Prosodic Templates in Tigre Verb Morphology: A phonologically informed analysis of Causative*

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1.0 Introduction

Mansa^{c} Tigre, a semitic language of Ethiopia, has a rich templatic system in its verb morphology. Templates interact with underlying roots of two, three and four consonants (radicals) to give a variety of surface forms. In the imperfective aspect, two interesting behaviors are to be found. First, in this aspect, but not in the perfective aspect, inflectional morphology is templatic in nature, so that the type of inflection (e.g. 3rd person, feminine, singular) determines the template instantiated. Second, I will argue, in the imperfective aspect, the appearance of causative is characterized by an operation applied after the template to be instantiated is selected and filled. Thus, it seems, data from Tigre provide an instance of a morphological process operating on the argument structure of a lexical item ("derivation" for those who subscribe to a distinction) which applies after inflectional processes.

In particular, I contend that this behavior runs counter to a typology of morphological operations recently proposed in Steele (in prep). Steele's model, Articulated Morphology (AM), makes status differentiations within lexical objects (signs) and explicit claims about the types of operations which can operate on the various levels of lexical object. I claim that the Tigre data provide evidence that this typology is too restrictive and must be extended to accommodate behaviors I cite.

The organization of this note is as follows: First I will give background of both the basic templatic system of Tigre and the formal models I will employ. Section 2 gives the Tigre background while section 3 introduces Articulated Morphology and Prosodic Morphology (McCarthy & Prince(1986, 1990)) with a focus to how ideas from these two models are utilized. Section 4 presents the data to be considered and formulates the generalizations which the analysis is to capture. In section 5, I give an analysis of the cited data. Section 6 is a discussion of the implications this analysis has for the Articulated Morphology model. Section 7 contains some concluding remarks.

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* Many thanks are in order. Thanks to Sue Steele, Diane Meador and Chip Gerfen for discussions and suggestions, and to Mike Hammond and Anna Ciszewska-Wilkins for comments on a paper addressing the phonological analysis I employ here. Thanks to all the participants in LING 535 Fall 1991 at the University of Arizona for listening to an earlier presentation of this work. All errors are my own. For notational purposes, the following notation is employed: /ʔ/ = glottal stop; /ᶜ/ = voiced phrayngeal fricative; long vowels noted with v:. This work was supported by a National Science Foundation Graduate Fellowship.

2.0 Basic Templatic Data

Varieties of meanings within the semantic field of a root are expressed by instantiating different templatic structures. Triradical roots in Tigre maximally instantiate four verb templates. Roots will be denoted as collections of consonants, represented in their underlying form by /ccc/ (c = consonant). Certain roots are found which take all of the four forms; others surface only in a subset of the four forms. Some examples of the Tigre verbs are given in figure (1):

(1)

(a) Template A		(b) Template B	
qatla	'to kill'	mazzana	'to weigh'
lakfa	'to throw'	ᶜaddama	'to invite'
kabra	'to be honored'	kabbara	'to give news'
hafna	'to become hot'	haffana	'to take with both hands'
harsa	'to plough'		

(c) Template C		(d) Template D	
qa:tala	'to do some killing	qata:tala	gloss not available
la:kafa	'to persist in throwing'	kada:dama	'to work on and off'
ha:rasa	'to cultivate the soil'	hara:rasa	'to plough a little'

Templates A and B serve as the semantic base. Some root melodies (e.g. **/qtl/** and **/mza/**) surface in one of either template A or template B exclusively as the semantic stem, while others (e.g. **/kbr/** and **/hfn/** c.f (a) and (b) above) are found in both forms. Within the triradical roots, I take this to be a lexical property of the root, something which will be formally encoded in the analysis I give.[1] Templates C and D express two derivative semantic notions. Respectively, these are increased force or intensity of the action denoted by the type A semantic base (template D) or frequentive or conative aspect of the action denoted by the type A simple base (template D). These two templates are also instantiated by verbs of four radicals, but express different semantic notions.

I propose that these four templates are underlyingly given by the folowing prosodic schema:

(2)

template A:	$\sigma_C\ \sigma_C\ \sigma_C$
template B:	$\sigma_C\ \sigma_C\ \sigma_C\ \sigma_C$
template C:	$\sigma_{\mu\mu}\ \sigma_C\ \sigma_C$
template D:	$\sigma_C\ \sigma_{\mu\mu}\ \sigma_C\ \sigma_C$

[1]Some A/B pairs seem to be semantically related, e.g. dagma 'to repeat' and daggama 'to tell', while others seem to be simply homophonous and not semantically related, e.g.hafna 'to become hot' and haffana 'to take with both hands. The latter may be different base signs which simply have the same phonemic melody, but are completely unrelated with respect to other aspects of the sign.

While these templates do not directly reflect the surface forms shown in (1), they interact with a vowel-deletion rule described below to produce varieties of surface forms. Under this analysis, a very few templates cover an extensive amount of Tigre verb data. Nonetheless, it is only templates A and B which are of concern for the analysis to follow. Of course, a complete analysis of the templatic system would include these templates as well, but such an extensive coverage is outside the scope of this paper.

3.0 Introduction to Theory and Formalism

The analysis is informed by two existing formal mechanisms: the morphological ideas employ aspects of the "Articulated Morphology" model of Steele (in prep) while the phonological issues are dealt with in a way most similar to the "Prosodic Morphology" of McCarthy (1979, 1981) and McCarthy and Prince (1986, 1990). The following sections will provide a brief overview of these two formal models, simultaneously presenting the manner in which they are used for the present analysis.

3.1 Prosodic Morphology

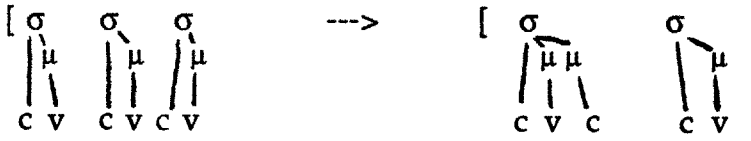
The basic idea in the analysis of nonconcatenative systems (since McCarthy 1979) has been to specify certain template and root melodies and then to provide some association mechanism which unifies the two; the template providing a prosodic structure for the prosodically deficient roots. Recent treatments of templatic morphology have sought to refine both the associative process and the prosodic templates themselves. McCarthy & Prince (1986, 1990) prescribe a prosodic typology which limits the prosodic units to which templates can refer. Prior to this innovation, templates were prescribed as sequences of Cs and Vs, a very powerful, but not very explanatory treatment.

Since the abandonment of unconstrained CV-skeleton templates, one problem has plagued accounts of semitic templatic systems. This is the contrast between a bimoraic syllable ($\sigma_{\mu\mu}$) which has a complex nucleus (CVV) and a closed syllable with a moraic coda (CVC). Since both should be properly covered by $\sigma_{\mu\mu}$, the problem lies in whether to associate a vowel melody or a consonant melody to the second mora. McCarthy & Prince (1986) appeal to metrical structure to get this contrast in Classic Arabic (p.66 in ms). The phonological analysis of Tigre I propose realizes this contrast by a different means. The long vowel/closed syllable contrast will be realized as a vowel deletion rule interacting with the prosodic templates.

The vowel-deletion rule is central to the entire analysis. It is essential both in terms of realizing the CVV/CVC contrasts without either placing some stipulations on the association to a bimoraic syllable or positing additional levels of representation (see Sloan's (1991) dissertation on Sierra Miwok) and in terms of the unified underlying characterization of the variety of surface configurations. The

rule itself is quite simple. Formalized below, the rule alters a sequence of two light core syllables word-initially (edge of a "prosodically complete" phonology, see section 2.3 below) to form a heavy syllable, σ_{cvc}:

(3) Vowel-deletion Rule



In support of this rule, I offer this evidence. Considering the data I have presented, and this seems to be true throughout the verb system, the language seems to desire a heavy (bimoraic) syllable in either the initial or second syllable of a given phonological form. Referring back to the basic templatic data in (1), this fact is easily observed. Furthermore, the differences in underlying form of CVC and CVV surface syllables are visible under the causative prefix. Where the underlying template has light syllables in the first two positions, there is an alternation in the causative form. In contrast, the cases where an underlyingly heavy syllable is subjected to the addition of the causative prefix, no such alternation appears.

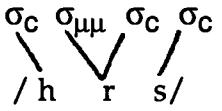
(4)	**SIMPLE**		**CAUSE (ʔa + template)**	
template A:	zamta	'to rob, raid'	ʔazmata	'to cause to raid'
	qatra	'to trickle'	ʔaqtara	'to drip
	masʔa	'to come'	ʔamsəʔa	'to cause to come'
template C:	qa:tala	'to do some killing'	ʔaqa:tala	'to cause to do some kiling'

3.2. *Template Association and Vowel-deletion.*

Besides the characterization of templates in prosodic units, one other phonological aspect of the analysis must be considered. This is a description of the associative mechanism between roots and templates. In this analysis, I will maintain that there is to be a linking between root consonants and a given template, similar to McCarthy (1979, 1981), although differing in direction of association. With respect to direction of association, I follow Yip's (1988) analysis of Classical Arabic, which she says engages an Edge-in Principle rather than strict right or left directionality. Thus, association works from the edge of the consonant melody inward, producing the result that when there are more syllables present in the

template than there are consonants in the root, there is a gemination of the medial consonant rather than a gemination at either edge[2]:

(5)

template D:  ---> hara:rasa 'to plough a little'

As a further point on template association, I take the appearance of most vowels to be a somewhat trivial result. In most cases, the surface vowel element is consistently an 'a'. This may either surface from a default melody or from a single vowel element prescribed as part of the template.

Finally, as a point of interest, this treatment of root-template association constrasts with that of Archangeli (1991), where root consonants project syllables and then syllabification (directionality and syllable satisfaction and maximization) allow for surface variations within the templates. I contend that the edge-in directionality of the template association precludes such an analysis of Tigre. My analysis also differs from Archangeli (1991) in that affixes are not seen as selecting certain templates. Detailed comparisons with Archangeli's analysis of Yawelmani will not be made.

3.3 *Articulated Morphology* [3]

Articulated Morphology (Steele, in prep) will contribute a much different element to the analysis of Tigre. As a model, Articulated Morphology has many goals, not all of which will be realized in the present analysis. Deviations from the spirit of the model will be noted and discussed at the appropriate times. First, an overview of the formal aspects of Articulated Morphology used in the present analysis.

Articulated Morphology considers all components of a lexical item, so the phonology, the syntax (categorial information) and the semantics are all part of the sign.[4] An example of a Tigre base sign is given below in (6):

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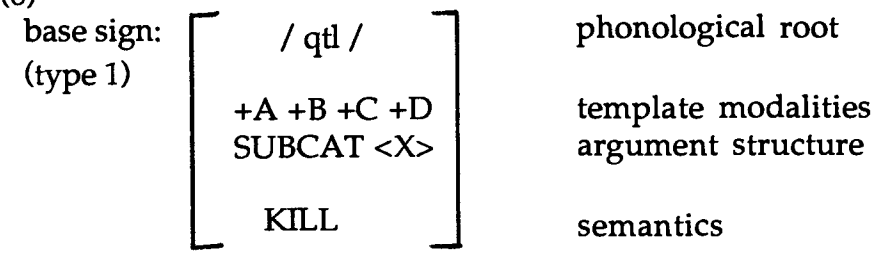
[2]What is available from the template is the syllable projection and the morae, consequently, the association mechanism must work under the constraint that all syllables, including initial ones, must have onsets. Tigre has evidence for such a syllabification constraint in that I have found no Tigre words which begin with an initial vowel, rather, all vowels which might have been word-initial are preceded by a glottal stop.

[3]While some of the basic claims and resources of this model are reviewed here, this is by no means a thorough explication, although later in this paper I will presume some familiarity with the ideas presented here and perhaps mistakenly some that are not. See work by Steele for the complete presentation of this model.

[4]Although included in every sign, the semantic component will not be developed in this analysis. This is certainly an area which merits further investigation.

(6)



Another element of the AM model is an operational typology. Not all types of signs are equivalent; nor are all operations. Sign types are defined by the properties of their attribute structure. Operations are characterized by the sorts of progressions in the sign structure which are allowed. In general, operations may produce effects in a single component of an attribute structure or in several components, e.g. In English an operation which would have (at least) consequences in phonology and the categorial component is the regular plural, -s. Types I propose for Tigre are:

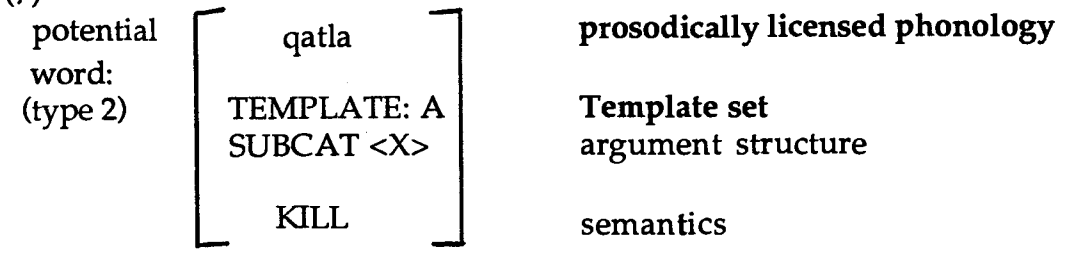
type 1: prosodically deficient (not prosodically licensed)
Template modalities

type 2: prosodically complete (licensed)
Modalities set (e.g. TEMPLATE: A)

type 3: prosodically complete (licensed)
Modalities set
additional feature/value pairs present (e.g. INFL: 3.m.pl)

Each type is characterized by a unique set of requirements on the attribute structure. In Tigre, these types are both phonologically as well as categorially defined. Type 1 signs (also called **bases**) have inherent features and modalities (see above).[5] Type 2 signs (also called **potential words**) are characterized by having all inherent features filled with values and any modal elements fixed. e.g.

(7)



[5]In the analysis of Tigre verbs I have none of the evidence of the type Steele cites for inherent features. See Steele (in prep) for inherent feature for number in Luiseño.

Type 3 signs (also called **words**) are characterized by all properties of type 2, but with the possibility of additional feature/value pairs, otherwise not present in type 1 and type 2 signs:

(8)

word: (type 3)	qatla	prosodically licensed phonology
	INFL: 2f. sg.	**Additional F/V pair**
	TEMPLATE: A	Template set
	SUBCAT <X>	Argument structure
	KILL	semantics

Morphological operations can cause signs to move among these types in a principled fashion, according to a sign and operational system. Operations which have the effect of moving a type 1 sign to a type 2 sign are particularly important in AM. Operations of these types enact a "closure" on the sign by fixing the modal attributes. After closure, further operations should not modify existing inherent attributes. With respect to the nature of closure operations, my analysis will differ from that of Steele. Differences will be discussed...

4.0 Meat and Potatoes time: Causative in Type A verbs

As I initially stated, the real issue at hand is the analysis of Type A simple and causative expressions in the imperfective aspect. Illustrative data are given in (9) below. In consideration of these data, note that root consonants are in bold. The data show typical roots in the imperfective aspect for all number, person, and gender markings in both the simple (non-causative) and causative states.[6] Notice that the template instantiated *varies* with the person, number and gender inflection. This is easily done by mentally stripping off the initial cv- prefix. What are revealed is a hidden template B form for some inflections, e.g. 2m. sg., but a template A form for others, e.g. 2f. pl. A second salient difference between the simple and the causative forms is a vowel alternation in the cv-prefix, 'ə' appears in the simple forms, 'a' appears in the causative :

[6]In Tigre, temporal notions are largely expressed by means of the perfective and imperfective aspect; perfective covers past time, imperfective covers non-past. More specific tense is expressed by means of verb complexes.

(9)

(a) simple imperfective (root: /qns/) (infinitive: ləqannəs 'to get up')			(b) causative imperfective (root: /ngf/) (infinitive: lanaggəf 'to let escape')	
sing	1c	ʔəqannəs	1c	ʔanaggəf
	2m	təqannəs	2m	tanaggəf
	2f	təqansi	2f	tanagfi
	3m	ləqannəs	3m	lanaggəf
	3f	təqannəs	3f	tanaggəf
plur	1c	ʔənqannəs	1c	nanaggəf
	2m	təqanso	2m	tanagfo
	2f	təqansa	2f	tanagfa
	3m	ləqanso	3m	lanagfo
	3f	ləqansa	3f	lanagfo

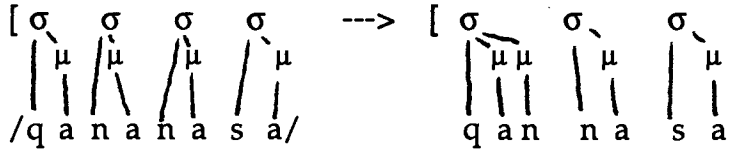
I draw attention to three key points in the above data. First is the fact that the template which is instantiated in each inflection *varies* with that inflection, so that, for example, 2m. sg., təqannəs (template B) differs from 2f.sg., təqansi (template A). This indicates that inflected forms are not derived from a single base, namely inflection has templatic effects, not just affixal effects. Further, there are no striking generalizations within person, number or gender, e.g. in the plural, both 2f and 3m instantiate template A, təqansa and təqanso, respectively. Contrast these with the singular counterparts just noted.

A second key point is the order of phonological events these forms demand. Recall from mentally stripping off the initial cv-prefix, canonical A and B templates (as shown in figure (1)) are revealed. Since these canonical templates surface inside of a prefix, the order of events, phonologically must be:

template association
v-deletion
affixation

This ordering is dictated by the application of the vowel-deletion. Recall that some of the canonical templates, namely A and B, were derived from underlying structure by the vowel-deletion rule:

(10) Vowel deletion rule applying to get surface form of Template B



In order for a canonical template to surface, the environment of the v-deletion rule must be met when the phonological form is as it is on the left hand side of this derivation. Thus, the part of inflection marking given by the initial prefix must be added *after* vowel deletion is said to apply.

The final vital point to be taken from the above data is the consistency of form across the non-causative and causative. The causative and non-causative demonstrate the same templatic behavior across all inflections. Furthermore, the same inflectional affixing (both additive and subtractive) occurs across the two types except for the quality of the vowel in the cv-prefix:

		SIMPLE		CAUSATIVE
sing	1c	ʔəqannəs	1c	ʔanaggəf
	2m	təqannəs	2m	tanaggəf
	2f	təqansi	2f	tanagfi
	3m	ləqannəs	3m	lanaggəf
	3f	təqannəs	3f	tanaggəf

In sum, the analysis of these data needs to capture the properties and dependencies discussed above, namely

(1). In both the non-causative and causative imperfective, the template filled by a root is determined by the inflection.[7]
(2). Template selection, instantiation and vowel-deletion must occur prior to affixation.
(3). The difference in the causative and non-causative forms is a superficial vowel alternation.

[7]This is not the case in the perfective. For the perfective counterparts to the data discussed here, the template is consistent across inflections, so choice of template does not seem to be an effect of inflection.

5.0 Capturing the generalizations

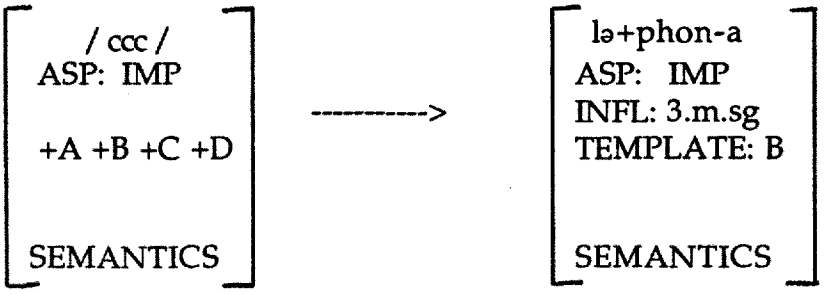
I will now give an analysis which respects the above generalizations using the AM signs and types discussed in section 3.3. It may prove beneficial for those readers unfamiliar with the AM model to refer back to this section at this point.

Of interest here are the operations enacting inflection and causation. Since, as noted above, there are no substantial generalizations to be made with the inflectional types, an inflecting operation will specify a group feature, which I have termed INFL, to be valued by a group value, e.g. 3 f.pl. Thus, there will be a family of inflection operations which are similar in effect except for the specific inflection group feature, the specific choice of template, and the specific affixation. Causative will be treated as a single operation which affects the subcategorization frame of the sign, altering the number of arguments from two to three. I consider a representative inflectional process and the causative in detail below.

5.1 Third Person, Masculine Singular

Presented here is the formalization of a representative inflection operation[8]

(11) Inflection: 3. m. sg.



The effect of this type of operation is to add a feature/value pair to the attribute structure, INFL:3m.sg, in this particular case. By definition,then, the resulting sign must be of type 3, since the feature INFL is not an inherent feature. The phonological effect of this sort of operation is to set the template A or B, associate to the template and apply the vowel-deletion rule, then finally circumfix, depending on the inflection. Since the specification of the template is made by this process, the input sign must be modal in the template feature. Base signs are characteristic of this property. Combining these two requirements, the inflection operation is a type 1 to type 3 operation. Below is a sample derivation using the rule in (11):

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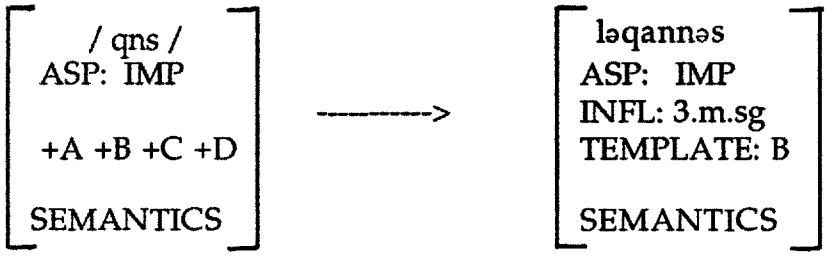
[8]For the purposes of this paper I will presume the feature ASP with a value IMP for imperfective. A complete analysis would need to explain this feature as well.

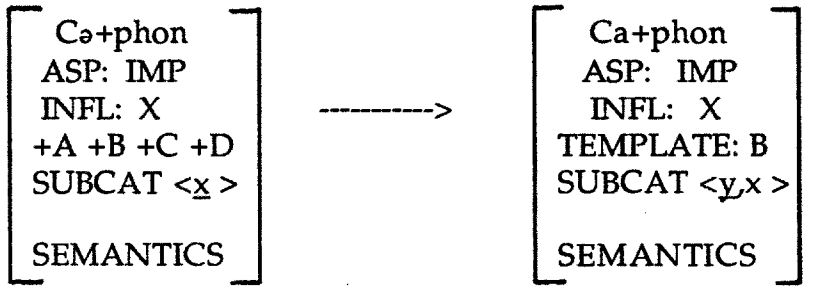
(12) Inflection of **ləqannəs** 'to get up 3.m.sg'



5.2 Causative Operation

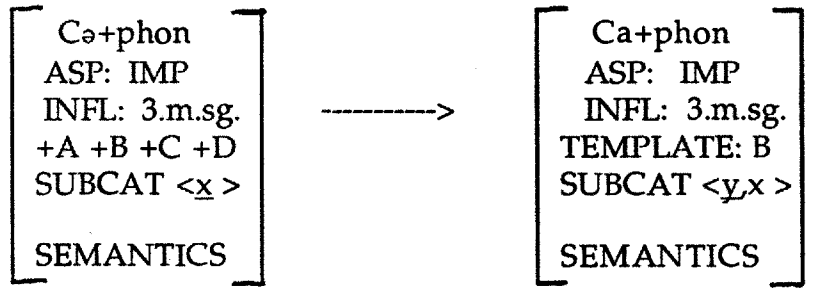
The causative operation I propose is a later process, operating on signs which would minimally be the output of inflection (viz. are specified for INFL). The CAUSE operation is compatible with any specified value for INFL, so long as one is present. The categorial effect is that of expanding the argument structure by manipulating the subcategorization frame. The resulting sign is still type 3. The CAUSE operation is formalized below:

(13) Causative



The phonological effect of this operation is minimal. Since the causative is formed after inflection, the phonological change can be characterized by a simple de-linking of the vowel features realized as 'ə' in the non-causative forms, resulting in the default vowel 'a' surfacing in the causative forms. An example of the causative operation in action is given in (14):

(14)



6.0 Discussion

The above analysis of the causative utilizes aspects of the Articulated Morphology model, but its implementation stands in conflict with some of the key ideas. Both processes I've described run counter to the operational typology. As the model is laid out (again, see Steele, in prep, for the original prescription of the model) operations of the sort I have proposed shouldn't be possible. In virtue of the definitions of sign types and the typology of operations, operations of the type specified in (15) below should not exist:

(15) Operation types not predicted by the AM model

(a)	type 2 --> type 2	(sequential modal-fixing operations)
(b)	type 3 --> type 2	(deletion of a feature/value pair)
(c)	type 1 --> type 3	(simultaneous modality-fixing and addition of feature/value fair)
(d)	type 3 --> type 3	(sequential addition of f/v pair)

In Steele's analysis, operations of types in (15) are not attested in Luiseño, However, in the analysis of Tigre I have proposed, the inflection processes are of the type (15c) and the causative process is of type (15d).

I have little comment on the discrepancy with respect to the inflectional operations I have proposed. I contend that based on the definition of type 1 signs, the apparent selection of template by inflection provides evidence for an operation of this type.

Regarding the causative as a type 3 to type 3 operation, there is more to be said. What is intended in the AM model, though possibly not adequately represented in my summary, is the extent to which these operational types are restricted in the sorts of attributes they can affect. In AM, operations acting on inherent features should be type 1 to type 1 (e.g. modality manipulation, filling in a value for an inherent but unspecified feature[9]). Causative, which manipulates the subcategorization frame, should be an operation of this type. Under the AM model, a type 3 to type 3 operation should not produce effects on inherent attributes. The causative operation I have argued for in Tigre must be of the type 3 to type 3, since it operates on signs which have been modified with an additional feature/value pair. Thus, although the actual effect of the particular type 3 to type 3 operation I have proposed is not a violation of the typology in terms of allowing sequential additions of feature/value pairs, it does differ from the intended separation of duties of each type of operation.

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[9]It is possible that a type 1 to type 2 operation could also fill-in an inherently unspecified feature in conjunction with "fixing" the modality.

7.0 Conclusions

What I hope to have shown in the above analysis and discussion is this: there are aspects of Articulated morphology which are supported by the Tigre data and others which are not. The treatment in AM of lexical items as signs which are differentiated into types is very suited to the phonological distinction in templatic systems between non-prosodically licensed objects and prosodically licensed ones. Further, the inherent "modal" attributes provide a means to specifically encode the lexical marking of the templates inherently instantiated by certain verbs while allowing these markings to be manipulated by morphological operations, which we've seen does happen here in the inflection of imperfective forms.

What is not supported by the Tigre data is the typology of morphological operations. I have argued that the typology prescribed by AM is too restrictive in its present state and would need to be modified, in the ways I have laid out, to accommodate the sorts of behaviors demonstrated.

References and Related Works

Archangeli, Diana (1991) "Syllabification and prosodic templates in Yawelmani", *Natural Language and Linguistic Theory 9*, 231-283.

McCarthy, John (1981) "A prosodic theory of nonconcatenative morphology", *Linguistic Inquiry 12*, 373-418.

McCarthy, John & Alan Prince (1986) "Prosodic Morphology", U Mass. and Brandeis University m.s.

McCarthy, John & Alan Prince (1990) "Foot and word in prosodic morphology: the Arabic broken plural", *Natural Language and Linguistic Theory 8*, 209-283.

Raz, Shlomo (1983). *Tigre Grammar and Texts*. Undena Publications, Malibu, CA.

Sloan, K. (1991). *Syllables and Templates: Evidence from Sierra Miwok*, Doctoral dissertation, MIT, Cambridge, Massachusetts.

Steele, S. (In prep).

Yip, Moira (1988) "Template morphology and the direction of association", *Natural Language and Linguistic Theory 6*, 551-577.