) ≫ Align-L/R(Red, Foot) ≫ Align-L/R(Red, Prwd)

Hierarchy (13) says that the base should be a prosodic constituent, i.e., it must be phonologically 'complete', while (14) makes the equivalent claim for the reduplicated form. A noteworthy consequence of (14) is that since it requires the reduplicated form to match the constituent that contains it, it will force the reduplicant to be peripheral. As this affects both edges, it will force reduplication to copy outside in, in accordance with 'Marantz's Generalization' (see Spaelti 1997; cf. also Nelson 1998). Thus (14) couples two of the three parts of the Affix to the Optimal Word ranking schema: the size restriction, and base minimization. This means that infixing reduplication of the 'affix to stress' type, comes about exactly when Max-BR intervenes at the appropriate place in delimiter hierarchy (14).

Putting all the pieces in place, we get the elaborated ranking schema in (15).

(15) Ranking Schema for 'Affix to Optimal Word' (refined)



Here the crucial rankings which constitute the three parts of the analysis are indicated in the diagram. Also the two alignment hierarchies have been emphasized in order to make them clearly visible.

This completes the general overview of Spaelti (1997). We now turn to see how a specific implementation of this ranking can account for the reduplication facts in several West Tarangan dialects.

3. Variation in West Tarangan reduplication

Nivens (1992, 1993) describes the complex system of reduplication encountered in several dialects of West Tarangan. All of these languages share a number of properties. For one, reduplication is partial. Also with longer forms reduplication is infixing. Furthermore all dialects have several patterns of reduplication, with the distribution of the patterns determined by prosodic conditions. However, the form of the patterns, and their distribution, varies from one dialect to the next.

3.1 Rebi West Tarangan

In Rebi, there are three patterns of reduplication: a light syllable form (16a), a heavy syllable form (16b), and a third form that consists of only a single consonant (16c). The consonant pattern is always realized with the consonant as a coda attaching to a light syllable in pre-stress position. By its very nature the third pattern can only occur when the reduplication is infixing. As (17) makes evident, reduplication in Rebi is generally infixing, as in all other dialects of West Tarangan.

(16)

a.	**'dɔam**	**dɔ'dɔam**	'pound'
b.	**'lɔpay**	**lɔp'lɔpay**	'cold'
c.	**bi'tɛm-na**	**bi'tɛmna**	'small-3s'

(17)

a.	**ta'puran**	**tar'puran**	'middle' (cf. Popj. **tapor'poran**)
	du'bɛm-na	**dum'bɛm**	'seven'
b.	**pay'lawa-na**	**paylaw'lawana**	'friendly-3s'

The three patterns are distributed as follows. The light syllable pattern occurs when there is no copyable consonant immediately following the stressed vowel in the base (16a). On the other hand, if a consonant is available, then the reduplication will prefer a heavy syllable (16b). With the infixing forms the single consonant pattern is chosen if the pre-stress syllable is light (17a), otherwise a heavy syllable pattern is the outcome (17b). Since the single consonant pattern always joins with a preexisting syllable, I call it syllable recycling. Overall the heavy syllable pattern is the optimal pattern. Analytically this is explained by simultaneously requiring the pattern to be both a syllable and a foot.

Descriptively the pattern distribution of Rebi can be summarized as follows. The reduplication is never more than a syllable. If possible it will form a full syllable, or even a foot. Formally the same thing can be stated in the form of the constraint ranking in (18). The full set of properties seen in Rebi reduplication is given in table (19).

(18) Max-IO ≫ **AllσRight** ≫ Align-L(Red, σ) ≫ Align-L(Red, Foot) ≫ Max-BR

(19)

Rebi West Tarangan reduplication	
alloduples:	CVC, CV, ...C
syllable recycling:	yes

3.2 Popjetur West Tarangan

The Popjetur dialect has only two patterns of reduplication: light syllable (20a) and heavy (20b). This is true even with infixing forms. As (21) shows, in the type of form where Rebi shows the syllable recycling pattern, Popjetur has a heavy syllable. Thus the reduplicant is always a complete prosodic constitutent in Popjetur.

(20) a. **'dɔam** **dɔ'dɔam** 'pound'
'raray **ra'raray** 'hot'
du'bɛm **dubɛ'bɛm** 'seven'
b. **'kɛy** **kɛy'kɛy** 'wood'
'borar **bor'borar** 'small'

(21) **ta'poran** **tapor'poran** 'middle' (cf. Rebi **tar'puran**)

Summarizing the Popjetur pattern distribution we find that the reduplication is always a syllable, but never more than a syllable. Preferably both a syllable and a foot, i.e. a heavy syllable. These facts are formalized in ranking (22), and the facts are captured in table (23). If we compare the constraint ranking in (22) with that for Rebi, we notice that the only difference is in the relevant ranking of the constraint AllσRight.

(22) Max-IO ≫ Align-L(Red, σ) ≫ **AllσRight** ≫ Align-L(Red, Foot) ≫ Max-BR

(23)

Popjetur West Tarangan reduplication	
alloduples:	CVC, CV
syllable recycling:	no

3.3 Kalar-Kalar West Tarangan

The third and last dialect that I will consider is Kalar-Kalar. This dialect differs from Popjetur in permitting a disyllabic footsize pattern of reduplication in addition to the two syllablesize ones. Examples are shown below.

(24) a. **ka'nɔir-na** **kanɔ'nɔirna** 'hungry.3s-3s'
i-'bɛbar **ibɛ'bɛbar** '3s-afraid'
b. **'tɔp** **tɔp'tɔp** 'short'
***gɔrsa** **gɔr'gɔrsa** 'coconut stem'
c. **'borar-na** **bora'borarna** 'small-3s'
i-'kɔlat **kɔla'kɔlat** '3s-spoon'

(25) **ma'nɛlay** **manɛl'nɛlay** 'sour' ***mal'nɛlay**
ɛ-la'jir **ɛlajir'jir** '3s-white' ***ɛlar'jir**

Kalar-Kalar also avoids the syllable recycling reduplication pattern, as can be seen in (25), and the reduplication always adds the size of a full prosodic constituent. The distribution of the patterns in (24) is complicated (see Nivens 1993 for discussion and Spaelti 1996 for an analysis). Relevant to the discussion here is only that since Kalar-Kalar permits reduplication to add more than a single syllable the minimizer constraint, AllσRight, must be demoted even further, below the delimiter that favors footsize reduplication. Descriptively this can be stated as: the reduplicant is at least a syllable, and

if possible a foot, but preferably no more than a syllable. The constraint ranking for this pattern is given below, together with a table summarizing the facts.

(26) Max-IO, Align-L(Red, σ) ≫ Align-L(Red, Foot) ≫ **AllσRight** ≫ Max-BR

(27)

Kalar-Kalar West Tarangan reduplication	
alloduples:	CVCV, CVC, CV
syllable recycling:	no

3.4 Summary of the West Tarangan reduplication facts

The three West Tarangan dialects Rebi, Popjetur, and Kalar-Kalar each have a slightly different set of reduplication patterns. In outline form it has been discussed how we can account for these patterns by varying the ranking of the prosodic minimizer constraint, AllσRight, with respect to the delimiter hierarchy in (14). For these constraints to work together as size restrictors in reduplication, they must also be embedded in the Emergence of the Unmarked ranking schema (8). The diagram in (28) provides a complete overview of the rankings for the three dialects.

(28) Analysis of the reduplicant shape variation

	Rebi	Popjetur	Kalar-Kalar
Max-IO			
.....	**AllσRight**		
Align-Left (Red, σ)			
.....		**AllσRight**	
Align-Left (Red, Foot)			
.....			**AllσRight**
Max-BR			
Align-Left (Red, Prwd)			

So far the argument for these constraint rankings has been made on purely conceptual grounds. In the next section I will show that the rankings in (28) do indeed correctly account for the facts in each of the dialects.

4. Analysis

I will now show how the analysis developped in section 3 correctly accounts for some of the critical data of West Tarangan. I will concentrate on the forms that show infixation, especially those forms which give rise to the syllable recycling pattern in Rebi.

4.1 Rebi West Tarangan

In Rebi the syllable recycling pattern was seen to arise with forms that have an open syllable preceding the main stress in their unreduplicated form. A typical example is

the form **ta'puran** 'middle', which reduplicates as **tar'puran**. The difference between the constraint rankings for the three dialects lies in the position of the 'minimizer', AllσR. And as tableau (29) demonstrates, the high ranking of this constraint forces syllable recycling.

(29)

Rebi	/red+tapuran/	A-LB,ω	AllσR	A-LR,σ	A-LR,Φ	MxBR	A-LR,ω
a. ☞	(tar)[pu.ran]		σσσ	*	*	pu an	ta
b.	ta(pun)(ran)	*!	σσσ	*	*	ra	tapu
c.	ta(pur)[pu.ran]		σσσσ!			an	ta
d.	(tapu)[pu.ran]		σσσσ!		*	ran	ta
e.	ta(pu.ra)[pu.ran]		σσσσσ!			n	ta
f.	(tap)[ta(pu.ran)]		σσσσ!			uran	

Candidate (b) shows the importance of the AffixtoPrwd part of the analysis (see 13, 15), since without this the base would truly be minimized. This constraint guarantees that the base include at least the stress foot. It is this requirement that gives rise to the 'affix to stress' effect seen with infixing reduplication.

Once this candidate has been eliminated, we can see right away how the syllable recycling pattern arises. Including the reduplication in preexisting structure, minimizes the number of syllables. Thus in this type of language, reduplication 'fills up' existing prosodic structure before creating more.

Next we can consider the case of **pay'lawa-na** 'friendly-3s', with the reduplicated form **paylaw'lawana**. As this type of form shows, if the pre-stress syllable is already maximally filled, reduplication adds a full heavy syllable. This is also correctly predicted from the ranking established in section (3), as tableau (30) makes clear.

(30)

Rebi	/red+paylawa-na/	A-LB,ω	AllσR	A-LR,σ	A-LR,Φ	MxBR	A-LR,ω
a. ☞	pay(law)[la.wa.na]		σσσσσ			ana	pay
b.	pay.la.wa(na.na)	*!	σσσσσ				paylawa
c.	pa(yaw)[la.wa.na]		σσσσσ	*!	*	l ana	pay
d.	pay.la[la.wa.na]		σσσσσ		*!	wana	pay
e.	pay(la.wa)[la.wa.na]		σσσσσσ!			na	pay
f.	(pay)[pay.la.wa.na]		σσσσσ			lawana!	

Candidate (a) is the winner. It beats candidate (b) which does not have a base that properly meets the prosodic word requirement. Our winning form adds a syllable, but any candidate that adds more will fail. Such is the fate of (e) which adds a disyllabic foot. Candidate (c) shows that the minimization requirement that drives this

pattern cannot be figured in a segmental — or even a *Struc — fashion. Otherwise we would expect the reduplication to recycle other base material if possible. Candidate (c) recruits a consonant to help fill the extra syllable. But this causes it to violate Align-L(Red,σ). Candidate (d) also violates a delimiter constraint, but this time the one that favors footsize reduplication. Finally the competition between the winner and candidate (f) shows how an appropriate ranking of Max-BR leads to infixation. Candidate (f), which has the reduplication in peripheral position, fares much worse than the winner on Max-BR. Constraint Align-L(Red,Prwd) favors (f), but it is ranked too low to affect the outcome.

4.2 Popjetur West Tarangan

Next we turn to Popjetur. The crucial case to consider is of course the form that corresponds to the syllable recycling case in Rebi. The Popjetur form **ta'poran** 'middle' reduplicates with a heavy syllable reduplicant, leading to a form **tapor'poran**. As tableau (31) shows, the higher ranked delimiter constraint prevents syllable recycling.

(31)

Popjetur /red+taporan/	A-LB,ω	A-LR,σ	AllσR	A-LR,Φ	MxBR	A-LR,ω
a. (tar)[po.ran]		*!	σσσ	*	po an	ta
b. (ta.po)(ra.ran)	*!		σσσσ		n	tapo
c. ☞ ta(por)[po.ran]			σσσσ		an	ta
d. (ta.po)[po.ran]			σσσσ	*!	ran	ta
e. ta(po.ra)[po.ran]			σσσσσ!		n	ta
f. (tap)[ta(po.ran)]			σσσσ		oran!	

The difference in ranking between the minimzer constraint AllσRight and the delimiter constraint Align-L(Red,σ) means that simply minimizing the number of syllables is not enough in Popjetur. Thus (a) which is the syllable recycling candidate fails. Once we've added a syllable, the remainder of the ranking favors a maximally filled heavy syllable, as in (c), rather than a more minimal light syllable (d). And again the competition between the infixing winner and candidate (f) with peripheral reduplication shows how the base minimizing effect of Max-BR favors infixation.

4.3 Kalar-Kalar West Tarangan

Finally we have the case of Kalar-Kalar. Here the outcome of reduplicating the form **ta'poran** 'middle' is different again, resulting in the form **tapora'poran**. In this case the even lower ranking of AllσR makes disyllabic reduplication possible.

(32)

Kalar-K. /red+taporan/	A-LB,ω	A-LR,σ	A-LR,Φ	MxBR	AllσR	A-LR,ω
a. (tar)[po.ran]		*!	*	po an	σσσ	ta
b. (ta.po)(ra.ran)	*!			n	σσσσ	tapo
c. ta(por)[po.ran]				an!	σσσσ	ta
d. (ta.po)[po.ran]			*!	ran	σσσσ	ta
e. ☞ ta(po.ra)[po.ran]				n	σσσσσ	ta
f. (tap)[ta(po.ran)]				oran!	σσσσ	
g. (ta.po)[ta(po.ran)]				ran!	σσσσσ	

5. Conclusion

— Affix to Optimal Word account of infixing reduplication naturally predicts the existence of syllable recycling

— Variation in West Tarangan accounted for by reranking of the constraints involved in the analysis

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