St'át'imcets /-miṅ/ transitivising suffix alternations: A case for paradigm leveling?

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The alternation of the transitivising suffix /-miṅ/ in St'át'imcets, an Interior Salish language, involves an interaction between the phonetics-phonology interface and morpho-phonology. The suffix /-miṅ/ alternates between glottalised and non-glottalised depending on the presence or absence of stress. Cyclical effects, in the form of neutralisation in a context where it is not predicted, occur and pose a challenge to current non-derivational theories.

The analysis proposed in this paper incorporates prosody, faithfulness and markedness constraints as well as phonetics and morphology in order to account for the /miṅ/ transitivising suffix alternation. The data and analysis present counterevidence to one of the basic tenets of modern attempts to account for cyclic effects in OT (McCarthy 2003, Steriade 2000, Orgun 1996), namely that these effects are inside-out in nature, and that inflected forms should never affect morphologically simpler forms.

1 Introduction[1]

The transitivising suffix /miṅ/ alternates between glottalised and non-glottalised depending on stress.[2] Van Eijk (1997:136) describes the situation in the following way: "The distribution between –min and –miṅ is as follows: We have -min under the stress, and in those cases where it may attract the stress in subsequent extensions... -miṅ where it cannot attract stress".

This description is interesting for a number of reasons. First, why should glottalisation be dependent on the absence of stress? Second, how can we account for alternations in a **potential** context? Phonological

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[2] By this I mean that we have [–min] vs. [-miṅ].

processes are generally understood to occur in specific contexts which motivate the alternation, and it is unclear how current OT[3] will cope with a context defined by being potentially under stress (i.e. the form is question is not stressed; rather, other forms derived from that form are). In order to solve the mystery of /-miṅ/ alternation, we first need to understand the St'át'imcets stress system (section 3). Then we will need to answer three questions:

1) What is the context for neutralisation? This will be clarified by appealing to foot structure and by using OT constraints to predict where stress will fall (section 4).

2) What motivates the neutralisation? Perceptual conflict will motivate neutralisation, and faithfulness and markedness constraints will be shown to interact with stress constraints (section 5).

3) How can we explain the case where neutralisation occurs outside of a stressed context (i.e. the 'potentially' stressed cases)? A possible solution may lie in paradigm-related theories--the idea that related morphemes in a paradigm should be maximally uniform (section 6).

Section 7 details theoretical implications and issues raised, and Section 8 concludes the paper.

2 Background

St'át'imcets is an Interior Salish language spoken in Southwestern Interior British Columbia from Pavilion (Ts'k'wáylacw) in the northeast to Port Douglas (Xáxtsa7) in the southwest. It is also known as Lillooet. The consonant inventory is found below:

2.1 Phoneme chart (Van Eijk 1997)

Lab.	Dent.	Lat.	Dent.	Palatal	Velar	Uvular	Laryngeal
p	t			c, c̓	k k^{w}	q q^{w}	
p̓		λ̓	c̓		k̓ k̓^{w}	q̓ q̓^{w}	
		ɬ		s, s̓	x x^{w}	χ χ^{w}	
m	n						
m̓	n̓						
		l, l̓					
		l', l̓'					
			z	y	ɣ	ʕ ʕ^{w}	h w
			z̓	y̓	ɣ̓	ʕ̓ ʕ̓^{w}	ʔ w'

3 Stress

It is clear from van Eijk's description that stress plays a major role in determining the context for /-miṅ/ glottal alternation. Stress, while

[3] Hansson (p.c.) notes that derivational approaches such as Lexical Phonology do not predict the possibility of outside-in effects.

predictable, shifts with the addition of suffixes. In order to accurately describe where stress falls, and thus where neutralisation occurs, we must first account for the stress system of St'át'imcets. Consider the following examples[4]:

(1)	a.	(ƛíq-miṅ)	to arrive for smt
	b.	(ƛíq-miṅ)-as	he arrived for it
	c.	(ƛiq-miṅ)-(ít-as)	they arrived for it
	d.	(páqʷu?)-min	to be afraid of smt
	e.	(paqʷu?)-(mín-as)	he is afraid of it
	f.	ṗáṅt	to return
	g.	(ṗan't)-(mín-as)	he returned for it

From example a. we can see that stress in St'át'imcets is trochaic. Example b. shows that feet are assigned from left to right, and example c. shows that words are right headed Examples d. and e. show that stress moves off the main vowel two vowels at a time, provided the target vowel is not in the final syllable (extrametricality).

St'át'imcets shows an interesting property in its stress system, in that root-final consonant clusters are considered moraic for stress assignment (van Eijk 1997:15). By comparing example d. and e. with examples f. and g. we can see that CVCC roots pattern with CVCVC roots with respect to stress.

To account for this stress pattern, we need the following constraints[5]:

RHTYPE=T	Feet are left-headed
All-Ft-Left	Align (Ft,Left,PRWd,Left) Every foot stands at the left edge of a PRWd[6]
Rightmost	Align (Hd-Ft,Right, PRWd,Right) The head foot is rightmost in PrWd
Ft-bin	Feet are binary
Parse- σ	Syllables are parsed into feet
Weight-by-position	Coda consonants are moraic
Final-C-μ]root	The final root consonant is weightless

[4] All examples are written in the St'át'imcets orthography, but with morpheme breaks. All examples are taken from Van Eijk (1987) and Van Eijk (1987) and re-elicited from a consultant.

[5] From Kager (1999).

[6] Following Van Eijk (1997), prefixes are not considered part of the Prosodic Word.

Feet in St'át'imcets are trochaic, assigned from the left, and words are right-headed. Given our definition of Rightmost, it is crucial that RHTYPE = T and All-Ft-Left outrank Rightmost in order to achieve the correct pattern:

RHTYPE = T, All-Ft-Left > > Rightmost

Tableau 1

UR ʔíwaʔ-miṅ	RHTYPE = T	All-Ft-Left	Rightmost
→a. (ʔíwaʔ)-(min)			*!
b. ʔi(wáʔ-min)		*!	
c. ʔi(waʔ-mín)	*!		

From the tableau above we can see that RHTYPE = T and All-Ft-Left must outrank Rightmost. Candidate a. violates Rightmost, but because it is crucially outranked by RHTYPE = T and All-Ft-Left, our expected winner comes out the optimal candidate. Candidate b. violates All-Ft-Left, candidate c. violates RHTYPE = T and both are ruled out.

Accounting for extrametricality and the fact that root consonant clusters count as moraic for stress requires two pairs of crucial rankings that are shown in the tableaux below. Stress never falls on the final syllable of a word[7], suggesting that 'stray' syllables word finally must be extrametrical. In order to achieve extrametricality in OT we need to rank the constraint that says feet must be binary over the one that says syllables must be parsed into feet:

Ft-bin > > Parse-σ

We can see the ranking demonstrated in Tableau 2:

Tableau 2

UR ʔíwaʔ-miṅ	Ft-bin	Parse- σ
→a. (ʔíwaʔ)-min		*!
b. (ʔiwaʔ)-(mín)	*!	

Because Ft-bin is crucially ranked above Parse- σ, candidate a. wins over candidate b. and we get the correct output form. If the final syllable were parsed as a foot, we would expect it to receive stress, under the Rightmost constraint. RH TYPE = T, Rightmost and Align-Wd-Left outrank Parse- σ as well. Consider Tableau 3 for the interaction of these crucially ranked constraints with the other stress assignment constraints:

[7] Exceptions include if the first vowel is schwa, and some strong affixes.

Tableau 3

UR ʔíwaʔ-miṅ	RH TYPE=T	All-Ft-Left	RIGHTMOST	Ft-bin	Parse-σ
→a. (ʔíwaʔ)-min			*!		*
b. (ʔíwaʔ)-(min)		*!		*	
c. ʔi(wáʔ-min)		*!			*
d. (ʔiwáʔ)-min	*!		*		*
e. ʔi(waʔ-mín)	*!	*			*

From Tableau 3 we can see that the stress assignment constraints, as well as Ft-bin, must outrank Parse-σ. Candidate a. is our winning candidate and violates Rightmost and Parse- σ. Because both Rightmost and Parse- σ are crucially outranked by other constraints, candidate a. is the winner. Candidate b., which parses the final syllable into a foot, violates All-Ft-left as well as Ft-bin. Candidate c., which parses its feet from the right hand side of the word violates All-Ft-Left and Parse- σ. Candidates d. and e. which have an iambic foot crucially violate RH-Type=T, as well as other constraints. Having shown the relevant rankings for extrametricality, we will move onto the second crucial ranking-consonant clusters.

Because a consonant cluster in the root counts as a mora for stress, we must assume that coda consonants have weight. However, CVC syllables do not behave as bimoraic, so we need to crucially rank the Final-C-μ]root constraint above the Weight-by-Position constraint:

Final-C-μ]root > > W-b-P

This interaction can be seen in the tableaux below:

Tableau 4

UR ṗaṅt-miṅ-as	Final-C-μ]root	W-b-P
→a. (ṗaṅt)-(mín-as) (μμ) (μμ)		*
b. ṗaṅt-miṅ-as (μμμ)-(μμ)	*!	
c. (ṗáṅt-miṅ)-as (μ-μ)		**!

Candidate a. with one mora for the vowel and one for the penultimate root consonant violates the Weight-by-Position constraint because the final coda consonant has no mora. However, because candidate b., with a mora for the vowel and each consonant, violates the higher ranked Final-C-μ]root constraint, it is ruled out. Candidate c. with no moras for its root consonants violates W-b-P twice and is ruled out. If we compare Tableau 4 with Tableau 5 below, we can see that this ranking can also account for CVC roots:

Tableau 5

UR ƛiq-miṅ-as	Final-C-μ]root	W-b-P
→a. (ƛíq-min)-as (μμ)		*!
b. (ƛiq)-(míṅ-as) (μμ) (μμ)	*!	

Candidate a., with a mora for the vowel, but not the final consonant, is our winner. It violates W-b-P, but because this is crucially ranked lower than Final-C-μ]root, it is the optimal candidate. Candidate b., with it's moraic consonant violates Final-C-μ]root and is ruled out.

Now that we have seen how both extrametricality and root consonant clusters are explained by crucially ranking constraints, consider Tableau 6, demonstrating all the relevant stress assignment constraints:

Tableau 6

UR ƛiq-miṅ-aš	RH TYPE =T	All-Ft-Left	RIGHT MOST	Ft-bin	Parse - σ	Fin-C-μ]root	W-b-P
a. (ƛiq)-(mín-aš) (μμ)		*!				*	
→b. (ƛíq-miṅ)-aš			*		**		**
c. (ƛíq)-(miṅ-aš)		*!	*				
d. (ƛiq)-(miṅ-áš)	*!	*					
e. (ƛiq)-(miṅ)-(áš)		*!*	*	*			

Candidate a., in which the root has a moraic consonant violates All-Ft-Left and Fin-C- μ]root. Candidate b., the winning candidate does not violate All-Ft-Left because the final syllable is not parsed into a foot. It violates Rightmost, which is crucially ranked lower than both RHTYPE=T and All-Ft-Left. Candidate b. also violates Parse-σ and W-b-P. Candidate c. violates All-Ft-Left as well as Rightmost. Candidate d., with its iambic foot violates RHTYPE=T and candidate e. has two violations of All-Ft-Left, as well as Rightmost and Ft-bin.

Now that we understand how the stress system works, we are able to predict exactly where stress will fall, and to define precisely the context of neutralisation. In the next section we will examine the data and how the stress constraints proposed here interact with faithfulness and markedness constraints to account for the neutralisation.

4 What is the context for neutralisation?

Recall that according to Van Eijk, neutralisation occurs when the suffix comes under stress, or might come under stress. Now that we understand exactly where that happens, we are in a better position to answer the question of where neutralisation occurs. A basic description of neutralisation is that [-miṅ] occurs with (C)CVC roots while [–min] occurs with (C)CVCC or (C)CVCVC roots. We can see this in the basic data below:

4.1 Basic data

4.1.1 /-miṅ/

(2)	a.	ƛ̓íq	ƛ̓íq-miṅ	to arrive here for smt
	b.	táw	táw-miṅ	to sell smt-tr
	c.	ƛ̓úp	ƛ̓úp-miṅ	to twist smt
	d.	sqwál̓'	sqwál̓-miṅ	to report on smb

4.1.2 /-min/

(3)	a.	k̓ʷúɬən	k̓ʷúɬən-min	to borrow smt from
	b.	ʔíwaʔ	ʔíwaʔ-min	to accompany smb
	c.	ṗáṅt	ṗáṅt-min	to return for smt
	d.	pták̓ʷɬ	pták̓ʷɬ-min	to tell a legend about smb

Recall that in the previous section CVCC roots patterned with CVCVC roots for stress, because both are bimoraic. Recall also that feet are binary and trochaic. Given these observations, we can say that [-miṅ] occurs with incomplete feet (CVC syllables have only 1 mora) while [-min] occurs with complete feet. Because of the trochaic nature of the stress system, [–miṅ]

attached to a CVC root will never be stressed in any derivation because it will always be in the weak position of the first foot (ƛíq-miṅ). In (CVCC)[-min] or (CVCVC)[-min] cases, [-min] adjoins to a complete foot, so it is in a potentially stressed position, as the head of any potential following feet. These patterns can be seen in the more complex derivations below:

4.2 Longer derivations

(4)	a.	(ƛúp-miṅ)	to twist smt
	b.	(ƛup-miṅ)-(twál̓-ən)	to twist things together
	c.	(ƛíq-miṅ)	to arrive for smt
	d.	(ƛiq-miṅ)-(ít-as)	they arrived for it

If we compare examples a. with b. and c. with d., we can see that stress shifts when inflectional suffixes are added. Because of the trochaic stress pattern, [-miṅ] is never stressed. However, if we look at roots that are complete feet we see that [-min] comes under stress:

e.	(ʔíwaʔ)-min	to accompany smb
f.	(ʔiwaʔ)-(mín-ts-kacw)	you went with me
g.	(ṗáṅt)-min	to return for smt
h.	(ṗan't)-(mín-as)	he returned for it

From the above examples we can see that while [-min] is not stressed in examples e. or g. (because it is not part of a foot) in f. and h. it is in the head position of the second foot, and thus comes under stress.

By appealing to the prosodic domain of foot we are able to specify exactly the context of neutralisation: neutralisation occurs when /-min'/ attaches to a complete foot. Using the constraints from the section 1, we are able to predict where stress will fall, and now can accurately describe the context in which neutralisation will occur.

Support that this analysis is correct can be seen if we take as an example the root *ƛiq*. In example 4c. and 4d. it surfaces with [–min'] and is never stressed: *ƛíq-miṅ, ƛiq-miṅ-ít-as*. However, if the lexical suffix /-c/, is added to the root, we see what at first glance appears to be an exception to our analysis.

i.	ƛiq-c-mín-as	sound reaches here

According to Davis (in progress) the lexical suffix becomes part of the root, so the root changes from the CVC root *ƛiq* which is an incomplete foot, to a bimoraic CVCC root-- *ƛiqc*. The 'new' CVCC root patterns with other CVCC roots and neutralisation occurs. Thus, our theory is able to account

for an apparent exception. Now, we must ask ourselves what motivates neutralisation in the first place. This will be addressed in the next section!

5 Why neutralise?

Based on van Eijk's generalisation and the data in section 4, we know that there is some interaction between stress and glottalisation. Previous research (Caldecott (1999); Bird (2003)) suggest that there may be a conflict between cues to glottalisation and cues to stress in St'át'imcets, possibly pitch.[8] Given current theories about grounded phonology, we would expect such a phonetic effect to have visible effects in the phonology as well. I believe that the /-miṅ/ alternation is just such an example.

According to Ladefoged (1993), one of the acoustic correlates to glottalisation is slowing down of the vibration of the vocal folds, and thus a *decrease* in pitch: "Thus creaky voice usually has a low pitch as well as a particular voice quality" (Ladefoged 1993:251). Stress is a perceptual phenomenon which has different acoustic cues in different languages. Ladefoged also notes "[A]n increase in the flow of air out of the lungs will also cause an increase in pitch, so that stressed sounds will usually have a higher pitch" (1993:251).

Given that one of the cues to stress is higher pitch and that one of the cues to creaky voice is lower pitch, we have a conflict between two competing cues. When /-miṅ/ occurs in a stressed position, there may be some conflict between the stress and the glottalisation cues, so we can explain the neutralisation under stress as coming from articulatory conflict. Because one of the sets of cues must lose, St'át'imcets' prefers to neutralise glottalisation rather than stress. In an OT analysis, we can see this as a crucial ranking, with constraints against glottalisation under stress and stress assignment outranking faithfulness to glottalisation cues. In order to account for neutralisation then, we need two new constraints:

]*glottal/stress	No glottalisation under stress (outside a root)[9]
Ident IO (glott)	All glottalisation in the input must be realised in the output

The markedness constraint *glott/stress must crucially outrank Ident IO (glott), or neutralisation would not occur:

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[8] Recent research (Bird and Caldecott (2004)) indicates that this interaction may not be as straightforward as predicted. While pitch was not considered, there seems to be a bigger correlation between syllable position and deglottalisation than stress and deglottalisation (though mostly it was mostly roots that were considered).

[9] Some ranking between the stress constraints and the glottalisation constraints must exist, since glottalised resonants are tolerated in stressed roots. Since an analysis of this interaction is, unfortunately, outside the scope of this paper, we will have to define our constraint as applying only outside of a root and leave further research to a later date. See section 7 for related domain issues.

]*glott/stress > > Ident IO (glott)

Evidence for this ranking can be seen in Tableau 7:

Tableau 7

UR /p̓an't-miṅ-as/	]*glott/stress	Ident IO (glot)
→a. (p̓aṅt)-(mín-as)		*!
b. (p̓aṅt)-(míṅ-as)	*!	

In this tableau we can see that the markedness constraint *glott/stress must outrank the faithfulness constraint Ident IO (glott). Candidate a. is the correct surface output and wins because of the crucial ranking, despite violating Ident IO (glott) by neutralising glottalisation. Candidate b., which keeps glottalisation, violates the higher ranked *glott/stress constraint. However, what is to stop a candidate such as (p̓áṅt)-(min'-as), with stress assigned incorrectly, or even a candidate with no stress at all from winning? Clearly we must go back to our stress constraints in section 1 and include them in our ranking. Because stress cues come out the winner in the conflict, the constraints governing the system of stress assignment must outrank the Ident IO (glott) constraint. But, because stress is not part of the underlying representation, we cannot just refer to faithfulness to stress cues. This means that the stress assignment constraints, working together, along with the markedness constraint, must outrank the faithfulness constraint.

In order to focus on the interaction between the stress cues and glottalisation, I will combine all of the stress constraints together in a mega constraint: STRESS (meaning that stress must be trochaic, words are right-headed, feet must be binary and consonant clusters in the root count as a mora for stress assignment). The constraint interaction can be seen in tableau below:

Tableau 8

UR /p̓aṅt-miṅ-as/	STRESS	]*glott/stress	Ident IO (glot)
→a. (p̓aṅt)-(mín-as)			*!
b. (p̓aṅt)-(míṅ-as)		*!	
c. (p̓áṅt)-(miṅ-as)	*!		
d. p̓aṅt-miṅ-as (no stress)	*!		

In this tableau we can see that the megaconstraint STRESS must outrank the faithfulness constraint Ident IO (glott).]*glott/stress rules out candidate b. where stress and glottalisation co-occur. Keeping glottalisation at the expense of stress, as in candidate c. (stress doesn't shift off the first vowel) and d. (no stress is present) is ruled out by the crucial ranking of STRESS above Ident IO (glott). From this tableau we see that the proposed constraint ranking can account for neutralisation under stress. Can it also account for

the cases where /miṅ/ does not neutralise, as in example 4d. *ƛiq-miṅ-ít-as*? Examine Tableau 9:

Tableau 9

UR ƛiq-miṅ-it-as/	STRESS	]*glott/stress	Ident IO (glot)
→a. (ƛiq-miṅ)-(ít-as)			
b. (ƛiq-min)-(ít-as)			*!
c. ƛiq-(míṅ-it)-as	*!	*	

Tableau 9 shows us that these constraints can indeed account for examples where neutralisation does not occur. No crucial rankings can be confirmed, because the winning candidate a. incurs no violations, but candidates b violates Ident IO glott by losing it's glottalisation, and candidate c. violates]*glott/stress and STRESS by having the stressed [-min'].

While this analysis can account for neutralisation under stress, it cannot account for the case of neutralisation when there is no context, as in *ṗán't-min*. Given that there is no stress on the glottalised suffix, neutralisation is both unexpected and inexplicable given our current constraints. This can be seen in Tableau 10 below:

Tableau 10

UR /ṗaṅt-miṅ/	STRESS	]*glott/stress	Ident IO (glott)
→a. ṗáṅt-min			*!
b. ṗáṅt-miṅ			
c. ṗaṅt-mín	*!		
d. ṗaṅt-míṅ	*!	*	

Candidates c. and d. are ruled out due to improper stress assignment. However Candidate a, the intended winner, loses out to candidate b. because the former violates Ident IO (glott), while the latter has no violations at all. Based on our theory of conflict motivating neutralisation, we would predict b. to be the winner. Our tableau as it stands will not select the correct output. In the next section we will look at a morphological theory that should help us account for this unexpected neutralisation.

6 How can we explain the unexpected neutralisation?

The analysis so far cannot account for examples like *ṗáṅt-min* because the context for neutralisation is not present. Why does neutralisation happen when there is no conflict between glottal cues and stress cues? Why don't we get *ṗáṅt-miṅ*, as predicted by our analysis?

One possible analysis might appeal to paradigm leveling, or the idea of Paradigm Uniformity. Paradigm Uniformity seeks to explain 'the systematic generalisation of one allomorph to positions where it is phonologically unjustified or unexpected' (Steriade 1999:1).

If we apply this to St'át'imcets', it would mean that all members of the paradigm involving the same root + -miṅ, -miṅ must have identical glottalisation features. In order for us to understand /-miṅ/ as part of the derivation set, it must be consistently glottalised or non-glottalised in that set.

Another version of Paradigm Uniformity is McCarthy (2003) Optimal Paradigms. Like Steriade's Paradigm Uniformity, McCarthy seeks to "...account for surface resemblances among morphologically related words" (2003:1). He explains his theory as follows: "In OP, candidates consist of entire inflectional paradigms. Within each candidate paradigm, there is a correspondence relation from every paradigm member to every other paradigm member. Faithfulness constraints on this intraparadigmatic correspondence relation resist alternation within the paradigm... "(2003:1).

In terms of St'át'imcets, this means that /-miṅ/ should be consistently glottalised or non-glottalised with the same root, and that in a tableau we will compare all derivations in one paradigm not only to the input form, but also to each other. It means the introduction of a new type of constraint, namely OP-ID (feature), which compares the inflected forms to each other. For us, this will be OP-ID (glott). Because uniformity of glottalisation across root + -min' is more vital than faithfulness to the underlying representation, we must rank OP-ID (glott) above IO-ID (glott). As before, *glott/stress must also outrank IO-ID (glott). The crucial ranking of these constraints then is :

*glott/stress, OP-ID (glott) > > IO-ID (glott)

In Tableau 11 we can see these constraints at work. We are comparing not only each possible derivation of root + -min' + suffixes to the input (as in a regular tableau), we are also comparing the outputs to each other.

Tableau 11

UR /ṗaṅt-miṅ/	*glott/stress	OP-ID-glott	IO-ID-glott
a. ṗáṅt-miṅ, ṗaṅt-míṅ-as...	*!		
b. ṗáṅt-miṅ, ṗaṅt-mín-as..		*!	*
→c. ṗáṅt-min, ṗaṅt-mín-as...			**...

Candidate set a. maintains glottalised [–miṅ] in all possible derivations in the paradigm. While this satisfies OP-ID (glott) and IO-ID (glott), it violates *glott/stress and is ruled out. Candidate b., the candidate set we would expect, is ruled out by the new OP-ID (glott) constraint. The uninflected form corresponds to the input, but not to other inflected forms in the

paradigm. Because OP-ID (glott) outranks IO-ID (glott), Candidate c., which violates the lowest ranked IO-ID (glott) for every derivation wins.

While appealing to a paradigm related theory can account for our data quite nicely indeed, some fundamental issues about the definition of paradigms and the supposed inside-out nature of morphology are raised. These issues, as well as potential problems for the analysis will be discussed in the next section.

7 Theoretical implications and issues

7.1 Theoretical implications

This analysis appeals to the morphological theory of paradigm leveling to account for the unexpected and unmotivated alternation in an otherwise fairly straightforward problem. Cyclical effects have always posed a problem for OT, a non-derivational framework. In a derivational analysis, if the context for an alternation is not present in the surface form (as for deglottalisation of /–min'/ is not present in cases like *ṗáṅt-min*), this could be explained through rule ordering: the context was there at some point earlier in the derivation. OT, being non-derivational, has forced linguists to come up with alternative analyses. In the case of Paradigm Uniformity (Steriade 2000) derivations in a paradigm are compared with a base form. In McCarthy (2003) Optimal Paradigms, inflected forms in a paradigm cannot be compared with derivational forms. The issue arises, then of just what constitutes a paradigm.

McCarthy (2003) defines a paradigm as '... a set of inflected forms based on a common lexeme or stem' (2003:1). Using this definition of paradigm, only *the inflected* forms of root+/-miṅ/ can be compared (*ṗaṅt-míṅ-as*) vs. (*ṗaṅt-míṅ-it-as*), not the inflected form to the stem (*ṗaṅt-míṅ-as* vs. *ṗáṅt-miṅ*)! In this theory, a penchant for uniformity across inflected forms may cause other inflected forms to change, but it should **never** affect uninflected forms. If we use McCarthy's definition of paradigm we lose the ability to account for the neutralisation in the unexpected context, because the two relevant examples do not constitute a paradigm. It also misses another phenomena that our current analysis can account for. [10]

Consider again examples *ƛ̓iq-c-mín-as* vs. *ƛ̓íq-miṅ*. These are related forms, yet their relationship cannot be discussed under Optimal Paradigms, because OP does not compare stems to stems (i.e. inflectional forms from one stem to those from another stem). Using the foot-based analysis argued for here, we can acknowledge and deal with the relationship between the bare root and the one with the lexical suffix, and predict how each will affect the glottal alternation.

The outside-in nature of this alternation (inflected forms affecting morphologically simpler forms) runs contrary to another morphological theory attempting to explain cyclical effects , namely Orgun

[10] Hansson (p.c.) points out that OP doesn't attribute any special status to the 'base form' within a paradigm. Directionality should be a matter of attraction to the less marked, which is what these findings support. More research is necessary.

(1996) Sign-Based Morphology. In this theory, constraints are considered to apply to morphemes at every level of a word, and thus due to the '[i]nside-out nature of interleaving effects....a morphologically simpler constituent affects the form of a morphologically more complex constituent of which it is part, but not vice-versa (14) and crucially, "...the ungrammaticality of one form results only in the ungrammaticality of more complex related forms, not less complex related forms within the same paradigm" (15). Under this theory the addition of suffixes, and thus 'potential' stress, should have no influence what-so-ever on more basic forms.

We can see that while a paradigm leveling analysis could at first glance help account for our unexpected alternation, the definition of paradigm, and the assumption that morphological effects are 'inside-out' means that the theories used in current OT theory cannot account for the outside-in nature of paradigm leveling in St'át'imcets.

7.2 Issues

I have claimed here that stress cues conflict with glottalisation cues, and thus neutralisation of glottalisation occurs. If we examine example 4d again *λiq-miṅ-ít-as*, we can see that glottalisation on the resonant can cooccur with stress, provided that it is the following vowel, rather than the preceding vowel that is stressed. If my analysis is correct, and a conflict does occur, this implies that the glottalised resonant in these examples must be pre-glottalised, or at least that there must be no conflict between the glottalised resonant and the following vowel. This analysis, then, crucially rests on the assumption that there is a conflict between a stressed vowel and a following glottalised resonant that does not occur between a glottalised resonants and a following stressed vowel.[11] Only more research into the phonetics of glottalised resonants can clarify for us the exact relationship between stress and glottalised resonants, and also the nature of the glottalised /ṅ/ in these data.

One other phonetic effect that must be considered is secondary stress. Although secondary stress is not marked in St'át'imcets, Pat Shaw (p.c.) notes that it does exist. The effects of secondary stress on glottalisation, particularly in the cases where we get neutralisation without context must be examined. One potential way to test stress effects would be to try and force a stress shift, perhaps by adding prefixes. Unfortunately in St'át'imcets, prefixes are never stressed and cannot affect the movement of stress.

There are a number of other possible non-phonetic explanations. It could be that the /ṅ/ in /-miṅ/ is syllabifying with the preceding syllable rather than the following one. There could be a constraint in the language that ideally has morpheme boundaries aligned with syllable boundaries (Align-Morph-R: The right edge of a morpheme coincides with the right edge of a syllable). This could mean that glottalisation within a syllable or

[11] In fact, Bird and Caldecott (2004) has shown significant deglottalisation (mainly in roots) in onset vs. coda position. There was no significant trend in deglottalisation in stressed vs. unstressed positions.

morpheme is more affected than across morpheme-boundaries. Along those same lines, there may be domain-related effects on the alternation. Perhaps faithfulness within the root's foot outranks faithfulness outside the root's foot.

Alternatively, it may be the domain of stem which is relevant. We have evidence of phonological effects that apply to the root only (clusters in root counts as moraic) so it would not be unexpected to have stem-specific phonological/phonetic effects that do not reach outside the stem. In St'át'imcets, the stem includes transitivisers but not subject or object suffixes, so vowels in inflectional suffixes may not affect glottalisation within the stem. Independent evidence of all of these suggested factors must be verified before a concrete analysis can be confirmed, and the results will affect not only the phonetics-phonology interface, but the phonology-morphology interface as well.

8 Conclusion

St'át'imcets glottal alteration in the transitivising suffix /-miṁ/ presents an interesting counter example to several theories attempting to explain cyclic effects in a non-derivational way. It challenges both the definition of paradigm and the supposed inside-out nature of morphological effects—inflectional suffixes should not have the power to affect stems. In St'át'imcets we see exactly that: neutralisation in potential inflected forms is responsible for neutralisation in the uninflected stem. It would be tempting to revert to a derivational analysis in order to account for the unexpected neutralisation, but even a derivational analysis fails to succeed. Under the St'át'imcets stress system, in an example like *pánt-min*, [-min] will NEVER, in any stage of derivation be under stress, so the context for neutralisation was never present.

If the motivation for neutralisation is indeed phonetic conflict, as proposed here, any analysis would have to explain how phonetics can 'see' in to the morpho-phonology and predict stress in hypothetical derivations. This is not only implausible, but presents issues for learnability. If learners had to store the effects of potential further derivations with the stem/root in the lexicon, it would be unmanageable. It would also suggest that in St'át'imcets, stress assignment would be included in the underlying representation and thus not be predictable. Predictable stress is not generally assumed to be part of the underlying representation and such a proposition has not been suggested by anyone dealing with St'át'imcets to my knowledge.

The pattern of neutralisation is extremely consistent (no exceptions in the data I had). This suggests perhaps a lexical solution. As deglottalisation is a process of language shift at the moment (H. Davis p.c.), this may be the reality. Unfortunately, the shift towards deglottalisation in younger speakers, and the rapidly aging older speakers means that it may soon be impossible to tell what effects language shift has on this process, and it may soon be impossible to research this interesting and challenging fact of St'át'imcets language.

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