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RULES VERSUS CONSTRAINTS IN PLAINS CREE PHONOLOGY

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This study points out various ways in which the optimality theoretic handling of opacity and abstractness, here in relation to absolute neutralization and palatalization in Plains Cree, suffers in comparison to an ordered rule approach to these phenomena.

1 Absolute neutralization and palatalization in Plains Cree

The surface vowel inventory of Plains Cree is not entirely symmetrical. While there are four distinct long vowels, there are only three distinct short ones:

(1) <i>surface vowel inventory</i>	<i>i</i>	<i>ii</i>	
	<i>o</i>		<i>oo</i>
		<i>ee</i>	
	<i>a</i>		<i>aa</i>

Wolfart (1973) assumes that the underlying vowel inventory is symmetrical, though, and contains an /e/, which merges with /i/ to surface as *i*. Other Algonquianists who have studied related languages with identical surface inventories have been likewise convinced that these languages have an underlying /e/ that undergoes absolute neutralization, yielding *i*. Piggott (1980) cites palatalization evidence in favor of /e/ to *i* absolute neutralization in the Odawa dialect of Ojibwa, for example. We find the same sort of evidence in Plains Cree, where there is a palatalization rule that turns /θ/ into *s* (a fricative varying from alveolar to alveopalatal, actually) in front of all instances of *ii* but only some instances of surface *i*:

(2) *palatalization of /θ/* (Dahlstrom 1991)

/ki - naaθ - <u>i</u> - n/	_	<i>kinaas̄in</i>	'you fetch me'
/ki - naaθ - <u>eti</u> - n/	_	<i>kinaat̄itin</i>	'I fetch you'

Any /θ/ that is not in the palatalization environment surfaces as *t*.

It makes sense to recognize those *i* that trigger palatalization as coming from /i/, and those *i* that fail to trigger palatalization as coming from /e/, as has been indicated in (2). Indeed, further support for positing this underlying distinction comes from data showing that exactly those /e/ that fail to trigger palatalization participate in coalescence, while exactly those /i/ that trigger palatalization resist coalescence:

(3) *coalescence* (Dahlstrom 1991)

/ki - peehtaw - i - n/ → *kipeehtawin* 'you hear me'
/ki - peehtaw - eti - n/ → *kipeehtatin* 'I hear you'

It so happens that Plains Cree also palatalizes underlying /t/. Once again, palatalization is sensitive to the underlying distinction between /e/ and /i/. Underlying /t/ becomes *c* (an alveolar to alveopalatal affricate) in front of /i/ and /ii/, but not in front of /e/ or /ee/:

(4) *palatalization of /t/* (Dahlstrom 1991)

/api - t - ik/ → *apicik* 'they are sitting [conjunct form]'

That palatalized /t/ surfaces as *c*, and not as *s*, motivates the assumption of an underlying distinction between /t/ and /θ/. As noted with respect to (2), abstract /θ/ undergoes absolute neutralization to surface as *t* when not palatalized. Underlying /t/, of course, also surfaces as *t* when not palatalized:

(5) *unpalatalized /t/* (Wolfart 1973)

/ni - sit - ehk/ → *nisitihk* 'on my foot'

The results of Plains Cree palatalization and intersecting patterns of absolute neutralization are summarized in (6):

(6) *summary* /...t - i.../ → ...ci... /...θ - i.../ → ...si...
 /...t - e.../ → ...ti... /...θ - e.../ → ...ti...

1.1 The rule-based account of opaque interactions in Plains Cree

An ordered rule analysis of these phenomena is very straightforward. The absolute neutralization of /e/ to *i* and of /θ/ to *t* both follow palatalization, resulting in counterfeeding:

(7) *ordered rule account*

	/...t - i.../	/...t - e.../	/...θ - i.../	/...θ - e.../	
→	...c - i...	--	...s - i...	--	(pal.)
→	--	...t - i...	--	...θ - i...	(abs. neut.)
→	--	--	--	...t - i...	(abs. neut.)
	...ci...	...ti...	...si...	...ti...	

Palatalization is opaque in Plains Cree in that we observe instances of surface *...ti...*, produced by absolute neutralization, which are not subject to palatalization despite their meeting the relevant structural description.

1.2 Optimality Theory and opacity in Plains Cree

Opacity is, by definition, the manifestation of anticonspiratorial relationships. In Plains Cree, one pattern, observed as palatalization, alters what would otherwise surface as *...ti...*. Another pattern, observed as absolute neutralization, creates surface *...ti...*. Opacity is an expected result of the ordered application of rules that share no common goal orientation, freeing them to do perverse things like counterfeed one another. But opacity is not an expected result of the optimality theoretic model, which stresses the homogeneity of output goals. Optimality Theory is tailor-made to deal with conspiracies, not anticonspiracies.¹

An optimality theoretic mechanism for handling opacity effects has, of course, been invented; opacity is so pervasive in segmental phonology that it could not go ignored. The correspondence approach to opacity advocated by McCarthy (1995) yields correct results in a number of cases where anticonspiratorial relationships hold. So let us explore an optimality theoretic analysis of Plains Cree opacity along the lines suggested by the correspondence approach.

A constraint against surface *e*, *NOSHORTE*, is well motivated in its conception even if, as we will see in a later section, its formulation is problematic. *NOSHORTE*, in concert with appropriate faithfulness constraints, enforces the absolute neutralization that accounts for the absence of *e* in Plains Cree's surface vowel inventory. We shall in addition to *NOSHORTE* assume another constraint that enforces absolute neutralization, *NOTHETA*. *NOTHETA*, in concert with lower ranked faithfulness constraints for place and continuancy features, enforces the absolute neutralization that accounts for the absence of surface *θ*.

The surface realization of underlying /...t - i.../ shows the need for a constraint NOTI. NOTI, in a first approximation, simply penalizes output candidates containing the string ...ti...²

(8) *palatalization of /t/ by NOTI*

/...t - i.../	NOTHETA	NOHORTE	NOTI	IDENT(CONT)	IDENT(PL)
...si...				*	*!
⊗ ...ci...					*
...ti...			*!		

Continuancy and place faithfulness constraints correctly choose a different optimal output candidate for underlying /...θ - i.../:

(9) *palatalization of /θ/ by NOTI*

/...θ - i.../	NOTHETA	NOHORTE	NOTI	IDENT(CONT)	IDENT(PL)
⊗ ...si...					*
...ci...				*	*!
...ti...			*!		

Trouble comes when output candidates for underlying /...t - e.../ are evaluated:

(10) *problem tableau*

/...t - e.../	NOTHETA	NOHORTE	NOTI	IDENT(CONT)	IDENT(PL)
...si...				*	*!
⊗ ...ci...					*
...ti...			*!		

Underlying /...t - e.../ actually surfaces as ...ti... But in (10), ...ti... has been ruled out for violating NOTI, and the incorrect ...ci... has been selected instead. In (11), the incorrect ...si... is selected, while ...ti... is again inappropriately ruled out for violating NOTI:

(11) *problem tableau*

/...θ - e.../	NOTHETA	NO SHORTE	NOTI	IDENT(CONT)	IDENT(PL)
⊗ ...si...					*
...ci...				*	*!
...ti...			*!		

Here is where the correspondence approach to opacity comes in.

Under the correspondence approach to opacity, the characteristics of the featural composition of affected and affecting segments are notated for level. Some characteristics are recognized as relevant in candidate evaluation only if they occur in the candidate's underlying representation, and others only if they obtain at the surface. Analogizing from comparable analyses presented in McCarthy (1995), the modification of NOTI to yield the opacity effects observed in Plains Cree requires a constraint that checks for the following mix of underlying and surface characteristics:

(12) NOTI *reconceived as* NOT(s)I_(UR)

NOT(s)I _(UR)	condition	level
α	(unpal'd) <i>t</i>	surface
β	V [+front, +high]	underlying
linear order	α > β	surface
adjacency	strict	surface

NOT(s)I_(UR) restricts the occurrence of a surface level unpalatalized *t* which is in front of a segment whose *underlying correspondent* is a [+high, +front] vowel. By thus introducing global power, NOT(s)I_(UR) seems to avoid the problems brought on by the original NOTI, which had no access to underlying representation.

With NOT(s)I_(UR) the optimal output candidate selected for underlying /...t - e.../ is now the correct one:

(13) *absolute neutralization of /e/, sidestepping palatalization*

/...t - e.../	NOTHETA	NOSHORTE	NOT(S)I(UR)	IDENT(CONT)	IDENT(PL)
...si...				*!	*
...ci...					*!
ᑭᑦ ...ti...					

And once we fix the extrinsic ranking of the faithfulness constraints for place and continuancy, the correct optimal candidate for underlying /...θ - e.../ is selected:³

(14) *absolute neutralization of /e/, sidestepping palatalization*

/...θ - e.../	NOTHETA	NOSHORTE	NOT(S)I(UR)	IDENT(PL)	IDENT(CONT)
...si...				*!	
...ci...				*!	*
ᑭᑦ ...ti...					*

In neither (13) nor (14) does ...ti... violate NOT(S)I(UR), because this structural constraint is not really interested in *output* structure after all; the surface characteristics of the vowel are completely ignored.

The introduction of global power into structural constraints, as opposed to confining globality to the faithfulness constraints, obscures insight into the obviously counterfeeding relationship typical of anticonspiratorial phonological processes. It is also an obvious compromise of Optimality Theory's advertised reliance on output goals. To make matters worse, the global power of NOT(S)I(UR) might still not be enough to account for what goes on in Plains Cree.

Unlike Dahlstrom (1991), Wolfart (1973) analyzes the Plains Cree 3pl suffix as /-k/, and the *i* triggering palatalization in words like the one in (15) as epenthetic:

(15) *palatalization of /t/ by epenthetic i*

/api - t̥ - k/ → *apicik* 'they are sitting [conjunct form]'

If Wolfart is right, and the triggering *i* is in fact epenthetic, then it is not present in underlying representation. This is nothing difficult for the rule-based analysis, which simply lets palatalization apply after epenthesis has taken place. But things are not so simple in the optimality theoretic analysis we have been exploring.

NOT_(S)I_(UR) fails to penalize an unpalatalized *t* if it is not next to a segment whose underlying correspondent is /i/. For the optimality theoretic analysis to get palatalization of a *t* that is in front of an *epenthetic* vowel *i* (while continuing to avoid the pitfalls of the original NOTI) a rather unsettling sort of constraint has to be formulated to take care of what NOT_(S)I_(UR) cannot:⁴

(16) *constraint for palatalizing /t/ in front of epenthetic i*

NOT _(S) C{C,#} _(UR)	condition	level
α	(unpal'd) <i>t</i>	surface
β	C{C,#}	underlying
linear order	$\alpha > \beta$	surface
adjacency	strict	underlying

NOT_(S)C{C,#}_(UR) does its trick by pushing globality into yet *another* dimension of analysis. NOT_(S)C{C,#}_(UR) penalizes an unpalatalized *t* whose underlying correspondent occurs in one specific instantiation of the more general environment into which syllable structure constraints motivate the epenthesis of *i*. That is, NOT_(S)C{C,#}_(UR) forces palatalization while looking ahead for other constraints to set up the context in which palatalization would most naturally take place.

Optimality Theory may eschew the up-front serialism of ordered rules, but we see from this example that the correspondence approach to opacity requires a suspiciously recursive exploitation of global power to be able to accomplish what is so elegantly captured in a derivation.

2 Absolute neutralization and the diacritic use of phonological features

If opacity effects such as naturally result from absolute neutralization challenge the explanatory adequacy of Optimality Theory, so too does the abstractness problem that accompanies most absolute neutralization analyses.

In Plains Cree, all /e/ become *i*. If such absolute neutralization means that underlying [-high] in the context of [-back] always changes to [+high] before surfacing, then this [-high] is being used, inappropriately, as a diacritic (Kiparsky 1968).

Nevertheless, as I have elsewhere argued with respect to Hungarian (Schmidt 1996a) and Basaa (Schmidt 1996b), an ordered rule approach incorporating a very principled version of underspecification makes it possible to construct absolute neutralization analyses in which there is neither reversal nor deletion of phonological feature specifications, and therefore no diacritic use made of them. But the optimality theoretic translation of this type of analysis severely

compromises Optimality Theory's advertised dissociation of repair strategies from constraints.

2.1 A rule-based account of absolute neutralization in Plains Cree

Given that length distinctions are a function of the association of vowel matrices to skeletal slots or mora nodes, Plains Cree needs employ only two phonological features to differentiate its four underlying vowel matrices:

(17) Plains Cree vowel matrices

	i/ii	e/ee	o/oo	a/aa
front	+	+		
high	+		+	

I assume a model of underspecification that uses monovalent features in a binary manner. Each feature may be either present or absent in a matrix. The matrices in (17) show all four logically possible combinations of the presence or absence of [+front] and [+high]. I follow Piggott (1980) in assuming that backness and height are the two relevant dimensions for a vowel system like this one. Because there is no other back vowel in Plains Cree that is higher than *o* or *oo*, we may safely characterize this vowel as phonologically [+high]. Piggott points out, incidentally, that /i/ and /o/ behave as a natural class with respect to a rule lowering word-final [+high] vowels in the Odawa dialect of Ojibwa.

Those matrices that emerge from the phonology without a [+front] specification will be *phonetically* interpreted as back, and those that emerge without [+high] will be *phonetically* interpreted as nonhigh. There seems no need to posit any *phonologically* overt [-front] or [-high] for Plains Cree.

As previously discussed, palatalization of /θ/ and of /t/ in Plains Cree takes place in the environment of /i/ and /ii/, but not in the environment of /e/ or /ee/, and so must be sensitive to the combination [+front, +high]. Of course, we still find instances of unpalatalized *t* (from either /θ/ or /t/) in the environment of surface *i*, due to a process of absolute neutralization, which turns all /e/ into *i*. This absolute neutralization, I propose, is effected by an immediately pre-phonetic feature-filling rule that supplies monomoraic [+front] matrices with [+high]:

(18) feature-filling rule

$0 \rightarrow [+high] / [+front]$ (short vowels only)	front	$\frac{e/}{+}$	→	front	$\frac{i}{+}$
	high	$\frac{}{+}$		high	$\frac{}{+}$

This analysis makes no diacritic use of any putative [-high] specification. There is no need to assume that a [-high] is what prevents palatalization from taking place in the environment of /e/ or /ee/. Palatalization just doesn't happen unless the triggering vowel is [+front, +high], and, in this analysis, /e/ and /ee/ are characterized only by [+front]. Eventually, the immediately pre-phonetic feature-filling rule illustrated in (8) supplies monomoraic [+front] matrices with [+high], accomplishing the absolute neutralization of /e/ to *i* by *feature-filling*, rather than by reversing or deleting a diacritic [-high] specification.⁵

2.2 Optimality Theory and abstractness in Plains Cree

The absolute neutralization of /e/ to *i* accounts for the absence of surface *e* in Plains Cree and, at the same time, for why some instances of surface *i* do not trigger palatalization. To accomplish the absolute neutralization of /e/ to *i* using Optimality Theory, it would seem we need an output constraint like *NOSHORTE*, penalizing surface *e*:

(19) *NOSHORTE* (*negative formulation*)

$$* \begin{array}{c} \mu \\ | \\ | \\ | \end{array} = \begin{array}{c} / \\ / \end{array}$$

[+front, -high]

Appropriate faithfulness constraints will also be needed to ensure that the optimal candidate generated from underlying /e/ is one that maintains its underlying monomoraic length and [+front] specification. The optimal candidate must comply with *NOSHORTE* only by sacrificing its [-high] specification.

As long as *NOSHORTE* is conceived of as a negative constraint, mention of [-high] in the formulation of *NOSHORTE* is unavoidable. Leaving mention of the height feature out of the formulation of *NOSHORTE* would not achieve the desired effect, as the constraint would then inappropriately penalize all monomoraic front vowels.⁶ Problem is, mention of [-high] in the formulation of *NOSHORTE* amounts to diacritic use of [-high]. A [-high] feature specification must characterize the underlying correspondent of all instances of surface *i* that are products of absolute neutralization via *NOSHORTE*, but putative [-high] is never seen in the surface matrices of the vowels affected by *NOSHORTE*, and seems to be otherwise phonologically inert in Plains Cree phonology.

In being forced to make diacritic use of [-high], the optimality theoretic analysis of absolute neutralization that expresses *NOSHORTE* as a negative constraint can be accused of excessive abstractness, and therefore suffers in comparison to the feature-filling rule analysis described in the previous section.

Diacritic use of [-high] can be avoided in the optimality theoretic analysis of Plains Cree absolute neutralization, but only if *NOSHORTE* is expressed as an if-then statement:

(20) NOSHORTE (*if-then formulation*)

if [+front] and monomoraic, then [+high]

This if-then formulation would allow those instances of surface *i* that fail to trigger palatalization to be underlyingly underspecified for height, just as they are in the previous section's feature-filling rule analysis, thus avoiding diacritic use of [-high]. The if-then expression of NOSHORTE, obviously a close analog of the feature-filling rule itself, runs very much counter to the spirit of Optimality Theory, though. To repair a matrix that might otherwise surface as the non-optimal vowel *e*, the if-then expression of NOSHORTE mandates the insertion of [+high]. Thus, unlike the negative formulation of NOSHORTE in (19), and not at all in keeping with the conceptual foundations of Optimality Theory, the if-then formulation of NOSHORTE in (20) prescribes a precise repair.

In short, with an optimality theoretic analysis of absolute neutralization, we either make diacritic use of a phonological feature specification, or we depart from the conceptual foundations of Optimality Theory by formulating structural constraints that dictate their own repairs.

3 So why not Optimality Theory?

We have seen that in order to handle opacity, Optimality Theory must countenance *globality* in candidate evaluation (i.e. sneak in *derivations*). And to get around abstractness, we have seen that Optimality Theory must formulate constraints that *prescribe precise repairs* (i.e. sneak in *rules*). Let's come clean. The most direct analysis of absolute neutralization and palatalization in Plains Cree is an ordered rule analysis.

If conceptual coherence and analytical elegance are what count toward explanatory adequacy, then the ordered rule model of segmental phonology should not be too hastily abandoned.

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¹ Significantly, most all the phonological conspiracies identified in the decades-old literature on that topic involve syllable structure as opposed to feature content (eg. Kisseberth 1970). For this and other reasons Optimality Theory is, I think, the best model of syllabification we have to date. But Optimality Theory's success in explaining syllable structure should not lead us to assume that it is an appropriate model of segmental phonology. Syllabification is very different from segmental phonology. Syllabification organizes segments into constituency relationships, while segmental phonology manipulates the content of segments. Syllable structure is predictable, while feature specification is not. Syllabification

has also been understood, even prior to the advent of Optimality Theory, to operate outside the rule-ordering mode. Schmidt (1992), in a view similar to that of Hayes (1989), describes syllabification as an "everywhere" algorithm that (optimally, I would now say) constructs syllable structure fresh each time for the segmental strings that result from each ordered rule application.

² As usual, dotted lines between columns indicate indeterminate or irrelevant dominance relationships among constraints.

³ If continuancy faithfulness remained higher ranked than place faithfulness, then ...*si*... would be selected as optimal.

Interestingly, the optimality theoretic perspective criticizes rule-based analyses for conflating constraint violations (= structural descriptions) and their repairs (= structural changes) into a single phonological statement (= rule). But rather than making any more general contribution, the extrinsic ranking of the faithfulness constraints in (14) plays *no other role* in the phonology of Plains Cree than to determine *exactly how to repair* violations of NOTHETA.

⁴ Or else epenthetic vowels must be stipulated to count as underlying, as in Cole & Kisseberth's (1995) analysis of Yawelmani. See, however, Archangeli & Suzuki's (1996) argument that such a stipulation actually fails to account for the Yawelmani facts.

⁵ The absolute neutralization of /θ/ to *t* can be likewise effected by an immediately pre-phonetic feature-filling rule supplying all [+dental] matrices with [+stop]: 0 → [+stop] / [+dental]. Consonant matrices that emerge from the phonology without a [+dental] specification will be phonetically interpreted as nondental, and those that emerge without [+stop] will be interpreted as continuant, there being no phonologically overt [-dental] or [-stop] feature specifications in Plains Cree. As for palatalization, it might be analyzed as involving the displacement of [+dental] in front of a [+front, +high] vowel segment.

⁶ Intended explicit reference to the *absence* of a height feature, or explicit reference to [0 high], is at the very least a questionable tactic, and would in any case be equivalent to the mention of [-high].

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