Opacity in Tundra Nenets

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1. Introduction[1]

The analysis of opaque relations presents a problem to classic Optimality Theory (OT) (Prince and Smolensky 1993, McCarthy and Prince 1993), inherently a surface-oriented theory. Many different proposals have been made to integrate the analysis of opacity into OT. In this paper, we address the problem of opacity in Tundra Nenets (TN), a Uralic (Samoyedic) language spoken in Arctic Russia and Northern Siberia.

TN has a complex system of alternations, many of which interact opaquely, and provides a good test case for the current theories of opacity. In this paper, we are concerned with the categorical metrical vowel deletion that represents a case of self-counterfeeding opacity, and its interaction with vowel deletion in final syllables. We show that among OT approaches to opacity, there are some that cannot handle metrical vowel deletion in TN in principle (Targeted Constraints, OT-CC), some that can but are undesirable on theoretical grounds (Local Constraint Conjunction, in particular, self-conjunction), and the full analysis of the data still requires combining two different theories (Stratal OT and Comparative Markedness).

2. Rhythmic vowel deletion: the non-iterativity problem

Among TN vowels /ʌ i iˑ u uˑ e o a/, /ʌ/ is the only vowel that regularly alternates with zero. The examples in (1) illustrate the generalization that /ʌ/ is always deleted in the final syllable and in even syllables counting from the left edge of the word, and it is never deleted in two syllables in a row.[2]

(1)		'knife'		'house'	
	NOM.SG.ABS	/xʌrʌ/	[xʌr]	/xarʌtʌ/[3]	[xarʌd]
	2SG.POSS	/xʌrʌ-rʌ/	[xʌrʌr]	/xarʌtʌ-rʌ/	[xardʌr]
	3SG.POSS	/xʌrʌ-ta/	[xʌrda]	/xarʌtʌ-ta/	[xardʌda]

The underlying /ʌ/ obligatorily surfaces within clusters of three consonants when such a cluster violates the Sonority Sequencing Principle (SSP) (2)a-b and within clusters of four consonants (2)c.

(2) a. /nultʌnʌ-s^{j}ʌ/ [nult.nʌs^{j}] 'to stop'
stop-MOD.GER

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[2] Note that /ʌ/ deletes in both open and closed final syllables. The discussion of the examples of the latter type is outside of the scope of this paper since vowel deletion in final closed syllables interacts with glottal alternations.

[3] Postvocalic obstruent voicing is responsible for the observed t~d alternations: in rule form, p p^{j} t t^{j} → [+voiced] / V __. In the following discussion, we ignore the effects of postvocalic voicing since it is irrelevant to the topic of the investigation.

 Proceedings of the 27th West Coast Conference on Formal Linguistics, ed. Natasha Abner and Jason Bishop, 274-282. Somerville, MA: Cascadilla Proceedings Project.

b. /sʌsʌ-rka-ʌ/ [sʌ.sʌr.kaː] *[sʌsrkaː] 'he is stronger'[4]
strong-COMPAR-3SG

c. /nercʌmla-ʌ/ [nercʌmlaː] *[nercmlaː] 'he tears'
tear-3SG

To account for vowel deletion in TN, we make the following analytical assumptions. First, to account for obligatory vowel deletion in the last syllable, we assume that the final syllable is extrametrical. Second, to account for deletion in even syllables, we analyze TN foot type as syllabic trochee: even syllables are weak positions.[5] On the basis of the data in (2) and the analysis presented in Staroverov (2006), we also argue that there are no null nuclei or degenerate syllables in TN: clusters that violate the SSP are indeed clusters (cf. the analyses of metrical vowel deletion with and without empty nuclei in Kager 1997, Kiparsky 2000, Jacobs 2004, Gouskova 2003, Blumenfeld 2006, McCarthy 2007, forthc.; see Salminen 1997 for a variant of a null-vowel analysis of TN).

To present the problem of metrical and extrametrical vowel deletion, we employ several uncontroversial and widely used metrical constraints, stated in (3)-(7). The constraints responsible for vowel deletion are listed in (8)-(9).

(3) NON-FINALITY: No foot is final in a prosodic word

(4) FT-BIN: feet are binary under syllabic analysis

(5) HEAD(EDNESS): Every prosodic constituent must have a head (Every prosodic word must contain at least one foot)

(6) PARSE-σ: syllables should be parsed into feet

(7) *CLASH: no adjacent stressed syllables

(8) *V-UNPARSED: no vowels in unparsed syllables

(9) *WEAKV: no vowels in weak positions

Additionally, the following faithfulness constraints find use in the analysis.[6]

(10) Max-ʌ: input ʌ should have an output correspondent

(11) Max-V[other than ʌ]: input V should have an output correspondent

(12) IdentV: input vowels are identical to their output correspondents in feature content

Since all grammatical words bear stress, HEADEDNESS is undominated. As was stated above, final syllables are extrametrical, and thus NON-FINALITY outranks PARSE-σ. As only /ʌ/ (the least sonorous vowel in TN) is affected by metrical deletion, the ranking in (13) holds. Note that below we compress Max-V[other than ʌ] and Ident-V into Faith-V.

(13) MAX-V >> *V-UNPARSED, *WEAKV >> MAX-ʌ
IDENTV >> MAX-ʌ

Forming a foot around /ʌ/ is not a solution to its being subject to deletion, giving evidence to the ranking in (14).

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[4] /ʌ/ is not deleted immediately following another vowel; the final long vowel is a result of vowel coalescence.

[5] TN stress is word-initial (Salminen 1997, Kavitskaya *under revision*, among others). We have no data to support the analysis of secondary stress in TN; this part of the analysis is based on the observation in Salminen (1997).

[6] Note that contra Gouskova (2003), we assume a differentiated MaxV hierarchy here. There are several possible analyses of differential syncope, such as the constraints of the type *Nuc/V (Gouskova 2003), differentiated markedness and differentiated faithfulness. Nothing in the present discussion hinges on the use of a particular analysis, and space does not permit the comparison of the three. However, differentiated faithfulness is compatible with different theories of opacity, while *Nuc/V might need to adhere to Stratal OT with metrified input to be able to explain why vowels do not delete in strong positions. Note also that *Nuc/V is not easily compatible with the results in McCarthy (forthc.) since such a constraint can operate before metrical structure assignment.

(14) *CLASH >> *WEAKV, *V-UNPARSED

Final vowel deletion does not improve on metrical well-formedness substantiating the ranking in (15).

(15) *V-UNPARSED, WEAKV >> NON-FIN, FT-BIN

The tableau in (16) shows the analysis for the word 'knife,' where the winner is correctly chosen on the basis of the constraints and ranking arguments presented. Metrical vowel deletion is correctly analyzed by the same ranking (17).[7]

(16) Analysis of the word *xar* 'knife'

xarʌ	HEAD	FAITH-V	*CLASH	*WEAKV	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ
(xarʌ)				*!		*			
(xa)rʌ					*!		*		*
(xa)(rʌ)			*!			*	**		
☞ (xar)						*	*	*	
xar	*!				*			*	*
(xa)ra		*!					*		*

(17) Analysis of the word *xarda* 'his knife'

xarʌda	HEAD	FAITH-V	*CLASH	*WEAKV	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ
(xarʌ)da				*!	*				*
☞(xarda)				*		*		*	
(xar)(da)			*!			*	**	*	
(xar)da					*		*!	*	*
(xa)(rʌ)(da)			*!*			*	***		
(xa)rʌda					**!		*		**

However, non-iterativity in vowel deletion, that is, the fact that vowels never delete in two syllables in a row, presents a problem for a standard OT analysis. On the assumption that footing is automatic and determined by the grammar, refooting happens with each iteration of vowel deletion. In the case of two consecutive ʌ's, such an analysis predicts that sometimes both of them will be deleted, as the choice of the incorrect winner in (18) demonstrates. The tableau in (18) provides an illustration of an opaque interaction: metrical vowel deletion fails to apply twice, counterfeeding itself.

(18) Failed standard OT analysis for the word *xardʌda* 'his house'

xarʌdʌda	HEAD	FAITH-V	*CLASH	*WEAKV	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ
(xarʌ)(dʌda)				**!		*			
(xarʌ)(dʌ)da				*!	*		*		*
(xardʌ)da ☹				*!	*			*	*
(xar)(dʌ)da			*!		*		**	*	*
(xar)(dʌda)			*!	*		*	*	*	
(xarʌd)da				*!	*			*	*
(xard)da					*		*!	**	*
☞ (xardda)[8]				*		*		**	

[7] The data do not allow to determine the relative ranking of NON-FIN and FT-BIN.

[8] Note that the consonant cluster in the winning candidate is well-formed in TN.

Moreover, metrical and extrametrical ʌ-deletions conspire to maintain the non-surface-based generalization with respect to non-iterativity. Even though both are applicable to the input *xarʌdʌ* 'house,' only the latter applies; again, two vowels in a row are never deleted.[9]

Tableau (19) demonstrates an unusual opacity problem: even though the two processes do not directly interact, the application of extrametrical ʌ-deletion prevents the application of metrical ʌ-deletion.

(19) Failed standard OT analysis of the word *xarʌd* 'house'

xarʌdʌ	HEAD	FAITH-V	*CLASH	*WEAKV	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ
(xarʌ)dʌ				*!	*				*
(xarʌ)(dʌ)				*!		*	*		
(xarʌd)				*!		*		*	
(xa)rʌd ☹					*!		*	*	*
(xardʌ)				*!		*		*	
(xar)dʌ					*!		*	*	*
☞ (xard)						*	*	**	

To summarize, the basic pattern of vowel deletion seems to point at predictable metrical structure. Null vowels or empty nuclei are not an option for an analysis of TN vowel deletion because, as was demonstrated earlier, vowel deletion respects sonority restrictions in clusters. In a standard OT architecture there is nothing that prevents refooting after the first application of vowel deletion. In turn, refooting predicts iterative vowel deletion, while the process is non-iterative. This non-iterativity can be treated as a special case of opacity.

In the next subsections we show how the existing theories of opacity would analyze this case. For the reasons of space, we will not discuss Sympathy (McCarthy 1999), Turbidity (Goldrick 2001), Contrast Preservation (Lubowicz 2003), and OO-correspondence (Benua 2000, Burzio 1999).

3. Analysis of TN opacity

3.1. OT with candidate chains (OT-CC) and Targeted Constraints (TCOT)

OT with candidate chains (McCarthy 2007, forthc.[10]) has been advocated as a theory that is able to capture all known cases of opacity. Within this theory, harmonic improvement proceeds from the input gradually. Each step improves harmony and introduces unfaithfulness. As a result, there is a candidate chain from input to output.

McCarthy (forthc.) outlines a solution to some of the problems mentioned in section 2. Deleting a vowel that can potentially surface as stressed is not an option in his theory, since both the deletion of the vowel and the removal of its stress are unfaithful operations, and two unfaithful operations cannot be performed at once. Thus, the gradualness requirement of harmonic serialism can be used to correctly analyze the cases like *xardʌda* (18) without any recourse to opacity.

However, the case of *xarʌd* 'house' (19) where the two deletion processes interact is problematic for OT-CC. To capture opacity, OT-CC makes use of a special family of Prec (precedence) constraints that evaluate candidate chains. Prec constraints require that faithfulness violations come in certain order. For instance, Prec(Id[nas], Max-V) requires that all processes that change the input feature [nas] occur before all processes that delete vowels. Prec constraints are only meaningful when the two processes that interact incur violations of different faithfulness constraints. However, this is not the

[9] An analysis referring to cluster conditions is not applicable to TN since the constraint *CC[-son +vd] relevant to the data in question finds no typological or theoretical support; cf. [taremgʌrt] 'and thus,' where the final *rt* cluster is well-formed (however, we are grateful to Colin Wilson for pointing out a possibility of this line of reasoning).

[10] The results in McCarthy (forthc.) are applicable to harmonic serialism of which OT-CC is a subclass.

case in TN since both metrical and extrametrical vowel deletion introduce violations of Max-ʌ. Nonetheless, the two processes interact opaquely.[11]

The prediction that OT-CC makes for opaque processes can be recast as in (20).

(20) To be able to interact opaquely, two processes should violate different faithfulness constraints.

This assumption is shared by another theory that has been applied to opacity – Targeted Constraints Theory (Wilson 2000). TCOT was introduced to account for contextual neutralization and opacity. In the domain of opacity, Wilson gives two ranking schemas: one for counterfeeding and one for counterbleeding. Crucially, on both schemas the two faithfulness constraints violated by the two processes interacting opaquely should be ranked separately. Hence, TCOT implies (20) and faces the problem illustrated in (19). Furthermore, TCOT does not provide a solution to the problem in (18) either, since the theory offers no special protection to the vowels that can surface as stressed.

3.2. Conjoined Constraints (C&C): the problem of self-conjunction

The mechanism of local constraint conjunction (Smolensky 1993, Ito&Mester 2003) provides a way to solve the problem of TN opacity. Interestingly, the conjoined constraint that could be employed in this case is exactly the kind of constraint that can be used to describe non-iterativity (Kaplan 2008). It is a self-conjoined constraint (Max-ʌ&Max-ʌ)$_\sigma$ that prohibits deletion in two syllables in a row (see Staroverov 2006 for details of the implementation of this constraint).

However, there are some theoretical problems with local self-conjunction in general and with (Max-ʌ&Max-ʌ)$_\sigma$ in particular. First, the domain of this self-conjoined constraint is an output syllable. However, determining the deleted vowel's affiliation to a particular output syllable is not trivial and defining the constraint on the input requires a stipulation that the domain is two adjacent syllables.

A more general problem posed by self-conjoined constraints is their ability to count. Roughly, if a constraint can be conjoined with itself once, nothing prohibits a triple self-conjunction, etc. This ability has been identified as problematic for instance by McCarthy (2003a) and Smolensky & Legendre (2006), since in general self-conjunction is able to penalize exactly *n* unfaithful operations but not *n-1*.

3.3. Stratal OT

In Stratal OT (Kiparsky 2000, forthc., Bermudez-Otero forthc.), it is assumed that the phonological grammar can be different at different levels of optimization. Levels or strata are tied with morphological structure.

A standard approach to metrical opacity in stratal OT is to postulate different metrical structure at different levels. It is assumed that at all the strata after the first one, the input is fully metrified (Jacobs 2004, Kiparsky 2000). This approach offers a possible solution to the problem with the example *xardʌda* 'his house' (18). To account for this example within Stratal OT, we need to assume that metrical vowel deletion is post-lexical, and that post-lexical footing differs from lexical one in that it allows for non-binary feet to be formed after vowel deletion. By promoting faithfulness to underlying prominence (MAX-PROM and DEP-PROM abbreviated as FAITH-PROM in the tableau (21))[12] and demoting *CLASH postlexically, this analysis can make (*xar*)(*dʌ*)*da* the optimal output for the input (*xarʌ*)(*dʌ*)*da.*

[11] As Adam Albright (p. c.) points out, one way to save the OT-CC analysis of TN would be to argue that metrical and extrametrical vowel deletion in fact violate different faithfulness constraints. This point needs further investigation under a broader theory of faithfulness.

[12] MAX-PROM penalizes deleting the input stress, and DEP-PROM penalizes inserting a stress that does not have an input correspondent.

(21) Stratal OT analysis of the word *xardʌda* 'his house' (post-lexical level)

(xarʌ)(dʌ)da	FAITH-V	FAITH-PROM	*WEAKV	*V-UNPARSED	*CLASH	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ
(xarʌ)(dʌda)			*!*			*			
(xarʌ)(dʌ)da			*!	*			*		*
(xardʌ)da		*!	*	*				*	*
☞(xar)(dʌ)da				*	*		**	*	*
(xar)(dʌda)		*!	*		*	*	*	*	
(xarʌd)da		*!	*	*				*	*
(xard)da		*!		*			*	**	*
(xardda)		*!	*			*		**	

However, this strategy does not work for the case of *xarʌd* (19) where metrical and extrametrical vowel deletions interact. To demonstrate this we have to consider two possibilities.

First, if metrical and extrametrical vowel deletions apply at the same level, stratal OT fares no better than standard OT. Both vowels are to be deleted in the input (*xarʌ*)*dʌ*, and it is unclear what could save one of the vowels.

Second, if extrametrical vowel deletion is ordered before metrical vowel deletion[13] (e.g., at the lexical level), then at an earlier level *WEAKV should be demoted below MAX-ʌ. This ranking predicts either (*xarʌd*) or *(xardʌ*) as the output of the lexical level for the input *xarʌdʌ*, as in (22).

(22) Failed stratal OT analysis of the word *xarʌd* 'house' (lexical level)

xarʌdʌ	HEAD	FAITH-V	*CLASH	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	*WEAKV	Parse-σ
(xarʌ)dʌ				*!				*	*
(xarʌ)(dʌ)					*!	*		*	
☞ (xarʌd)					*		*	*	
(xa)rʌd				*!		*	*		*
☞ (xardʌ)					*		*	*	
(xar)dʌ				*!		*	*		*
(xard)					*!	*	**		

(23) Comparison: stratal OT analysis of the word *xar* 'knife' (lexical level)

xarʌ	HEAD	FAITH-V	*CLASH	*V-UNPARSED	NON-FIN	FT-BIN	MAX-ʌ	*WEAKV	Parse-σ
☞(xarʌ)					*			*	
(xa)rʌ				*!		*			
(xar)					*	*!	*		

Even if we find a way to rule out *(xardʌ*) (e.g., by stipulating a different metrical system coming from the stem level), the comparison between (22) and (23) shows that the difference between the inputs (*xarʌ*) and (*xarʌd*) needs to be addressed post-lexically. We do not see a good way to explain why the vowel deletes in *xarʌ* yielding *xar* 'knife', but not in *xarʌd* 'house'[14].

3.4. Comparative markedness (CM)

Comparative Markedness (McCarthy 2003b) has been put forth as a theory that can capture many phenomena that had been problematic for OT before. In CM, the markedness violations of the

[13] The opposite ordering is not an option since metrical vowel deletion should be post-lexical to be able to cope with examples like (18).

[14] The difference cannot be attributed to the constraint against word-final vowels, since the consonant-final words also follow this pattern (though it is complicated by word-final alternations with the glottal stop). For instance, an input like *m^{j}atʌn* 'tent-GEN.SG' yields *m^{j}adʔ* with vowel deletion.

candidate under consideration are compared to those of the *fully faithful candidate* (FFC, the one that does not violate any faithfulness constraints). Markedness constraints (M) are split into M_{OLD} and M_{NEW} versions that can be ranked separately. M_{OLD} is violated if FFC also violates M. M_{NEW} is violated otherwise.

CM offers a temptingly elegant analysis of the form *xarʌd* 'house,' (19) vs. (24). On this analysis, *V-UNPARSED is split into old and new versions and only *V-UNPARSED$_{OLD}$ is ranked above MAX-ʌ.

(24) CM analysis of the word *xarʌd* 'house'

xarʌdʌ	FAITH-V	*CLASH	*WEAKV	*V-UNPARSED$_{OLD}$	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ	*V-UNPARSED$_{NEW}$
(xarʌ)dʌ - FFC			*!	*				*	
(xarʌ)(dʌ)			*!		*	*			
(xarʌd)			*!		*		*		
☞ (xa)rʌd						*	*	*	*
(xardʌ)			*!		*		*		
(xar)dʌ				*!		*	*	*	
(xard)					*!	*	**		

Note however, that in (24) the solution to vowel being in the weak position in the FFC is to make it unparsed rather than delete it. Thus, CM potentially incurs a too-many-solutions problem, as we do not expect such repairs on standard assumptions about syncope (Blumenfeld 2006, McCarthy forthc.).

This problem turns out to be real as we consider more TN examples. For instance, to handle *xardʌda* 'his house,' we could assume that old and new versions of *WEAKV are also ranked separately. *WEAKV$_{OLD}$ does not penalize the actual output form if it is parsed as *(xardʌ)da*. However, splitting both constraints favoring deletion does not yield the correct result for the simple case of *xar* 'knife' (25). Here, as in the previous cases, CM predicts that it is better to produce a marked metrical structure (since this structure is new w. r. t. FFC) instead of deleting the vowel. Notice that changing the FFC to *(xarʌ)* (by reranking) would not resolve the problem since it renders *(xa)rʌ* optimal.

(25) Failed CM analysis of the word *xar* 'knife'

xarʌ	HEAD	*CLASH	*WEAKV$_{OLD}$	*V-UNPARSED$_{OLD}$	NON-FIN	FT-BIN	MAX-ʌ	Parse-σ	*WEAK V$_{NEW}$	*V-UNPARSED$_{NEW}$
(xa)rʌ - FFC				*!	*					
☞ (xarʌ)					*			*		*
(xa)(rʌ)		*!			*	**				
☹ (xar)					*!	*	*			
xar	*!						*			

In summary, CM does not allow us to analyze all relevant cases. However, CM is successful at analyzing exactly those examples where Stratal OT and OT-CC fail. In the next section we develop an account of TN vowel deletion that combines the virtues of CM and Stratal OT.

3.5. Combining CM with Stratal OT

As we argued above, none of the theories (except for conjoined constraints that have specific problems) is able to account for our data. In this section, we suggest a solution that involves a combination of two theories.

First of all, it is worth noticing that CM is not easily combinable with OT-CC. The reason is that CM allows for the Duke-of-York derivations where a given faithfulness violation is first introduced and then removed. This kind of derivation destroys one of the virtues of harmonic serialism: chain convergence is no longer guaranteed. If A goes to B and B goes to A, then all inputs with A will yield an infinite harmonic serialism derivation: the system gets stuck in the A-B-A loop.

However, CM can be combined with Stratal OT to account for our data. On a joint account, the two cases of non-iterativity illustrated in (18) and (19) receive a different treatment. We assume that only one of the constraints driving deletion, namely the *V-UNPARSED, comes in the CM version. *WEAKV$_{OLD}$ and *WEAKV$_{NEW}$ are ranked together.

Non-iterativity of metrical vowel deletion receives a stratal explanation. At the postlexical level, where vowel deletion becomes applicable (formally, *WEAKV and *V-UNPARSED$_{OLD}$ are promoted above MAX-ʌ), only vowels in even syllables are targeted because the postlexical metrics differs from the lexical one: it preserves the input stress at the expense of violating *CLASH. The result of the tableau in (21) repeated here as (26) does not change if we split *V-UNPARSED into old and new versions since the decision is made by the constraints that are ranked higher than both versions of *V-UNPARSED.

(26) Stratal OT (with CM) analysis of the word *xardʌda* 'his house' (post-lexical level)

(xarʌ)(dʌ)da	FAITH-V	FAITH-PROM	*WEAKV	*V-UNPARSED$_{OLD}$	*CLASH	NON-FIN	FT-BIN	MAX-ʌ	PARSE-σ
(xarʌ)(dʌda)			*!*			*			
(xarʌ)(dʌ)da - FFC			*!	*			*		*
(xardʌ)da		*!	*	*				*	*
☞ (xar)(dʌ)da				*	*		**	*	*
(xar)(dʌda)		*!	*		*	*	*	*	
(xarʌd)da		*!	*	*				*	*
(xard)da		*!		*			*	**	*
(xardda)		*!	*			*		**	

The non-iterative interaction of metrical and extrametrical vowel deletion is analyzed as an effect of CM. Note that the ranking of FAITH-PROM and *CLASH in (26) does not affect the result in (24); hence, the Stratal OT analysis that assumes highly ranked FAITH-PROM and demoted *CLASH postlexically is compatible with (24). Crucially though, a stratal analysis presents an alternative explanation for non-iterativity of metrical vowel deletion and removes the need to split *WEAKV into old and new versions. With *WEAKV acting as an ordinary markedness constraint, the analysis of *xar* 'knife' is possible. The tableau in (27) illustrates this analysis and suggests that *CLASH should not be demoted lower that NON-FIN at the postlexical level.

(27) An analysis of the word *xar* 'knife' in Stratal OT with CM

(xa)rʌ	FAITH-V	FAITH-PROM	*WEAKV	*V-UNPARSED$_{OLD}$	*CLASH	NON FIN	FT-BIN	MAX-ʌ	PARSE-σ
(xa)rʌ - FFC				*!			*		*
(xarʌ)			*!			*			
(xa)(rʌ)					*!	*	**		
☞ (xar)						*	*	*	

4. Conclusion

To sum up, the existing opacity-oriented versions of OT cannot handle the TN data. The problem for OT-CC and targeted constraints is the assumption that to be able to interact opaquely, two processes should violate different faithfulness constraints (20). An interesting fact about harmonic serialism is that it cannot be easily combined with CM and hence requires its own solutions for the problems that CM solves.

Stratal OT's ability to distinguish between different footings at different levels appears as an advantage, but even this powerful mechanism is not powerful enough to deal with all cases. CM faces the too-many-solutions problem, predicting that violations may be repaired by making marked structures new.

Our general solution is thus to combine Stratal OT and CM. However, it is worth pointing out that this is not a principled solution, and the final model that we are led to is arguably too powerful (cf. McCarthy 2007 on OT-CC and many of the contributions to Theoretical Linguistics 29 on CM).

There are two possible solutions that could in fact allow us to coach our data in just one theory of opacity. First, assuming a more sophisticated theory of faithfulness could make the data analyzable in OT-CC terms. Note that if the vowels in final and penultimate syllables are protected by different faithfulness constraints, then the generalization (20) does not prevent (at least potentially) the Prec constraints from applying in this case. Second, a general analysis of apparent non-iterativity in metrical domain might be a way to go. However, both lines of research require more effort on a broader typological perspective and have to remain for the future.

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