An optimality-theoretic analysis of the phonology of Tibetan Numerals

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Abstract

The problem of Tibetan numerals, which has plagued undergraduate phonology students for decades, is analysed first using a derivational methodology. The underlying forms discovered through this derivational method are then used to facilitate an optimality-theoretic analysis of Tibetan phonology. Specifically, the constraints investigated are constraints against consonant clusters in onsets (*Complex), input phonemes without correspondence in the output (MAX), output phonemes without correspondence in the input (DEP), and consonants in syllable codas (NoCoda).

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1 Introduction

Commonly used as a torture device on undergraduate phonology students, Tibetan numerals exhibit behavior that seems quite exotic at first glance. For example, consider the phonetic realizations listed in Table 1.

Having just seen these data, it appears that we have the insertion of a [g] in the case of the term for 'eleven' and a [b] in the case of the term for 'fourteen.' The term for 'forty'

PR	English Gloss
ǰu	'ten'
ǰig	'one'
ǰugǰig	'eleven'
shi	'four'
ǰubshi	'fourteen'

Table 1: PRs for select Tibetan Numerals

UR	PR	English Gloss
/bǰu/	ǰu	‘ten’
/gǰig/	ǰig	‘one’
/bshi/	shi	‘four’
/rgu/	gu	‘nine’
/ŋa/	ŋa	‘five’
/bǰurgu/	ǰur.gu	‘nineteen’
/rgubǰu/	gub.ǰu	‘ninety’

Table 2: URs for selected Tibetan Numerals

(shibǰu) also appears to have an inserted [b], which suggests that the inserted consonant might be related to the morpheme for ‘four.’ The terms for ‘nine’ (gu), ‘nineteen’ (ǰurgu) and ‘ninety’ (gubǰu), however, have demonstrate that even in numbers derived from the same morphemes different inserted consonants are found. This negates the intuition that the inserted consonant is dependent upon just one morpheme regardless of its linear order. The terms for ‘five’ (ŋa), ‘fifteen’ (ǰuŋa) and ‘fifty’ (ŋabǰu) show that in some cases there is no insertion at all.

The prospects of an insertion based analysis are grim, but if we re-analyze this as a deletion process, we have a much better outlook. The most important realization for capturing this process is that the seemingly inserted consonants are in actuality part of the second morpheme in the terms. The underlying representations of some of these morphemes include initial consonant clusters as seen in table 2. The deletion process can then be quickly summed up with the rule $C \rightarrow \emptyset$ / #____C .

2 OT Analysis

Optimality Theory (OT) is a theory based on the existence of Universal Grammar (UG). In its strongest version, OT claims that all constraints are language-universal phenomena. Taking this claim to be true, this paper analyzes the data from the Tibetan numeral data using constraints that have been demonstrated to have an effect in other human languages.

/bǰu/ → ǰu

Input: /bǰu/	*Complex	MAX
a. bǰu	*!	
b. ☞ǰu		*

Table 3: *Complex ≫ MAX

/rgu/ → gu

Input: /rgu/	*Complex	DEP	MAX
a. rgu	*!		
b. ri.gu		*!	
c. ☞gu			*

Table 4: *Complex, DEP ≫ MAX

There are four constraints in particular that this paper will focus on:

***Complex** Syllable onsets and syllable codas may contain at most one consonant.

DEP Each segment in the output must correspond to a segment in the input.

MAX Each segment in the input must have a corresponding segment in the output.

NoCoda Syllable codas must be empty.

Tibetan numerals never have syllables with complex onsets or codas. The *Complex constraint must be very high ranking in Tibetan. Something must happen, then, when we have underlying forms that contain word-initial consonant clusters. From our derivational analysis, we know that Tibetan deletes the first consonant in this case, violating MAX. This indicates that—in Tibetan—the ranking must be *Complex ≫ MAX, as seen in table 3.

What Tibetan does not do is to insert a vowel to break up the problematic consonant cluster, although that would certainly be a reasonable solution. This means that the DEP constraint must have a higher ranking than MAX, which is argued in table 4. Notice that no output forms in Tibetan have either an inserted vowel or a complex onset, so no ranking relationship can be determined between *Complex and DEP.

/gǰig/ → ǰig

Input:	/gǰig/	*Complex	MAX	NoCoda
a.	gǰig	*!		*
b.	gǰi	*!	*	
c.	ǰi		**!	
d.	☞ǰig		*	*

Table 5: MAX ≫ NoCoda

/bǰurgu/ → ǰur.gu

Input:	/bǰurgu/	*Complex	DEP	MAX	NoCoda
a.	bǰur.gu	*!			*
b.	bi.ǰur.gu		*!		*
c.	☞ǰur.gu			*	*
d.	ǰu.rgu	*!		*	
e.	ǰu.gu			**!	

Table 6: *Complex, DEP ≫ MAX ≫ NoCoda

Languages in general tend to shy away from consonant-final syllables. In OT this tendency is explained through NoCoda, the constraint which militates against syllables with codas. In Tibetan, however, this constraint is relatively low ranked, so many syllables have codas. Most importantly, MAX is more highly ranked than NoCoda, as demonstrated in table 5; Tibetan speakers would rather maintain a syllable coda than delete the offending consonant. Also, because MAX is critically order lower than *Complex and DEP, we know through the transitive property of constraint rankings that NoCoda is ranked lower than *Complex and DEP as well. This is summarized in table 6.

3 Conclusions

Through a series of ranking arguments, this paper has demonstrated that in Tibetan the four constraints under investigation are critically ranked *Complex, DEP ≫ MAX ≫ NoCoda. The low ranking of NoCoda is immediately visible in the data. In a language where words can end in a consonant, syllables can end in a consonant. The status *Complex is less obvious, but the absence of onset clusters in the data certainly is suggestive of a high ranking. The interesting part of this analysis is in the relationship between MAX and DEP. In the introduction, we started with an analysis of insertion, which would coincide with a ranking MAX $\gg$ DEP. The demonstration that the process was one of deletion rather than insertion implied that the ranking was actually DEP $\gg$ which was then argued formally in table 4.