

Prosody Drives the Syntax: O'odham Rhythm*

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0. Introduction

In this paper, I examine two restrictions on the syntax of Tohono O'odham. I propose a reanalysis of these restrictions as following from prosodic considerations, rather than syntactic ones. When these restrictions are viewed as derived by the prosody, we unify the two cases of distributional facts. In contrast, a syntactic treatment of the restrictions shows them to be arbitrary and unrelated.

Specifically, I will argue that the left edge of utterances in Tohono O'odham prefers an initial trochaic foot. To create this optimal prosodic structure, the prosody manipulates the syntax in two ways: 1) The *g* determiner does not appear initially in an utterance to prevent the sentence from beginning with a nontrochee, and 2) The auxiliary appears in second position to avoid beginning an utterance with a nontrochee. The analysis I propose will make use of the insights offered by Optimality Theory (McCarthy and Prince 1993; Prince and Smolensky 1993). I show that a theory with ranked, violable constraints, such as Optimality Theory, shows us how prosodic and syntactic constraints interact.

The paper is organized as follows. First, I describe the syntactic restrictions. A brief overview of word-level stress in Tohono O'odham follows this section. The third section synthesizes the syntactic and phonological background with a look at the data from the prosodic perspective. I then provide an analysis for the data, after giving background on Optimality Theory. The paper concludes with a discussion of the further repercussions of the analysis presented here.

1. The Syntactic Restrictions

The focus of this paper is on two restrictions on Tohono O'odham syntax. Tohono O'odham (TO; formerly Papago) is a Uto-Aztecan language spoken in southern Arizona. It is a language with free word order, although there are some constraints on where certain elements may or may not appear. The two restrictions relevant for this paper are those placed on the *g* determiner and the auxiliary. Let us now examine the distribution of these elements.

Nouns in TO cannot occur without a determiner, a demonstrative, or a numeral.¹ There is a specific rule pertaining to the *g* determiner.² All nouns, even names, must be accompanied by the *g* determiner, except when they occur sentence initially.

The determiner, although written in TO orthography as *g*, consists of an unstressed syllable. This can be seen in the following comparison between the orthography and a broad transcription, taken from Hill and Zepeda (1992: 368):

- | | | |
|-----|---|---|
| (1) | a. In TO orthography:
'alidagaj g ju:kam
child DET Mexican (male)
'the Mexican man's child | b. In phonetic transcription:
[ˈalidəgajə gə juˈkɑm] |
|-----|---|---|

The phonetic form of the determiner will appear in the same form before a vowel-initial form such as *o'odham*, 'person', as all such forms will begin with a glottal stop as the onset.

Now let us examine the restrictions on the distribution of the *g* determiner, shown in (2):

- | | | |
|--------|--|-------------------|
| (2) a. | Gógs 'o hí:nk.
dog AUX barking
'The dog is/was barking.' | (Zepeda 1988: 13) |
| b. | Hí:nk 'o g gógs.
barking AUX DET dog
(same as 2a) | (Zepeda 1988: 13) |
| c. | O'odham 'o ñéok.
person AUX speaking
'The person is/was speaking.' | (Zepeda 1988: 13) |
| d. | *G ó'odham 'o ñéok.
DET person AUX speaking | (Zepeda 1988: 13) |
| e. | Ñéok 'o g o'odham.
(same as 2e) | |

The first pair of sentences in (2a-b) show the contrast with the noun phrase, *g gógs*, when it appears in initial (2a) and noninitial (2b) position. When the noun phrase is initial, the *g* determiner does not appear in the sentence. However, when the sentence begins with the verb phrase and the noun phrase appears in a noninitial position, the *g* determiner precedes the noun. In the contrast between (2c-d) we see further that an initial noun which is not preceded by the *g* determiner will result in a grammatical sentence (2c), while when the *g* determiner precedes a noun sentence-initially, an ungrammatical sentence results (2d). Note that these variations in word order do not change the sentence's reading with respect to the definiteness or specificity of the noun; crucially the absence of the *g* determiner cannot be due to a definiteness or specificity effect found when the noun is the first element of the sentence. The generalization, then, is that all unmodified nouns must be preceded by the *g* determiner, unless the nouns occur sentence-initially.

Now let us examine the auxiliary and its behavior. As mentioned before, TO is a free word order language. The TO auxiliary carries information about the person and number of the subject, as well as aspectual and other information.³ Every TO sentence must have an auxiliary, although overt subjects and objects may be dropped from the sentence. Further, the auxiliary is restricted to second position in most sentences. The word order variations that this creates can be seen in (3):

- | | | |
|--------|--|-------------------|
| (3) a. | Bán 'o húhu'id g cú:wĩ.
coyote 3AUX chasing DET jackrabbit
'The coyote is/was chasing the jackrabbit.' | (Zepeda 1988: 31) |
| b. | Húhu'id 'o g bán g cú:wĩ.
(same as (3a)) | (Zepeda 1988: 31) |
| c. | Bán 'o g cú:wĩ húhu'id.
(same as (3a)) | (Zepeda 1988: 31) |
| d. | Cú:wĩ 'o húhu'id g bán.
(same as (3a)) | (Zepeda 1988: 31) |
| e. | Húhu'id 'o g cú:wĩ g bán.
(same as (3a)) | (Zepeda 1988: 31) |

- f. Cú:wǐ 'o g bán húhu'id. (Zepeda 1988: 31)
 (same as (3a))
 g. *O g cú:wǐ g bán húhu'id.

The sentences show that canonical word order requires that the auxiliary appear in second position. Note again that these variations in TO ordering all correspond to a single translation. It is also the case that the TO auxiliary follows the first constituent of the sentence. This is evident when a possessed noun phrase occurs sentence-initially, as in this example:

- (4) a. 'Áli jé'e 'at o cípk s'álim. (Zepeda 1988, 75)
 child mother 3AUX:PERF FUT working tomorrow
 'The child's mother will work tomorrow.'
 b. S'álim 'at o cípk g 'áli jé'e. (Zepeda 1988, 75)
 tomorrow 3AUX:PERF FUT working DET child mother
 (same as (4a))

TO requires that constituency be respected in other contexts, such as postpositional phrases, so we can assume that the positioning of the auxiliary after the first constituent of a sentence follows from independent restrictions on constituency found elsewhere in the language.

The necessary generalization for the auxiliary, then, is that it must appear in second position, following the first constituent of the sentence. This generalization is contradicted, however, when we view additional data with the perfective auxiliary in future tense. In such cases, the auxiliary must come first:

- (5) a. 'At o cípkanad.
 3AUX:PERF FUT working:SG:FUT-IMP
 'He will be working.'
 b. *O 'at cípkanad.
 c. *Cípkanad 'at o.
 d. *O cípkanad 'at.

These examples from the future imperfective show us that the auxiliary may come first. Restrictions on the future marker, *o*, (which must precede the verb) will interact with restrictions on the auxiliary (which must appear in second position) to determine word order. The only grammatical possibility for such a sentence is for the auxiliary to appear initially. At this point, there are two possible analyses of the basic position of the auxiliary within the sentence: 1) The auxiliary appears in first position 2) The auxiliary appears in second position. In either case, it is not clear why the syntax should prefer the auxiliary in either first or second position; the restriction on the auxiliary, like that on the *g* determiner, is apparently arbitrary. At this point in the exposition, we will reserve judgement on which is the correct analysis.

This section has demonstrated the behavior of the two syntactic elements in TO that this paper will focus on. I will now provide the phonological background which provides the necessary underpinnings of the prosodic reanalysis.

2. The Phonology

The prosodic reanalysis of the syntactic restrictions necessitates a look at TO stress at the word-level, as word stress is what constructs the prosody of the

utterance. Therefore this section will provide a brief description of primary stress in TO.

In monomorphemic content words, primary stress falls on the initial syllable of the word (Zepeda, 1988). This can be seen in (6):

- | | | |
|--------|---------|-------------------|
| (6) a. | ó'odham | 'person, O'odham' |
| b. | cíkpan | 'working' |
| c. | hí:nk | 'barking' |
| d. | gógs | 'dog' |

In reduplicated words, stress falls on the reduplicant (still the initial syllable). All other prefixes (such as the *ha-*, third person plural object) are unstressed; the stative suffix *s-* will be syllabified with the following material:

- | | | |
|--------|-----------|--|
| (7) a. | gógs | 'dog' |
| b. | gógogs | 'dogs' |
| c. | ñéid | 'seeing' |
| d. | ñéñeid | 'seeing (plural subject)' |
| e. | ha-ñéñeid | 'seeing them (plural subject, 3pl object)' |
| f. | s-dádpk | 'smooth (plural)' |

Tohono O'odham has relatively short words⁴, and monosyllabic words frequently occur in the language. The generalization here is that the word-level phonology of TO prefers trochees.

3. The Data and a Phonology-Syntax Synthesis

This section investigates the effects of the syntactic restrictions from the first section on the stress patterns of TO utterances. To do this, we will reexamine the sentences from the first section, but here we will do so with an eye to what the stress patterns are. To indicate this information, I will align each sentence with a metrical grid, following Hayes (1983), where an "X" indicates lexical stress and "." indicates a syllable without stress. Pay close attention especially to the left edges of utterances, as these edges reveal the effects of the syntactic restrictions.

First, let us examine the stress patterns of sentences which exemplify the distribution of the *g* determiner, as in (8):

- | | |
|--------|------------------------------|
| (8) a. | X . X |
| | Gógs 'o hí:nk. |
| | dog AUX barking |
| | The dog is/was barking.' |
| b. | X . . X |
| | Hí:nk 'o g gógs. |
| | barking AUX DET dog |
| c. | X . . . X |
| | Ó'odham 'o ñéok. |
| | person AUX speaking |
| | The person is/was speaking.' |
| d. | . X . . . X |
| | *G ó'odham 'o ñéok. |
| | DET person AUX speaking |
| e. | X . . . X . . |
| | Ñéok 'o g ó'odham. |

The grammatical sentences (6a-c,e) begin with the trochaic sequence "X ." and where nouns occur initially (6a,c) the *g* determiner does not appear. However, the ungrammatical sentence, where the noun occurs initially and the *g* determiner is retained, does not begin with a trochaic sequence, but rather an iambic one: ". X".

As we examine the stress patterns of sentences showing the auxiliary's distribution, a similar pattern emerges. Examine these sentences in (9):

- (9) a. X . X . . . X .
 Bán 'o húhu'id g cú:wǐ.
 coyote 3AUX chasing DET jackrabbit
 'The coyote is/was chasing the jackrabbit.'
- b. X X . X .
 Húhu'id 'o g bán g cú:wǐ.
- c. X . . X . X . .
 Bán 'o g cú:wǐ húhu'id.
- d. X . . . X . . . X
 Cú:wǐ 'o húhu'id g bán.
- e. X X . . X
 Húhu'id 'o g cú:wǐ g bán.
- f. X . . . X X . .
 Cú:wǐ 'o g bán húhu'id.
- g. . . X . . X X . .
 *'O g cú:wǐ g bán húhu'id.

In the grammatical sentences (9a-f), the auxiliary appears in second position and all sentences begin with a trochaic sequence. However, the ungrammatical sentence in (9g) begins with two unstressed syllables, ". ." and the auxiliary occurs sentence initially. The pattern here is nearly identical to that of the data in (8); grammatical utterances begin with a trochee; ungrammatical sequences do not begin with trochees.

However, the data from the future imperfective does not align easily with this pattern. The grammatical example begins with a nontrochaic sequence:

- (10) a. . . X . .
 'At o cǐpkanad.
 3AUX:PERF FUT working:SG:FUT-IMP
 'He will be working.'
- b. *O 'at X . .
 cǐpkanad.
- c. X
 *Cǐpkanad 'at o.
- d. . X
 *O cǐpkanad 'at.

The pattern for this data is as follows: in (10a), the grammatical sequence begins with two unstressed syllables and the auxiliary is in first position; in (10b), the ungrammatical sentence begins with two unstressed syllables. but the future marker is separated from the verb; in (10c), the ungrammatical sentence begins with a trochee; however, the verb and the future marker are again broken up; finally, in (10d), the ungrammatical sentence begins with an iamb, although the future marker and the verb are together.

What do the variations in (10) tell us? First, they show that the restrictions on syntax are violable. Second, they show us that it is possible for utterances in TO to begin with a nonrochaic sequence. However, note that the allowed nonrochaic sequence is *not* an iamb. Interestingly, the TO utterance allows what (in general) meter allows: Meter feet may contain stressed or unstressed material in the strong position (S; here the first syllable, as the foot is trochaic), while the weak position (W; here the second syllable) only allows unstressed material and severely restricts when stressed material may occupy the weak position.⁵

Finally, the variations in (10), together with those in (8-9), tell us that the effects of the syntactic restrictions appear to be to avoid the nonrochaic sequences. The *g* determiner, if retained initially, would automatically create an iambic foot, as all nouns begin with initial stress. It is not retained, however, and its absence effectively begins all utterances with a stressed syllable. In the case of the auxiliary, it also does not appear initially, as this would begin the utterance with an unstressed syllable. However, by placing the auxiliary in second position, the prosody has an unstressed syllable at its disposal. Whenever an utterance begins with a monosyllabic content word, the auxiliary provides the unstressed syllable necessary to complete the trochaic foot, as in (9a,c). For longer words, the trochee will be completed word-internally, as in (9b), and the unstressed syllable provided by the second position auxiliary will not be necessary. Thus the auxiliary appears to act as a type of buffer, providing an unstressed syllable should it be necessary, given that TO often has monosyllabic words. Under the prosodic account, we now have an answer to why the auxiliary must appear at the left edge of an utterance. The prosody needs an unstressed syllable at the left edge to complete the trochaic foot. The second position auxiliary now has a principled account.

The behavior of both the *g* determiner and the auxiliary reveals that TO prosody plays a strong role in shaping the surface structure of TO utterances. The conclusion from the data in this section is that the syntactic restrictions have prosodic effects on the left edges of utterances. In Section 5, I will provide an analysis for the data which synthesizes these generalizations under the auspice of creating the optimal O'odham prosodic structure.

4. Background on Optimality Theory

Recent work in phonology and prosodic morphology has focused on the theoretical framework provided by Optimality Theory (henceforth OT; McCarthy and Prince 1993a,b, Prince and Smolensky 1993). OT argues for a nonderivational, output oriented approach. The centerpiece for this theory is the reliance on constraints; OT is based on the notion that constraints are both violable and ranked. The ranking of constraints is crucial, as they reveal the optimal candidate of all possible output candidates. The evaluation of candidate outputs, as well as constraint ranking and violability, is shown below.

For this chart, two constraints are relevant:

(11) **-COD**
Syllables do not have codas.

(12) **EDGEMOST** (ψ ; E; D)
The item ψ is situated at the edge E of domain D.

The chart below exemplifies the Tagalog prefix /um/, which appears on verbs. The column beneath candidates represents a sample of the candidate set of outputs generated for evaluation; the other two columns represent the constraints relevant for the /um/ prefixation. The asterisk represents the violation of a constraint; while the exclamation point signals where in the evaluation the candidate is rejected. The arrow indicates which output is chosen by the constraints as the optimal output. Note also that under EDGEMOST, the "#" is an informal notation to indicate the distance from the left edge of the word to where the /um/ appears. Finally, shaded boxes represent those which are irrelevant in determining the crucial violations. The evaluation is as follows :

(13) Evaluations of /um + gradwet/ (Prince and Smolensky 1993, 36)

Candidates	-COD	EDGEMOST (um, L)
.UM.grad.wet.	***!	#0
.gUM.rad.wet	***!	#1
→ .grUM.Mad.wet.	**	#gr
.gra.UM.dwet.	**	#gra !
.gra.dUM.wet.	**	#gra ! d
.grad.w...UM...	**	#gra ! dw...

By reversing the ranking of the constraints, we do not correctly predict the optimal candidate for output. Finally, note that under OT, only one optimal candidate is allowed. Ties are settled by descending down the constraint hierarchy to lower-ranked constraints to determine which output is the optimal one.

While OT has not been applied to prosody, the advantages of doing so are clear. First, this will allow us to capture the interactions between phonology and syntax by interleaving the two. Second, we have seen that restrictions in TO are not inviolable; rather, violations may occur, but only under certain contexts.

5. The Analysis

Let us review briefly the facts. First, the *g* determiner is always dropped sentence-initially, changing the left edge of the phonology of an utterance from an iambic sequence into a trochee. Second, the auxiliary appears in either first or second position. Second position AUX results in an initial trochee, with the unstressed AUX often completing the trochaic foot. It appears in first position when other word order possibilities (specifically here involving the future marker) are disallowed because they break up the future marker and the verb or because they create an iambic sequence sentence-initially. These facts mean that because of the phonological structure and size of O’odham words (initial stress, tendency toward monosyllabic words), an initial auxiliary or *g* determiner would result in an initial iamb. The only exception will be when the auxiliary is followed by an unstressed syllable, as in the future imperfective. In fact, we see that it is in the future imperfective where the AUX comes sentence-initially.

The similar behavior of the *g* determiner and the AUX suggest that the basic position of the AUX within an utterance is sentence-initial. However, unlike the *g* determiner, the AUX contains information crucial to the sentence, and therefore cannot be absent from the utterance. Here is where the asymmetry between the

two becomes clear. Both create illicit prosodic structure at left-edges; the *g* determiner is deleted, while the *AUX* appears in second position. Second position guarantees an unstressed syllable to complete the trochee, as well as places the *AUX* as close to the left-edge of the utterance as possible. These syntactic manipulations are the result of prosodic demands.

The question we are now faced with is how to capture these strategies of O'odham rhythm. Prosodic analyses standardly rely on the Prosodic Hierarchy (as in Hayes 1989) and its categories to formulate rules for the interaction of elements in domains larger than the word. The Prosodic Hierarchy will allow the restriction of only the left edge of an utterance. However, the violable behavior of restrictions in TO prosody is difficult to capture in a rule-based approach. Therefore, we shall draw upon the insights of the Prosodic Hierarchy, but formalize the analysis within an approach that can capture these interactions in TO prosody: Optimality Theory.

The prosody guides the syntax into creating trochees (and avoiding nontrochees) at the left edges of utterances. We wish to rule out all nontrochaic feet (so * . . and * . X). This can be formalized by using the parameters provided by Generalized Alignment (GA; McCarthy and Prince 1993b); we previously saw a specific instance of GA as *EDGEMOST* (*um*, *L*). Generalized Alignment "demands that a designated edge of each prosodic or morphological constituent of type Cat1 coincide with a designated edge of some other prosodic or morphological constituent Cat2" (GA, 2). The following constraint will effectively check each utterance to ensure it begins with a trochaic foot.

- (15) **Trochee Constraint**
Align (Foot, Left, Utterance, Left)

We further know that each noun phrase must be preceded by a *g* determiner (save sentence-initially). Although this constraint is syntactic, it behaves in a manner similar to prefixes. Specifically, we can consider that the *g* determiner is "prefixed" onto the left edge of the noun phrase. Following OT, the restriction is formalized as follows:

- (16) **G Constraint**
Edgemost (*g*, Left, Noun Phrase)

The restriction on the auxiliary's positioning in the sentence is prosodic; the prosody demands that the auxiliary appear on the left edge to supply the prosody with a movable unstressed element. The basic positioning of the auxiliary is initially; it is the interaction of this prosodic consideration with other constraints which derives second position aux. Note that there is an additional benefit of analyzing the auxiliary as a first position element; it never appears in third or final position. The preference is clearly for the auxiliary to be as leftmost as possible. This constraint is formalized here:

- (17) **AUX Constraint**
Edgemost (AUX, Left, Utterance)

How do these constraints rank with respect to each other? We have seen that the preference for trochees will force the *AUX* into second position, as well as "deleting" the *g* determiner sentence-initially. The Trochee Constraint will thus

be a higher constraint than the other two. The *G* and the *AUX* constraints cannot be ranked with respect to each other (indicated by the dotted line separating them). Here is the evaluation of the first set of sentences:

(18) Evaluations of *G* Determiner Sentences

Candidates	Trochee	AUX	<i>G</i>
→a. Gógs 'o hí:nk		*	*
→b. Hí:nk 'o g gógs.		*	
→c. O'odham 'o ñéok.		*	*
d. *G ó'odham 'o ñéok.	* !	*	
→e. Néok 'o g ó'odham		*	

Two problems arise.⁶ First, OT allows only one optimal candidate, but there are three optimal candidates (none is more preferred than the other). A language such as O'odham, which has free word order, clearly ranks several candidates as optimal, rather than only one. Second, the optimal candidates differ in whether they violate both the *AUX* and *G* constraints, or only one. These problems require that we modify Optimality Theory when it is applied to prosodic domains. The two problems can be resolved if we allow that prosody (and, presumably, syntax) judges all candidates equal at the point of first violation. As the *AUX* and *G* constraints are unranked with respect to each other, all that is needed is a violation on either one of the constraints; the second violation is "free" if each constraint is violated. Therefore, given two sentences, one which violates only *AUX*, one which violates only *G*, the two candidates will be ranked equally. Let us explore this further by examining some of the candidates representing the auxiliary's distribution:

(19) Evaluations of *AUX* Sentences

Candidates	Trochee	AUX	<i>G</i>
→a. Bán 'o húhu'id g cú:wĩ.		*	*
→b. Húhu'id 'o g bán g cú:wĩ.		*	
→c. Bán 'o g cú:wĩ húhu'id.		*	*
→d. Cú:wĩ 'o húhu'id g bán.		*	*
→e. Húhu'id 'o g cú:wĩ g bán		*	
→f. Cú:wĩ 'o g bán húhu'id.		*	*
g. * 'O g cú:wĩ g bán húhu'id.	* !		
h. * 'O húhu'id g cú:wĩ g bán.	* !		

Exactly as we would expect, based on the previous evaluations, where the auxiliary appears first (19g-h), a prosodic violation occurs, so that we must now evaluate the remaining candidates with respect to the next constraint. These candidates (19a-f) are all equal at the first violation of one of the constraints. What, then, of the interactions of the prosody with the restrictions placed on the future marker? Here again, we formalize the future marker as if it were a "prefix" onto the verb, as in (20):

(20) *O* Constraint
Edgemost (*o*, Left, Verb)

This constraint must outrank the others, as we saw that in the future imperfective, nonoptimal prosody will be created. The tableau evaluating the candidate outputs is shown below:

(21) Evaluations of the *O* Future Marker

Candidates	<i>O</i>	Trochee	AUX	<i>G</i>
→a. 'At o cípkanad.		*	*	
b. *O 'at cípkanad.	* !	*	*	
c. *Cípkanad 'at o.	* !		*	
d. *O cípkanad 'at.		*	** !	

Note that there are two asterisks marking the AUX column. This parallels the example of Tagalog infixation, where the prefixal infix violates EDGEMOST (*um*, L) with each successive segment that separates the prefix from the left edge of the word. Each successive constituent which separates the AUX from the left edge will accumulate as violations of the AUX constraint. (It also appears to be the case that among nontrochaic sequences, two unstressed syllables ". ." are preferred over iambs ". X".)⁷

6. Conclusions

In this paper, I have argued for the prosodic reanalysis of syntactic restrictions in Tohono O'odham. Specifically, I have made these four points: 1) The *g* determiner does not appear sentence-initially because it would begin an utterance with an illicit nontrochaic sequence. 2) The TO auxiliary is a first position element. 3) The auxiliary appears in second position because it would begin an utterance with an illicit nontrochaic sequence. 4) The preference of utterance prosody in Tohono O'odham is for trochees.

In arguing for this reanalysis, I have made a number of theoretical points. First, prosody may be interleaved with the syntax, such that prosody drives the syntax (or syntax curtails the prosody). For Tohono O'odham, we saw specifically that the behavior and restrictions on the determiner and the auxiliary reflects how the prosody may manipulate the syntax. Further, I showed that violations of prosodic constraints reflect how certain syntactic constraints may outrank prosodic ones. Second, the use of Optimality Theory as the framework for the current analysis allows the mixed dominance relations between syntax and prosody. Third, I showed that for Tohono O'odham, with its free word order, an optimal-theoretic account of the prosody-syntax interface must allow for multiple optimal candidates.

In conclusion, there are further repercussions of this work in two areas. First, the prosody of O'odham parallels both words and song meter (Fitzgerald, in submission) in preferring trochees. Second, Optimality Theory may be extended to larger prosodic structures, here utterances, and the prosodic interface with syntax. Finally, the formulation of syntactic constraints in terms of Generalized Alignment is also an innovation for both Optimality Theory and syntactic theory.

* Thanks to the following for helpful discussion and comments: Chris Golston, Andrea Heiberg, Eloise Jelinek, Sue Lorenson, Diane Meador, Jan Mohammad, Diane Ohala, Pat Pérez, as well as members of the audience at BLS 20. Thanks also to Amy Fountain, Mike Hammond, Jane Hill and Ofelia Zepeda for more in-depth discussion of Tohono O'odham and the analysis presented here. All errors are my own.

¹Nouns in postpositional and possessive phrases act slightly differently.

²The *g* determiner may correspond to either a definite or indefinite reading. It appears to have no semantic effect.

³For example, the reportative suffix, *s'*, may appear on the auxiliary.

⁴In fact, the short length of words is viewed as a distinguishing trait between Tohono O'odham and 'Akimel O'odham (formerly Pima), which allows longer words with more morphemes, according to Ofelia Zepeda (p.c.).

⁵The analysis presented here is also using meter feet, rather than stress feet. This means that feet are binary trees with a strong and weak position. The ordering of these two positions is where an iamb and a trochee differ.

⁶There is a third problem; the constraint hierarchy as formulated will consider the following ungrammatical sentence, where a *g* determiner is dropped noninitially, as optimal output:

*Ñéok 'o ó'odham.

The sentence will incur one violation each of AUX and *G*, and thus rank equally with (18e). I suggest that constraint violations "cost more" when they are not motivated by satisfying a higher constraint.

⁷One apparent exception to this is found in prefixed forms; such items as nouns with possessive prefixes, or verbs with object prefixes, will create an initial iambic sequence. The exception can be explained if we assume that the prosody can only manipulate syntax; morphology resists these manipulations.

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