



Prosodic Inconsistency in Tohono O'odham

Author(s): Colleen M. Fitzgerald

Source: *International Journal of American Linguistics*, Vol. 78, No. 4 (October 2012), pp. 435-463

Published by: [The University of Chicago Press](#)

Stable URL: <http://www.jstor.org/stable/10.1086/666930>

Accessed: 11/08/2014 13:16

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The University of Chicago Press is collaborating with JSTOR to digitize, preserve and extend access to *International Journal of American Linguistics*.

<http://www.jstor.org>

PROSODIC INCONSISTENCY IN TOHONO O'ODHAM¹

COLLEEN M. FITZGERALD

UNIVERSITY OF TEXAS AT ARLINGTON

This paper makes a typological contribution by describing a stress system that uses syllabic trochees while also displaying characteristics more typically associated with a quantity-sensitive language. The description comes from Tohono O'odham. The rhythm of this language is quantity-insensitive and trochaic, although the language also displays characteristics often associated with quantity-sensitivity (i.e., long vowels, gemination). Examined together, the facts illustrated here demonstrate the PROSODIC INCONSISTENCY of Tohono O'odham: that rhythm and prosodic morphology offer different perspectives on the role played by quantity, and that Tohono O'odham is the first language documented to split its rhythm and prosodic morphology along quantitative lines.

[KEYWORDS: Tohono O'odham, prosody, reduplication, quantity, stress]

1. Introduction. This paper presents a comprehensive study of the phonology and morphology in Tohono O'odham (ISO code: ood), arguing that the language displays a split previously undocumented: the language is quantity-insensitive in its stress system but displays quantity-sensitive behavior in its prosodic morphology. Tohono O'odham (formerly known as Papago) is a Uto-Aztecan language spoken in southern Arizona and Mexico. Rhythm in Tohono O'odham is trochaic, analyzed as a quantity-insensitive system with a left-headed foot, the syllabic trochee (i.e., Fitzgerald 2002a).

¹ Data in this paper come from my fieldwork, as well as from Mathiot (1973), Saxton, Saxton, and Enos (1989), and Hill and Zepeda (1998). Fieldwork has been funded by the University of Arizona Graduate College, the University at Buffalo, the UUP, and the Phillips Fund of the American Philosophical Society. My special thanks go to the Tohono O'odham speakers who contributed their knowledge and their insights to this study: Albert Alvarez, Ron Geronimo, George José, Daniel Lopez, Phillip Miguel, Felicia Nuñez, and Del Ortiz. Thanks to the following for helpful discussion or comments as this paper evolved: Diana Archangeli, Eric Bakovic, Luis Barragan, Megan Crowhurst, Amy Fountain, Jason Haugen, Bruce Hayes, Jane Hill, Karin Michelson, and Jason Riggle, as well as anonymous *IJAL* reviewers and associate editors.

A few notes on phonetic symbols: *č, ʃ* represent affricates; *ñ* the palatal nasal; *ɻ, ʂ* are the two retroflexes; *ɭ* represents a palatal lateral flap; and *i* a high central unrounded vowel. Voiceless or "extra-short" and long vowels are typically marked (the former with the ◌̥ diacritic and the latter with a colon underneath); but other features, such as preaspiration of voiceless obstruents, are unmarked here. It should be noted that there is considerable variation in the voiceless/extra-short vowels among different dialects. All words are marked with their primary stresses; words are only marked with subsidiary stresses if they were obtained from published materials (primarily Fitzgerald 1997; 1999a; 2001a; 2002a) documenting secondary stress or if they were collected during my fieldwork. Any errors are my responsibility.

[*IJAL*, vol. 78, no. 4, October 2012, pp. 435–63]
© 2012 by The University of Chicago. All rights reserved.
0020-7071/2012/7804-0001\$10.00

However, the quantity-sensitive behavior surfaces in a number of ways in the language's prosodic morphology, typically enhancing the initial syllable, which carries primary stress.

These patterns in O'odham are important not only for our understanding of the language and the role of quantity in the Uto-Aztecan family but also in a larger theoretical context, relating to what Broselow (1995:98) terms "moraiic consistency," which is also characterized by Gordon (1999/2006:5) as "the 'moraiic uniformity hypothesis' [in which] all weight sensitive phenomena within a single language observe the same weight criterion and thus employ the same weight representations." It also augments our understanding of this, as Gordon (1999/2006; 2002; 2004a) examines these issues without systematically considering prosodic morphology, with the exception of minimal word patterns. Prosodic consistency in languages has been documented; for example, Hayes (1995:103) analyzes Pintupi (ISO code: piu), a Pama-Nyungan language of Australia, with quantity-insensitive feet (syllabic trochees) and yet quantity-sensitive bimoraic word minima. Later researchers have also addressed various dimensions of prosodic inconsistency, including Kager (1992a; 1992b), Hayes (1995), and Gordon (1999/2006), as well as work in generative meter focusing on how the prosody of the language dictates the shape of the meter (Hanson and Kiparsky 1996 and Golston and Riad 2000). Tohono O'odham presents a novel case, however, of a language where the role of quantity can be neatly separated in terms of rhythm versus prosodic morphology.

This paper documents the phenomena that bear on the issue of quantity in Tohono O'odham, bringing together a wide range of published data but viewed through the prism of prosodic consistency. This includes issues such as contrastive length, rhythmic alternations, minimal word effects, as well as patterns relevant to shortening, lengthening, and the creation of closed syllables. All involve the types of issues that have appeared in the phonological literature as quantitative effects. Of particular interest, both to this particular language and to phonological theory more generally, is what appears to be a novel observation: Tohono O'odham appears to be the first language documented as having a quantity-insensitive stress system coupled with a quantity-sensitive prosodic morphology. Here I argue for three specific points. First, there is a distinct division in quantitative behavior based on whether one analyzes the prosody (rhythmic domains) or the prosodic morphology. Second, the quantity-sensitive prosodic morphology of Tohono O'odham tends to enhance the prominence of the initial syllable, where main stress falls. Finally, it expands our understanding of the moraiic inconsistency of languages, adding to the constellation of quantitative features already documented in this literature, especially in the work of Gordon (1999/2006).

Section 2 considers prosodic morphology and rhythm in the context of quantitative issues, laying out the typological "gap" that I argue is instantiated

by the full range of patterns in Tohono O'odham. The third section of the paper lays out the quantity-insensitive behavior of Tohono O'odham, while the fourth section presents a counterpoint to this by examining quantity-sensitive behavior, drawing in large part on data from prosodic morphology. Section 5 concludes the paper and presents the implications of this study.

2. Prosodic morphology, rhythm, and quantity-(in)sensitivity. As a preliminary to the more in-depth discussion of quantitative aspects of Tohono O'odham rhythm and prosodic morphology in the two sections below, I first present a brief discussion of these issues in a typological context.

Many languages put light syllables, which are monomoraic, in opposition to heavy syllables, which have two moras. Variation in the world's languages can come in whether closed syllables count as heavy and, also, whether quantitative oppositions affect the stress pattern. Work on these rhythmic stress systems led to Hayes's (1987) proposal of the asymmetric foot typology. This proposal constrained the attested rhythmic stress patterns in the world's languages, with three possible feet: a syllabic trochee (quantity-insensitive and left-headed, consisting of two syllables of any kind), a moraic trochee (quantity-sensitive and left-headed, consisting of either two light syllables or a single heavy syllable), or an iamb (quantity-sensitive and right-headed, consisting of a heavy and a light syllable, two light syllables, or a single heavy syllable). While Hayes's proposal analyzed stress patterns, McCarthy and Prince (1986) proposed a similar foot inventory to argue that prosodic categories define template shape. They drew from patterns in shape invariant (templatic) morphology that characterize reduplication, infixation, and root-and-pattern systems, identifying these as prosodic morphology. The insights from prosodic morphology and stress, among other areas, have led to the proposal that languages are moraicly consistent or uniform, such that light and heavy syllables are consistent across all the relevant phenomena of a language (see Hyman 1985, McCarthy and Prince 1986, and Hayes 1989, among others).

We can further ask whether the prosodic type is consistent across domains, in addition to moraic criteria. In the subsequent sections, I argue that Tohono O'odham is not prosodically consistent in its rhythm, and its prosodic morphology and its patterns suggest that languages partition those domains by whether they are quantity-sensitive or -insensitive.

Contrasting with Tohono O'odham is a more familiar type of pattern, where the prosodic type is consistent in both domains. Choctaw (ISO code: cho) and closely related Chickasaw (ISO code: cic) of the Muskogean language family are analyzed as having quantity-sensitive, iambic stress by Hayes (1995:209–11), which incorporated a variety of sources, but especially Nicklas (1974), Munro and Ulrich (1984), and Ulrich (1986). Choctaw is also treated in Hammond (1993) and Ulrich (1994), and Chickasaw is further analyzed

in Gordon (2004*b*). The prosodic morphology exhibited by Choctaw verb grades received considerable attention in the 1990s for competing analyses of its quantity-sensitive prosodic morphology (Lombardi and McCarthy 1991, Hammond 1993, and Ulrich 1994). Lombardi and McCarthy (1991) argue that alternate lengthening and minimal word size in Choctaw both require an iamb. The data in (1) from one grade, the *y*-grade, show how the prosodic morphology of this system works drawing on quantitative distinctions of consonant and vowel length in the grade-formation, since geminates and long vowels are moraic.

(1) Choctaw *y*-grade patterns (Lombardi and McCarthy 1991:47–48)

	Base	<i>y</i> -grade	Gloss
(1a)	<i>talakči</i>	<i>tállakči</i>	'to be tied'
(1b)	<i>binili</i>	<i>bínniili</i>	'to sit'
(1c)	<i>okčamali</i>	<i>okčámmaali</i>	'blue, green'
(1d)	<i>pisa</i>	<i>píyyiisa</i>	'to see'
(1e)	<i>oktabli</i>	<i>oktáyyabli</i>	'to dam up'
(1f)	<i>čokkowa</i>	<i>čokkóyyoowa</i>	'to enter'

As seen in (1), there are a variety of strategies invoked in *y*-grade formation. This system belongs to a complex system of verb grades that makes use of quantitative distinctions, suggesting that Choctaw has a quantity-sensitive rhythm and prosodic morphology. Other languages that have been analyzed as having similar quantity-sensitive patterns in both domains would be Arabic (ISO code: arb) (McCarthy and Prince 1990), for which main stress,² diminutives, and broken plurals are analyzed with quantity-sensitive feet, and Japanese (ISO code: jpn) (Poser 1990), in which the meter and a wide variety of hypocoristic and nicknames have been typically analyzed with bimoraic feet (moraic trochees).

On the quantity-insensitive axis, we find a Pama-Nyungan language like Diyari (ISO code: dif), whose stress system and prosodic morphology uses the disyllabic foot (Austin 1981 and Poser 1989), or from the Bunaban language family, Gooniyandi (ISO code: gni) (MacGregor 1990 and *World Atlas of Language Structures* [online]; but see also the more quantity-sensitive interpretation of the data in Kager 1992*a*). In fact, Australian languages seem to favor a disyllabic set of patterns for both phenomena, as suggested in Evans (1996). In (2), Diyari illustrates a consistently quantity-insensitive distribution

² Arabic varieties vary in their exact stress patterns but, by and large, have primary stress patterns that are quantity-sensitive; Hayes (1995) gives varieties that favor moraic trochees in their analysis, and still others that favor iambs, but none that are consistent syllabic trochees.

	QI Rhythm	QS Rhythm
QI Prosodic Morphology	Diyari, Gooniyandi (?)	unattested
QS Prosodic Morphology	Tohono O’odham	Choctaw, Chickasaw, Arabic

FIG. 1.—The interaction between QI and QS in rhythm and prosodic morphology.

of stress (2) and reduplication (3), characterized in terms of a disyllabic foot (syllabic trochee).³

(2) Diyari stress patterns (Austin 1981)

(2a) *kána* ‘man’

(2b) *pínadu* ‘old man’

(2c) *ńándawàlka* ‘to close’

(3) Diyari reduplication patterns (Austin 1981)

(3a) *wila wila-wila* ‘woman’

(3b) *ńankanti ńanka-ńankanti* ‘catfish’

(3c) *tilparku tilpa-tilparku* ‘bird sp.’

We can express this quantitative symmetry as a typological distribution of quantitative features, as in figure 1. Figure 1 illustrates the logically possible quantitative interactions between prosodic morphology and rhythm. This investigation suggests a gap in the way that stress systems and prosodic morphological systems can interact. To my knowledge, there is no language previously described as having a quantity-insensitive stress system coupled with a quantity-sensitive prosodic morphology. Tohono O’odham thus fills that gap; we can call it **PROSODICALLY INCONSISTENT**, because the prosody of the language is not consistently quantity-sensitive or -insensitive in all its domains.⁴

3. Quantity-insensitive behavior. There are four main arguments for quantity-insensitive behavior in Tohono O’odham. First, stress falls on odd-numbered syllables. Alternating rhythm without disruption is one hallmark of a quantity-insensitive system. Second, the distribution of final secondary stresses is predictable on morphological grounds, rather than on

³ While Diyari exhibits secondary stress, the presence of secondary stress is not a prerequisite for fitting into these typological patterns. For example, a Latin-type stress pattern with only a main stress, which is determined by quantitative considerations at the right edge, illustrates a quantity-sensitive pattern for rhythm.

⁴ I treat rhythm as including both word stress and poetic meter, working under the assumption that weight in these two rhythmic phenomena should be treated uniformly. This follows claims made in Golston and Riad (2000), among others. This is the case for Tohono O’odham, as shown below, as well as many other languages.

phonological grounds, such as weight-based licensing. Third, there is a wide variety in the types of syllables allowed in all positions, but no evidence that heavy syllables attract stress. Systems in which heavy syllables attract stress are prototypical quantity-sensitive systems. Fourth, verse regulates stressed and unstressed syllables, rather than light and heavy syllables. The facts in this section are drawn from Fitzgerald (1997; 1998; 2001*a*; 2001*b*), where the language is analyzed as quantity-insensitive.

3.1. Alternating stress. Stress falls on odd-numbered syllables in O'odham regardless of syllable weight. Alternating rhythm and odd syllable stress favor a trochaic analysis of these facts. Representative data appear in (4). Note that vowel–vowel sequences syllabify together; except for one function word, onset-less syllables are not permitted.

(4) Alternating stress on odd syllables⁵

Shape	Example	Gloss
SW	<i>síbio</i>	'hoe'
	<i>kúí-ga</i>	'to own a mesquite tree'
SWS	<i>hí-him-àd</i>	'will be walking, plural'
	<i>ñú:kud-à</i>	'the object taken care of'
SWSW	<i>pákoʔò.la</i>	'Pascola dancer (Sp.)'
	<i>wá-pai.là-dag</i>	'someone good at dancing'
SWSWS	<i>há-haiwàñ-ga-kàm</i>	'one who owns cattle'
	<i>čipos-ìd-a-kùd</i>	'branding instrument'
SWSWSW	<i>hí-hidòd-a-kùd-dam</i>	'someone with a cooking instrument'

Secondary stresses are permitted regardless of the type of syllable (i.e., open, closed, light, or heavy). In terms of secondary stresses that occur word-finally, these occur in morphologically complex words, without regard to syllable weight in that position. The forms in (5) show that word-finally, both CV and CVC syllables fail to receive a final stress in a monomorphemic word.

(5) Absence of final stress in a monomorphemic SWW word⁶

(5*a*) Final open syllable

<i>músi.go</i>	'musician (Sp.)'
<i>má:gi.na</i>	'car (Sp.)'
<i>wísi.lo</i>	'calf (Sp.)'

⁵ In some cases, I have suppressed the stative proclitic, *s-*, and the reflexive, *?i-*, for ease of viewing the data. This does not affect the stress patterns. For a more detailed description of factors involved in secondary stress patterns, see Fitzgerald (1997; 2002*a*).

⁶ All words of this type that are also longer than two syllables are loanwords; no native roots larger than two syllables exist. The fact that these types of loans otherwise act like native roots is attested by the identical stress patterns of loan and native roots of one and two syllables. This subject is discussed further in Fitzgerald (1999*a*). There is an additional set of Spanish loanwords that do actually behave exceptionally; these are discussed in 4 below.

- (5b) Final closed syllable
síminjũ.l 'cemetery (Sp.)'
ʔásuga.l 'sugar (Sp.)'

In (6), additional forms reinforce this point. Tohono O'odham creates polymorphemic words by reduplication (here a prefixed light syllable), as well as by adding one or more suffixes of varying segmental shapes (C, V, VC, CV, CVC). The only prefix in the language is a reduplicant; Tohono O'odham is otherwise a suffixing language. The forms in (6) show that syllable types are not distinguished word-finally in terms of attracting a final stress in a polymorphemic word.

- (6) Presence of final stress in a polymorphemic SWS word

- (6a) Final open syllable
mú-msigò 'musician, plural (Sp.)'
ñú:kuɫ-à 'the object taken care of'
wá-paikà 'ditch, plural'
háywañ-gà 'to own cattle'
tá-tab.lò 'shawl, plural (Sp.)'
tá-taɫài 'roadrunner, plural'

- (6b) Final closed syllable
pí:go-kàm 'one with a pick (Sp.)'
hí-him-àd 'will be walking, plural'
ʔásugà.l-t 'make sugar (Sp.), imperfective'
sí-sminjũ.l 'cemetery, plural (Sp.)'
číkpan-dàm 'worker'

Syllable type is thus unimportant in predicting final stress; morphology is the relevant factor. CVC syllables do not attract stress, suggesting a quantity-insensitive system.

3.2. Positional freedom of syllable types. In Tohono O'odham, there is a wide variety in the types of syllables allowed, and these syllable types are not restricted by position. Closed syllables and syllables with diphthongs can occur in both odd and even syllables and in non-final syllables. Closed syllables can also surface with diphthongs in any position in the word, although (as we shall see below) closed syllables with long vowels are more restricted in their distribution. These patterns support a quantity-insensitive analysis of such syllables. In contrast, languages that are quantity-sensitive may make distinctions between open syllables and other types of syllables, such as those with coda consonants, long vowels, or diphthongs. There are also languages claimed to exhibit three-way distinctions in weight, such as Arabic and Hindi (ISO code: hin) (Hayes 1995). These languages have stress patterns sensitive to these distinctions, or they restrict the positions where different types of syllables can occur, such as the limitation on the

Arabic “superheavy” syllable (CVCC or CVVC) to word-final position (Hayes 1995). The forms in (7) show the distribution of syllable types in monosyllables; (7*h*) is reduplicated.

(7) Complex codas in Tohono O’odham monosyllables⁷

- (7*a*) *híkčk* ‘to chop’
 (7*b*) *gógs* ‘dog’
 (7*c*) *bíščk* ‘to sneeze’
 (7*d*) *dágšp* ‘to press down with a finger’
 (7*e*) *hí:nk* ‘to bark’
 (7*f*) *ñók* ‘to speak’
 (7*g*) *gá:t* ‘gun’
 (7*h*) *kó:kš* ‘to sleep, plural’
 (7*i*) *tó:nk* ‘ridge, dike’

The polysyllabic words in (8) and (9) show that syllables with codas or diphthongs are unrestricted and can occur throughout the word.⁸ In (8), we see that closed syllables can occur in any syllable from the first to the sixth position.

(8) Closed syllables by position in the word

		Gloss
Initial syllable	<i>gátwidačùd</i>	‘to shoot at object for someone’
	<i>dákpokàm</i>	‘one with hair in his nose’
	<i>ʔi:bhio</i>	‘to regain one’s breath’
	<i>bídšpakùd</i>	‘instrument for plastering’
Second syllable	<i>kópodkà</i>	‘to become swollen, full of air’
	<i>bihagpìʔo</i>	‘to uncoil, unwrap object’
Third syllable	<i>bámustkàm</i>	‘one with a good temper’
	<i>káihinàm</i>	‘to want to kick people’
	<i>hímajkàmga</i>	‘to have a lot of people’
	<i>háhaiwàñgakàdma</i>	‘will seem to be owning cattle, plural’
Fourth syllable	<i>bihagàdkam</i>	‘one who is good at surrounding, cornering, tripping’
	<i>čúču.lgàkadmà</i>	‘will seem to be owning chickens’
	<i>ǰúhu?uǰu.lk</i>	‘zigzagging’

⁷ Hill and Zepeda (1992) derive these types of syllables from underlying CV sequences where the vocalic mora is demoted to create these coda clusters.

⁸ One explanation proposed for restriction of long vowels to initial position and the tolerance of diphthongs in closed syllables throughout the word is that diphthongs are only bimoraic in initial (or other stressed) syllables (Miyashita 1998).

Fifth syllable	<i>húgkubinadkam</i>	'one who is good at plucking a stringed instrument'
	<i>pípisà.Itakùdkaĵ</i>	'by means of a scale, plural'
	<i>hú:kaĵidakùḍdam</i>	'one with a heater'

The next set of data shows examples where diphthongs occur in varying positions within the word. Where possible, examples show diphthongs in non-final syllables. The absence of any affixes with a VV sequence contributes to the difficulty of finding examples beyond four syllables. The examples in (9) also include cases where the diphthong occurs in a closed syllable.

(9) Diphthongs by position in the word

		Gloss
Initial syllable	<i>kóawuɪ</i>	'any species or fruit of the wolfberry'
	<i>?ó.ɪdakùḍ</i>	'bean pot used for frying beans'
	<i>káisc̣ud</i>	'to become rich'
	<i>kíṭpag</i>	'to massage object with one's feet'
Second syllable	<i>dáḍiɪḍag</i>	'to have a propensity to buck'
	<i>bá?iokà?i</i>	'to swallow object'
	<i>kéɪmait</i>	'to become a middle-aged man'
Third syllable	<i>báñiɔpdám</i>	'one who crawls, a crawler'
	<i>júʂaḍkàid</i>	'to loosen object'
	<i>híñhupàic̣ud</i>	'to make object hiccough'
	<i>náhagio</i>	'mouse'
	<i>čúkuḡsuaḍ</i>	'cricket'
	<i>hóhodaigkam</i>	'place having lots of rocks, stones here and there'
Fourth syllable	<i>?ó?okokoi</i>	'white-winged doves'
	<i>?ó?okimait</i>	'to become middle-aged women'
	<i>wá?apdadkaid</i>	'to shine object, plural'

Here we have seen that the distribution of non-final syllables with diphthongs or codas shows that they can occur in all syllables. Even more interestingly, closed syllables with diphthongs can occur in various positions as well. Closed syllables with long vowels can occur word-initially; this is discussed in more detail below. The importance of these types of distributional patterns comes from the role that such syllable types play in other languages. At any rate, while in some languages these types of syllables might be viewed as super-heavy, there is no evidence for an asymmetric class of syllables like super-heavy in Tohono O'odham.

3.3. Poetic meter. In a patterning meter, the rhythm comes from the pattern of different types of units in a line. Fabb (1997) classifies patterning meters into two basic types: accentual and quantitative. An accentual meter regulates stressed and unstressed syllables, while a quantitative meter regulates light and heavy syllables. One example of the former type of verse is the meter of Somali (ISO code: som) *masafo* (Fitzgerald 2006). In contrast, Tohono O’odham verse regulates stressed and unstressed syllables. Both traditional song meter and contemporary poetic meter exhibit a trochaic rhythm, although the specifics vary somewhat. This section presents some of these specifics.

Traditional songs in Tohono O’odham display a fairly rigid trochaic meter, manifest in four ways (Fitzgerald 1998; 2002*d*). First, song lines begin with either a strong–weak or weak–weak sequence, but never with a strong syllable in the second position. Weak–weak sequences are possible line-initially when two monosyllabic function words occur, as they do not bear lexical stress. Second, there are no lines with a stressed syllable in the final position. Third, there are no lines with adjacent stressed syllables. Fourth, a “vacuous” (non-morphological) reduplication ensures strong–weak rhythm by adding a weak syllable. This prevents a final stress or two adjacent stresses. Traditional Tohono O’odham song meter regulates stressed syllables, which must always be followed by an unstressed syllable, and the meter forces every line to parse a trochaic foot at the left edge in order to avoid a stressed syllable in the second position in the meter. These aspects of the meter are strongly trochaic, but the surface meter also shows the effect of vocables (added meaningless syllables) and the lack of restrictions on the distribution of unstressed syllables. This means that lapses of unstressed syllables are permitted and that unstressed syllables are permitted in the strong position of the foot. The song in (10*a*) shows the distribution of most of these aspects of song meter, with (10*b*) providing an example of a song line with “vacuous” reduplication (from another song).⁹

(10) Tohono O’odham songs and reduplication

(10*a*) First Celkona song (song text from Haefer 1977)¹⁰

Text	Scansion
<i>Húduñiŋ táhŋio g ñíñi káinagimi</i>	SWW SW W SW SWWW
<i>Húduñiŋ táhŋio g ñíñi káinagimi</i>	SWW SW W SW SWWW
<i>Kuč amí wó?i wa kamí ñíñiáčuŋa</i>	W WW SW W WW SWWW

⁹ Fitzgerald (1998) shows that there is no pattern to or interaction between the number of syllables and the number of stressed syllables per line. Also, secondary stresses are ignored by the meter and thus not indicated here in the scansion.

¹⁰ Song language phonology is different from spoken language in a number of ways, including nasalization of consonants and additional vowels. See Haefer (1977) and Fitzgerald (1998) for more details.

Húduñ i wíñiumhim am SW W SWW W
ina si wá ham káinada. WW W S W SWW

At dusk, before the songs resounding
 At dusk, before the songs resounding
 And I arrive there and watch
 Dusk, being pulled along
 Inside, arriving there to be heard.

(10b) Vacuous reduplication (see Fitzgerald 1998:14; song from Wallace 1981)

SONG:	<i>Oi</i>	<i>na</i>	<i>śóśo</i>	<i>kú:kun̄i</i>
SCANSION:	W	W	S W	S W W
CITATION:	<i>oi</i>	<i>na</i>	<i>śón</i>	<i>kú:g</i>
GLOSS:	soon	perhaps	the beginning	the end
TRANSLATION:	'soon perhaps the beginning, the end.'			

Another accentual verse form in Tohono O'odham comes from the contemporary poetry of Ofelia Zepeda (1995; 1997), also analyzed as trochaic in Fitzgerald (2002*d*; 2003). This meter is less rigid than the song meter. Line-initially, any sequence of strong and weak can begin a line. The sequences that are the most favored are weak–weak and strong–weak. There is a strong avoidance of an initial sequence of two stressed syllables, which occurs in approximately 2% of the lines. This poetry can end with a stressed syllable or allow line-internal adjacent stresses, neither of which ever occur in songs.

The word order of contemporary poetry also signals the role played by trochaic rhythm; lines begin with a content word (initial stress) preceding an auxiliary verb. In narrative prose, lines favor an initial auxiliary word followed by another function word. This means that the initial sequences are most often weak–weak (Fitzgerald 2003). The poem in (11) gives an example of these characteristics. Note that the first three lines scan the same in terms of strong (stressed) and weak (unstressed), even though the initial syllable is either light or heavy.

(11) *Ka:cim śu:daḡi* by Ofelia Zepeda (from Zepeda 1997)

Text	Scansion
<i>S-wégima ?am ká:č há?icu híosig</i>	SWW W S SWW SW
<i>S-cédaghim ?am ká:č há?icu híosig</i>	SWW W S SWW SW
<i>S-í:bhaghim ?am ká:č há?icu híosig</i>	SWW W S SWW SW
<i>?am ká:č híg dá:m gí?i ká:čim śu:daḡi</i>	W S W S SW SW SW
<i>Híg wúu ?att ?i-ú.l g s-kég há?iču čéḡitodag</i>	W S W W S W S SWW SWW
<i>Híg wúu ?att ?i-ú.l g s-?áp tá:hadag</i>	W S W W S W S SWW
<i>Híg wúu ?att ?i-ú.l g ?úmdag</i>	W S W W S W SW
<i>?am ?att tát g gí?i káčim śu:daḡi</i>	W W S W SW SW SW
<i>k ?ámj̄id ?am ?as ?i-dáḡito</i>	SW W W W SW

Red-colored blossoms

Green-colored blossoms
 Purple-colored blossoms
 All float above the laying water
 Toward it we extend only good thoughts
 Toward it we extend only good feelings
 Toward it we extend kinship
 We touched this laying water
 And then we left it alone

To summarize, both traditional song meter and contemporary poetry are trochaic, but traditional songs display more trochaic characteristics than modern poetry.

4. Quantity-sensitive behavior. This section outlines the quantity-sensitive behavior, starting with the distributional facts that show vowel length is a lexical contrast. The remaining behavior lies squarely in the domain of prosodic morphology in Tohono O'odham, seen in the patterns of minimal words, morphological truncation, and various types of reduplication. First, the minimal word is bimoraic. Second, morphological truncation of a final segment results in lengthening of a vowel if the truncated form would otherwise be subminimal. Third, plural reduplication results most often in a closed initial syllable. Fourth, two cases of exceptional phonology for plurals utilize vowel length in reduplication. Fifth, gemination is employed as a strategy to mark distributive and other reduplications. Finally, an examination of other reduplicative strategies shows that in adjectives and postpositions, the reduplicant needs to be defined in quantity-sensitive terms.

In most of the cases examined here, we see a clustering of behavior that either strengthens or maintains the strength of the initial syllable, which is the locus of primary stress. The language does this by licensing long vowels in this position, lengthening vowels under morphological truncation, closing the initial syllable with a coda consonant, and creating geminates that close the initial syllable. These strategies, together with other patterns presented here, create a picture of a language with a prosodic morphology that relies on quantity-sensitive distinctions as a fundamental element of word formation.

4.1. Distribution of long vowels. This subsection demonstrates that there is a length contrast in the vowel inventory. Length contrasts in vowels are typically accounted for by assuming a quantitative distinction between short vowels (one mora) and long vowels (two moras). The length contrast in O'odham vowels is restricted to initial syllables, although we shall also see below that some loanwords have non-initial long vowels when stress is transferred (see 4.4.2 below).¹¹ Minimal pairs for length appear in (12).

¹¹ Hayes (1995) lists a number of languages that use syllabic trochees and contrast vowel length (i.e., Hungarian [ISO code: hun]).

(12) Minimal pairs for vowel length

		Gloss
(12a)	<i>čím</i>	'small'
	<i>čé:m</i>	'heel'
(12b)	<i>bíd</i>	'clay, mud plaster'
	<i>bí:d</i>	'to put object on a plate for somebody'
(12c)	<i>hík</i>	'navel, bellybutton'
	<i>hí:k</i>	'to cut'
(12d)	<i>tón</i>	'shining'
	<i>tó:n</i>	'knee'
(12e)	<i>húk</i>	'piece of lumber'
	<i>hú:k</i>	'warm (stative)'
(12f)	<i>čúk</i>	'black (stative)'
	<i>čú:k</i>	'to piggyback someone or something'

To show that the long vowels are not just a by-product of short words, longer forms with long vowels appear in (13). Polysyllabic words with long vowels may also form a minimal pair with a word with a short vowel, as in (13i).

(13) Polysyllabic words with long vowels

		Gloss
(13a)	<i>wí:ko:l</i>	'great-grandparent'
(13b)	<i>tá:had</i>	'to have fun, to rejoice'
(13c)	<i>ná:kag</i>	'a cactus'
(13d)	<i>šú:dagj</i>	'water'
(13e)	<i>má:maḍ</i>	'children'
(13f)	<i>kí:tadäg</i>	'to be good at making a house'
(13g)	<i>ñú:kuḍà</i>	'the thing taken care of'
(13h)	<i>jšé:ñkuḍdàm</i>	'one with a smoking instrument'
(13i)	<i>hí:gam</i>	'to be jealous of object'
	cf. <i>hégam</i>	'that one, that (plural demonstrative pronoun)'

4.2. Minimal word. One typical diagnostic of the moraic shape of words comes from the presence of systematic gaps in the distribution of the smallest possible content words. The examples in (14) show the distribution of monosyllables for Tohono O'odham. Words of the shape CVV, CVC, CVCC, and CVVC all appear, while there are none with a CV shape. This suggests a bimoraic word minimum (Hill and Zepeda 1992). It should also be noted that long vowels of the type in (11b) are retained under suffixation, which suggests that vowel length is a property of the lexicon, as opposed to lengthening to avoid minimality.

(14) Distribution of word types in monosyllables

	Shape		Gloss
(14a)	CV	—	
(14b)	CV:	<i>kí:</i>	'house' (cf. <i>kí:t</i> 'to build/make a house')

	<i>ká:</i>	‘to hear’
	<i>hí:</i>	‘to walk, perfective’
(14c) CVV	<i>kái</i>	‘seed’
	<i>kúí</i>	‘mesquite tree’
	<i>múa</i>	‘to kill object’
	<i>ǰá</i>	‘hailstones’
(14d) CVC	<i>dóá</i>	‘to be healthy’
	<i>nóǰ</i>	‘a plant of the yucca family’
	<i>ǰúk</i>	‘to behave in a certain way’
	<i>ñím</i>	‘liver’
(14e) CV:V	—	
(14f) CV:C	<i>má:č</i>	‘to know’
	<i>kíš</i>	‘to put object in a standing position’
	<i>ñí:ñ</i>	‘tongue of a person’
	<i>mó:s</i>	‘maternal grandchild’
(14g) CVV:	—	
(14h) CVVC	<i>ñíok</i>	‘to speak’
	<i>číoj</i>	‘boy, man’
	<i>kais</i>	‘rich’
(14i) CVCC	<i>gógs</i>	‘dog’
	<i>wínk</i>	‘hard, firm, strong’
	<i>tótkp</i>	‘to boil (for food)’
(14j) CV:CC	<i>ǰú:kš</i>	‘calf of the leg’
	<i>dá:dk</i>	‘noses’
	<i>pú:st</i>	‘saddle’
	<i>tó:nk</i>	‘ridge, dike’
(14k) CVVCC	<i>ǰúačk</i>	‘to roll up a cigarette’
	<i>náumk</i>	‘to get drunk’
	<i>dóǰk</i>	‘to be wild, untamed’
	<i>háĩnk</i>	‘place having a crack’
	<i>híašp</i>	‘to cover object with soil’

The absence of CV forms, combined with the presence of CVV and CVC, suggests the following. First, there is a bimoraic minimal word. Second, diphthongs and coda consonants are bimoraic, at least so far as word minimality is concerned. Third, the CVCC and CV:CC forms are tolerated, as closed syllables in these cases do not trigger vowel shortening. Fourth, CV: words do not surface with length alternations, even under suffixation, which shows that the CV gap is a property of the lexicon.

4.3. Lengthening with morphological truncation. O’odham uses morphological truncation to form perfectives (Hill and Zepeda 1992). Truncation deletes the final segment or two segments from the imperfective (Fitzgerald and Fountain 1995). One point of interest is that some truncated monosyllabic forms show the effect of lengthening. Morphological truncation of a final segment results in this “compensatory lengthening” if the

truncated form would otherwise be subminimal. Thus Tohono O'odham has compensatory lengthening but not as an across-the-board phenomenon. This is demonstrated by the contrast between (15) and (16). The cases immediately below show that the imperfective is of the shape CVC, while the corresponding perfective has a long vowel appearing in an open syllable.

(15) Final consonant deletion with vowel lengthening

	Imperfective	Perfective	Gloss
(15a)	<i>míd</i>	<i>mí:</i>	'to run'
(15b)	<i>júñ</i>	<i>jú:</i>	'to be a certain time of day or night'
(15c)	<i>hím</i>	<i>hí:</i>	'to walk'
(15d)	<i>húg</i>	<i>hú:</i>	'to eat object'
(15e)	<i>nód</i>	<i>nó:</i>	'to bend object'
(15f)	<i>ñíñ</i>	<i>ñí:</i>	'to wake up'
(15g)	<i>wúđ</i>	<i>wú:</i>	'to tie object with a rope'

The forms in (16) also contrast the imperfective form (of varying shapes larger than CVC) and its morphologically truncated perfective counterpart. The perfectives in (16) do not consistently lengthen the final vowel, or any other vowel. There are some perfectives that have a long vowel, but always where long vowels occur in the imperfective (non-truncated) forms. The forms below never lengthen, leading to the conclusion that not all final consonant deletions trigger lengthening under morphological truncation.

(16) Final consonant deletion without vowel lengthening

	Imperfective	Perfective	Gloss
(16a)	<i>śísp</i>	<i>śís</i>	'pinning'
(16b)	<i>híkčk</i>	<i>híkč</i>	'to cut'
(16c)	<i>bídşp</i>	<i>bídş</i>	'to paint object'
(16d)	<i>híhim</i>	<i>híhi</i>	'to walk, plural' (cf. lengthened singular form in 15c)
(16e)	<i>híhink</i>	<i>híhin</i>	'to bark, plural'
(16f)	<i>ñíñok</i>	<i>ñíño</i>	'to speak, plural'
(16g)	<i>hí:k</i>	<i>hí:</i>	'to get a haircut (reflexive)'
(16h)	<i>háin</i>	<i>hái</i>	'to crack, get a crack in one place (reflexive)'

The difference between the two sets of data is that the first set (in 15) would consist of words of the shape CV if there were no lengthening, while the second set (in 16) can truncate a final segment and still have sufficient size to avoid being subminimal. This suggests that there is lengthening to prevent subminimal forms from surfacing. In derivational terms, this acts like compensatory lengthening; the consonant deletion leaves a mora behind. The vowel lengthens by associating with that mora, thus satisfying word minimality.

4.4. Reduplication. In this section, I present a wide range of facts coming from reduplication in Tohono O’odham, which has multiple reduplications such that multiple prosodic shapes and morphosemantic categories are employed (Fitzgerald 2004; 2009). This section makes two main points. First, the reduplicative patterns of Tohono O’odham make use of weight contrasts and so are quantity-sensitive in nature. Consonant gemination and vowel lengthening are two manifestations of different reduplicative patterns and they suggest a quantitative system reminiscent of Choctaw verb grades shown in (1). Finding quantity-sensitivity in Tohono O’odham, despite the quantity-insensitive rhythmic system described in **3** above, suggests further contradictions and inconsistencies in the prosodic nature of the language. Second, I argue that some of these strategies serve to strengthen the stressed syllable. The regular pattern of plural reduplication is argued to involve syncope, which creates an initial closed syllable (Fitzgerald 1999*b*); the “heavy plural” pattern of plural reduplication (Hill and Zepeda 1998) lengthens the initial vowel, again strengthening the primary stressed syllable. Distributive reduplication (see the data in 22 below) results in surface forms closed by a geminated consonant, again suggestive of an enhancement strategy in the prosodic morphology directed at the primary stressed syllable.

While I do not present a formalized analysis of the reduplication facts here, some elements of the description draw upon insights of Optimality Theory (Prince and Smolensky 1993 and McCarthy and Prince 1993), particularly in a correspondence-type version of this theory (McCarthy and Prince 1995). Correspondence Theory compares the base string and the reduplicant string, looking at the identity of segments and features between these two strings. I draw on the vocabulary of this approach in characterizing the data.

Also of theoretical importance is how to characterize the nuanced role of quantity in the reduplication, given its absence in the rhythmic system. The stress patterns in **3** above present no evidence that the Weight-to-Stress Principle (Prince 1990), which states that heavy syllables attract stress, holds for Tohono O’odham. However, the facts in this subsection support the relevance of its counterpart, the Stress-to-Weight Principle (Prince 1990 and Fitzgerald 1999*b*), which holds that stressed syllables are heavy. Evidence in support of the Stress-to-Weight Principle comes from quantity-enhancing strategies in reduplication, when these strengthen the primary stressed syllable.

This subsection presents reduplicative data from plurals, exceptional plurals, various morphosemantic categories of reduplication that involve gemination, and several additional cases of reduplication that illustrate the use of quantity-sensitive prosodic categories as reduplicant.

4.4.1. Plural reduplication. Plural reduplication has been the subject of a fair amount of discussion in Tohono O’odham (for recent examples, see Hill and Zepeda 1992; 1998, Fitzgerald 1998; 1999*b*; 2000; 2004, Miyashita

2004, Riggle 2006, and Steele 2008), and in fact, nearly all published discussions of reduplication in Tohono O'odham (and the related dialect Akimel O'odham, also known as Pima [ISO code: ood]) focus only on the plurals. Our interest here is in the relationship between reduplication and the shape of the initial syllable in the reduplicated word. The basic generalization is that the word-initial syllable is always a closed syllable, except where this would result in an ill-formed phonotactic sequence (i.e., a laryngeal coda). The relevance of this is that some languages treat closed syllables as heavy or more prominent, presumably resulting from the Stress-to-Weight Principle. Note also that a reduplicated /w/ surfaces as a /p/ medially.

(17) Reduplicated forms with syncope

	Base	Reduplication	Gloss
(17a)	<i>sító.l</i>	<i>sí-stó.l</i>	'syrup (Sp.)'
(17b)	<i>tókĭ</i>	<i>tó-tkĭ</i>	'cotton'
(17c)	<i>dápk</i>	<i>dá-dpk</i>	'to press down with fingers repeatedly'
(17d)	<i>č'ípos-ìd</i>	<i>č'í-č'pos-ìd</i>	'to brand object'
(17e)	<i>músigo</i>	<i>mú-msigò</i>	'musician (Sp.)'
(17f)	<i>wósk</i>	<i>wó-psk</i>	'father'
(17g)	<i>wáks</i>	<i>wá-pks</i>	'bedroll'
(17h)	<i>wísi.lo</i>	<i>wí-psi.lò</i>	'calf (Sp.)'

A singular form like *sító.l* 'syrup' has a plural form, the reduplicated *sísto.l*. For this discussion, I treat reduplication as prefixation, suggesting that the reduplicated form should be analyzed as *sí-stó.l*, with the underlined portion the reduplicated part of the word and the remainder the base. Under that analysis, the vowel of the reduplicant has no matching vowel in the base, as it would in the unattested **s'í-sító.l*. The absence of that vowel in the base means that the initial syllable of the word is closed by a coda consonant. This base deletes a vowel, but the reduplicant preserves that vowel in the output word so that, ultimately, every element present in the singular form is present somewhere in the plural (see Fitzgerald 1999b; 2000).

The forms with syncope contrast with those in (18), where the vowel appears in both the reduplicant and base portions of the plural form. In these cases, the base retains the vowel for some other reason, either because it avoids violating phonotactic constraints (18a–18d) or because deleting one vowel still would not result in a closed initial syllable because of a diphthong (18e–18i).

(18) Reduplicated forms without syncope

	Base	Reduplication	Gloss
(18a)	<i>háwu.l</i>	<i>há-hawù.l</i>	'lima bean'
(18b)	<i>hím</i>	<i>hí-him</i>	'to walk'

(18c)	<i>pá:do</i>	<i>pá-padò</i>	‘duck (Sp.)’
(18d)	<i>tádai</i>	<i>tá-taḍài</i>	‘roadrunner’
(18e)	<i>kái</i>	<i>ká-kai</i>	‘seed’
(18f)	<i>kúi</i>	<i>kú-kui</i>	‘mesquite tree’
(18g)	<i>wáika</i>	<i>wá-paikà</i>	‘ditches’
(18h)	<i>ǰíawuɫ</i>	<i>ǰí-ǰiawuɫ</i>	‘a devil or demon’
(18i)	<i>dáikuḍ</i>	<i>dá-daikuḍ</i>	‘chair’

Reduplicated forms such as (18a) would result in ill-formed codas if the base allowed syncope. The actual reduplicated form, *há-hawùɫ* ‘lima bean, plural’, has an identical vowel appearing in both the reduplicant and the base. The unattested **há-hwuɫ* has syncope in the base string, but it results in an illicit coda for the syllable. This suggests that the Stress-to-Weight Principle cannot create closed syllables that are not well-formed according to the phonotactic considerations that hold in the language. The second set of forms, which also fail to exhibit syncope, all have diphthongs in the base. Such forms are exemplified by the reduplicated *kú-kui* ‘mesquite tree, plural’, and they surface with the vowel in both the reduplicant and base portions of the word. Notice that syncope in the base fails to produce an initial closed syllable, **kú-ki*. The only way the reduplicated word would surface with a closed syllable is for the base portion to delete both vowels, as in **kú-k*. Deletion to that extent means that some vowels never appear in the output, a more costly consequence for failing to preserve and produce input elements in the output. The syncope-resistant forms in (18) favor an analysis that treats syncope as a prominence-enhancement strategy (as in Fitzgerald 1999b); deletion of a base vowel is forced to strengthen the initial primary stressed syllable, but deletion is unattested if illicit syllables would result or if the resulting initial syllable fails to gain a coda consonant.¹²

While the preceding paragraphs have laid out a syncope-driven understanding of the plural reduplication patterns, this is expressed where the reduplicant is a prefix. However, an alternative analysis to a prefixal treatment of this pattern is infixation (Riggle 2006). Under Riggle’s analysis, infixation copies only the initial C, unless forced by phonotactics to copy the initial two segments, CV. Under both the prefixal and infixal analysis, the same phonotactics (i.e., avoid laryngeal codas) are operating. Riggle argues that there are theory-internal reasons in Optimality Theory that favor infixation; however, his analysis does not consider that this pattern of plural reduplication could be considered in a context of a larger language-wide strategy of strengthening or maintaining the strength of the initial syllable, such as I argue throughout 4.

¹² There is an additional set of words in this pattern with a small subset of the diphthongs, where one vowel in the diphthong appears in the reduplicant and the other appears in the base, as seen in this singular/plural pair: *číoj* ‘boy, man’ versus the reduplicated *číčoj*. See Fitzgerald (2000) for more details on this.

The infixation analysis could be recast in terms of the strengthening strategy of base syncope. However, there are additional patterns of reduplication seen in the following subsections that present analytic challenges associated with the infixation analysis. In particular, there are too many possible ways to analyze reduplicated words.

Ultimately, the analysis of the plural reduplication pattern argues for a result in which the word starts with a closed syllable. I claim that this is a strengthening effect associated with the Stress-to-Weight Principle. Under this approach, plural reduplication, in the larger context of the range of prosodic morphology presented in this section, uses coda consonants in a way that suggests they play a quantity-sensitive role in this part of the language.

4.4.2. Exceptional plural reduplication. While the previous section covered the “norm” for plural reduplication, this subsection covers two cases of exceptional plural reduplication, both of which present more evidence of the quantity-sensitive role played by vowel length. The first is a set of Spanish loanwords that occur with non-initial long vowels. The second case involves reduplication in a restricted set of words where the plural reduplicant is a heavy syllable.

Because of their proximity to Spanish speakers from Mexico, the Tohono O'odham borrowed lexical items from Spanish. In some of these, non-initial long vowels occur. There are approximately 150 of these loanwords in Mathiot (1973), constituting only a small portion of the vocabulary. Mathiot (1973) represents these words with vowel diacritics for length and stress. The marked vowel always corresponds to the stressed vowel in the Spanish source word. Current usage suggests that speakers vary how they stress these words (Jane Hill, personal communication). For our purposes, these words are interesting because they suggest that at some level, vowel length is a salient category to O'odham speakers.

(19) Borrowings with non-initial long vowels (Mathiot 1973)

	Gloss
(19a) <i>mi.lgá:n</i>	'white man, American (Sp., from <i>americano</i>)'
(19b) <i>paná:l</i>	'honeybee (Sp., from <i>panál</i>)'
(19c) <i>sa.ldí:n</i>	'frying pan (Sp., from <i>sartén</i>)'
(19d) <i>ʔańí:l</i>	'blueing (Sp., from <i>añil</i>)'
(19e) <i>hamó:n</i>	'ham (Sp., from <i>jamón</i>)'
(19f) <i>kantí:n</i>	'bar (Sp., from <i>cantína</i>)'
(19g) <i>kawhí:</i>	'coffee (Sp., from <i>café</i>)'
(19h) <i>pa.ló:ma</i>	'dove (Sp., from <i>palóma</i>)'
(19i) <i>Ma.lí:ya</i>	'Maria (Sp., from <i>María</i>)'

Some of the words like this also reduplicate to mark plurality. Such forms introduce novel reduplicative patterns. The pluralized words surface with a copy of the initial syllable and a copy of the stressed syllable. Also, the long

vowel disappears in all of the reduplicated words, and syncope surfaces in the same types of environments as in other reduplicated (plural and distributive) words. For more discussion on this type of reduplication, see Miyashita (2004) and Munro and Riggle (2004). These words do appear to have a number of possible plurals for each singular, as noted in Munro and Riggle (2004) from their consultant, and by O. Zepeda (personal communication), who is a native speaker.

(20) Borrowings with non-initial long vowels (Mathiot 1973)

	Singular	Plural	Gloss
(20a)	<i>pa.ló:ma</i>	<i>pap.ló.loma</i>	'dove (Sp., from <i>palóma</i>)'
(20b)	<i>paiá:sa</i>	<i>papiáiasa</i>	'clown (Sp., from <i>payáso</i>)'
(20c)	<i>wagí:a</i>	<i>wapgígia</i>	'milk cow (Sp., from <i>vaquílla</i>)'
(20d)	<i>?iskó:wa</i>	<i>?i?iskókowa</i>	'chisel (Sp., <i>escoba</i>)'
(20e)	<i>limí:da</i>	<i>li.lmímida</i>	'glass (Sp., <i>limeta</i>)'
(20f)	<i>ka.lsí:da</i>	<i>kaka.lsí:sida</i>	'sock, stocking (Sp., <i>calzado</i>)'
(20g)	<i>kadó:di</i>	<i>kakódodi</i>	'marble (Sp., <i>ágata</i>)'

One might analyze this as a foot reduplicant, as two syllables are copies. No one has examined the prosodic structure of these words since Mathiot (1973), and so the secondary stress patterns are not cataloged. One point of interest is that while reduplication of the first syllable may trigger syncope, reduplication of the stressed syllable does not. The plurals in (20d) and (20f) would be perfect candidates for syncope later in the word: **kaka.lsí:da* and **?i?iskókwa*.

The second issue that shows the relevance of vowel length comes from heavy reduplication. A restricted set of forms uses a heavy syllable reduplicant for the plural. Hill and Zepeda (1998) argue that these words constitute a semantic class of items.¹³ They note that the size of this group is also restricted, with fewer than 100 noun stems occurring with a long vowel in the reduplicated syllable. By their figures, more than 1,000 of the countable nouns use the plural form documented in 4.4.1 above. These forms pluralize with a long vowel in the reduplicant, for example, *bán* 'coyote', *bá:-ban* 'coyote, plural'. A chart of these exceptional heavy plurals appears in (21) below.

(21) Heavy syllable plural reduplication (Hill and Zepeda 1998)¹⁴

	Singular	Plural	Gloss
(21a)	<i>máđ</i>	<i>má:-mađ</i>	'woman's child'

¹³ They present strong evidence that noun stems with heavy reduplicants are "centered on an image schema . . . of a deep intrusion into or a tall protrusion from a broad, flat, unmarked surface, prototypically manifested by certain body parts" (Hill and Zepeda 1998:3).

¹⁴ These forms favor a prefixal analysis for plural reduplication, contra Riggle (2006). Riggle (2006) includes items like 'liver' (his chart in section 7 of his paper) and 'ear (lobes)' (his chart in section 5), but he presents them as having short vowels throughout singular and plural forms,

(21b)	<i>táđ</i>	<i>tá:-tađ</i>	'foot'
(21c)	<i>číñ</i>	<i>čí:-číñ</i>	'mouth'
(21d)	<i>čí:mĭ</i>	<i>čí:-čímĭ</i>	'heel' (cf. <i>čí:m</i> , <i>čí:-čím</i> in Mathiot 1973:183)
(21e)	<i>móʔoʃ</i>	<i>mó:-moʔoʃ</i>	'head of bed'
(21f)	<i>ñím</i>	<i>ñi:-ñím</i>	'liver'
(21g)	<i>wáʔigĭ</i>	<i>wá:-paʔigĭ</i>	'liquid in container with small opening'
(21h)	<i>kóʔowĭ</i>	<i>kó:-koʔowĭ</i>	'rattlesnake'
(21i)	<i>ǰĭg</i>	<i>ǰi:-ǰĭg</i>	'hole, clearing'
(21j)	<i>śúđ</i>	<i>śú:-śud</i>	'puddle (also, vagina)'
(21k)	<i>ǰířĭ</i>	<i>ǰi:-ǰ</i>	'mother'
(21l)	<i>mós</i>	<i>mó:-ms</i>	'woman's daughter's child'
(21m)	<i>wúlim</i>	<i>wú:-p.lim</i>	'bale, bundle, ponytail or bun on back of head'
(21n)	<i>kú:čki</i>	<i>kú:-kčki</i>	'burning stick'

The plural forms all surface with an initial long vowel. Other than this, the marked and unmarked plurals are quite similar. The marked plurals show a word-initial /w/ appearing as a /p/, as in the unmarked plural and distributive forms from above. The forms in (21) also vary in whether they display syncope in the base (21k–21n) or not (21a–21j).

4.4.3. Gemination in reduplication. Geminates have been particularly important to the development of moraic theory (Hayes 1989), although there is evidence that not all geminates are moraic or against the position that all geminates maintain a consistent moraic representation within a single language (Steriade 1991 and Tranel 1992). Geminates are thus relevant to any discussion of quantity because many languages allow geminates to bear moras. The role of geminates in Tohono O'odham is not entirely clear, as this aspect of the language has not been studied much. True geminates appear to exist only as products of the morphology; geminates do not appear to have independent, contrastive phonological status.¹⁵ This section highlights some of the relevant observations that we can make about geminates in Tohono O'odham, gleaned mostly from the work of Saxton (1982), from the dictionaries of O'odham (Mathiot 1973 and Saxton, Saxton, and Enos 1989), and from fieldwork I have done.

Two processes of morphological gemination show the relevance of consonant length: distributive formation (for both nouns and verbs) and repetitive

contra other published sources on O'odham (i.e., Mathiot 1973, Hill and Zepeda 1998, and Saxton, Saxton, and Enos 1989). One possible explanation for this may be the speaker's contact with English, as Riggle worked with only one Pima speaker. Riggle (2006) does not discuss a vowel length contrast, and none of his reduplication paradigms have long vowels, although one (unreduplicated) word with a long vowel appears in a footnote (Riggle 2006:n. 3).

¹⁵ For more discussion of these issues, see Fitzgerald (2002b; 2002c).

verbs. Distributive reduplication, shown in (22), results in an initial syllable with a geminate. Morphologically created geminates thus result as a product of distributive formation (Fitzgerald 2002*b*; 2002*c*).¹⁶

(22) Gemination in distributive reduplication

	Singular	Plural	Distributive	Gloss
(22a)	<i>nówíu</i>	<i>nónowíu</i>	<i>nónnowíu</i>	'ox'
(22b)	<i>náhagio</i>	<i>nánhagio</i>	<i>nánnhagio</i>	'earring'
(22c)	<i>dáikuḍ</i>	<i>dádaikuḍ</i>	<i>dáddaikuḍ</i>	'chair'
(22d)	<i>kótoñ</i>	<i>kóktoñ</i>	<i>kókktoñ</i>	'shirt'
(22e)	<i>hódai</i>	<i>hóhodài</i>	<i>hóhhodài</i>	'rock, stone'
(22f)	<i>?á:g</i>	<i>?á?ag</i>	<i>?á?ag</i>	'a pair of animal's horns'
(22g)	<i>káhio</i>	<i>kákio</i>	<i>kákkio</i>	'leg'
(22h)	<i>hím</i>	<i>híhim</i>	<i>híhhim</i>	'to walk'

The forms in (22) could conceivably treat either the singular or plural form as the base. A set of defective paradigms exists, with only a distributive and another form. In all of these cases, the non-distributive form has the form of a reduplicated word, with two identical consonants separated by a vowel. These forms, shown in (23), support an analysis that forms the distributive by lengthening the leftmost non-initial consonant.

	Non-Distributive	Distributive	Gloss
(23a)	<i>bábad</i>	<i>bábbad</i>	'frog'
(23b)	<i>tátamko</i>	<i>táttamko</i>	'jaw'
(23c)	<i>tá:tam</i>	<i>tá:ttam</i>	'tooth'
(23d)	<i>nó:nha</i>	<i>nó:nnha</i>	'egg'
(23e)	<i>gégog</i>	<i>géggok</i>	'to stand'

Gemination can mark the distributive in nouns and verbs. In shape-invariant terms, the consonant lengthening indicates this type of reduplication. Consonant length here is analyzed moraically. Distributive reduplication typically involves the affixation of a (consonantal) mora to the initial syllable.

Some verbs instead have a unitive/repetitive contrast (rather than plural/distributive; there is also a unitive/distributive classification in Mathiot 1973). The phonological markers of this contrast are the same as in the distributive paradigms. The pairs are reduplicated with a CV/C for the unitive and with a lengthened consonant for the distributive. Some examples are given below, where repetitive verbs (middle column) are compared to their unitive counterparts. The unitive/repetitive paradigm appears extremely limited in its occurrence and has received even less attention than the distributive.¹⁷

¹⁶ This pattern is complicated based on what type of aspectual paradigm the verb appears in, and by certain phonological structures, like when the base has a laryngeal.

¹⁷ The morphology of Tohono O'odham verbs is an area in which much more needs to be done, as is the case for semantics. For relevant issues on the topic of number, see Mathiot (1967),

(24) Gemination in repetitive verbs

	Unitive	Repetitive	Gloss
(24a)	<i>hǎhim</i>	<i>hǎhhim</i>	'to laugh'
(24b)	<i>ków</i>	<i>kókkow</i>	'to dig object out of the ground'
(24c)	<i>ñá</i>	<i>ñáñna</i>	'to look in a certain direction'
(24d)	<i>gǎʔw</i>	<i>gǎggǎw</i>	'to hit object'
(24e)	<i>gǎʔa</i>	<i>gǎggǎ</i>	'to attack with rope or string'

The influence of morphology on creating geminates is clear. The question then raised is whether length is contrastive in consonants, even if this is only true in certain positions, as for the vowels. I claim that gemination does not have status as purely phonological contrast;¹⁸ in other words, there are no minimal pairs for consonant length like there are for vowel length. All cases of apparent minimal pairs are related members of a morphological paradigm, like distributives (22 and 23) and repetitives (24).

The unitive–repetitive patterns also include a series where gemination occurs, but the consonant that is geminated is not the word-initial segment. Examine the pattern in (25), where a medial consonant is geminated to mark repetitive morphology. It may be that the lengthening serves to highlight *-sp*, the suffix that marks instrumental. (The *ǎ* in 25f and 25g appears to be the remote past marker.)

(25) Non-initial gemination in repetitive verbs

	Unitive	Repetitive	Gloss
(25a)	<i>bǎǎsp</i>	<i>bǎǎǎsp</i>	'to paint, dirty object'
(25b)	<i>kámǎsp</i>	<i>kámǎǎsp</i>	'to put object in one's mouth'
(25c)	<i>ǎǎsp</i>	<i>ǎǎǎsp</i>	'to nail object with one nail'
(25d)	<i>mǎǎǎsp</i>	<i>mǎǎǎǎsp</i>	'to cover object'
(25e)	<i>dǎǎsp</i>	<i>dǎǎǎsp</i>	'to put object in a sitting position (somewhere)'
(25f)	<i>ǎǎnto</i>	<i>ǎǎnttoǎ</i>	'to finish smoking object'
(25g)	<i>nǎ:to</i>	<i>nǎnttoǎ</i>	'to get through with what one is doing'
(25h)	<i>wǎǎum</i>	<i>wǎǎummuk</i>	'to get under water'
(25i)	<i>wǎǎpogid</i>	<i>wǎǎǎppogid</i>	'to get even with, the same height as, object'

which discusses the semantic import of this category in Tohono O'odham. All of these issues are deserving of more study in the future.

¹⁸ Possible counterexamples to this claim are few but include the following: *ǎǎtto* 'cooking tripod', *wǎtto* 'ramada', and *kómmoʔoʔ* 'millipede, rainworm', as well as the dictionary form *tóhono* 'desert', transcribed as *tóhonna* (personal communications from J. Hill and O. Zepeda). In my fieldwork, I have not found a speaker who knows the first word, and speakers appear to pronounce a single (short and preaspirated) [t] in the word for 'ramada'. It should also be noted that these counterexamples do not have contrastive examples of words with singleton consonants.

Here we see that a medial consonant is geminated, and the result is to augment the second syllable of the word or to create a new syllable to the left of the initial one by adding a vowel if necessary. Fitzgerald (2004) observes that many semantic categories of reduplication correlate with multiple phonological exponents, and aside from the plural reduplicative patterns, these other patterns have received less attention in the literature. However, the examples in this section show that gemination appears in a number of reduplicative patterns, often enhancing the prominence of the initial syllable. Treating gemination as the insertion of a mora at some locus in the word (prefixed or infix) is a straightforward analysis of these facts. The presence of geminates suggests coda consonants are moraic, a treatment that is not supported in the stress system but that does receive support in the prosodic morphology. Again, gemination does not appear to exist as an independent phonologically contrastive category for consonants. Equally striking is the point that morphological processes result in geminates.¹⁹

4.4.4. Other cases of reduplication. The examples in the preceding subsection hint at the prosodic complexity of the reduplicative processes in Tohono O'odham, both in terms of the shape and in the sometimes discontinuous placement of the reduplicant. In this section, I present two brief examples of other reduplicative patterns that present more evidence supporting the general quantitative contradictions of the system in the prosodic morphology. What we see here is that it is difficult to find a definitive characterization of the prosodic shape of the reduplicant. In other languages, a single, unambiguous analysis might be supported in part by drawing on consistent patterns elsewhere in the language's internal and external phonology. These next two cases in Tohono O'odham are more ambiguous in nature.

The forms in (26) present one of the four phonological subtypes of adjectival reduplication (all appear to reflect a distributive meaning). In these reduplicated words, the initial CV is followed by a ?-V-C, where the V-C represents a copy of the initial CV. The reduplicated portion of the word has two possible analyses. The reduplicant is an infix ?VC or a prefixed CV?V. Both analyses would require a slight modification to deal with (26*e*), which has an additional vowel. There are three possible analyses of the reduplicant: a heavy syllable, a disyllabic foot, or a bimoraic foot.

¹⁹ "False" geminates resulting from affixation also occur in Tohono O'odham, as shown here:

Unaffixed	Affixed	Gloss
<i>?lhug</i>	<i>?lhugga</i>	'devilsclaw'/'place where there is x'
<i>hím</i>	<i>hímma</i>	'is/are walking'/'seems to be x-able'
<i>má:é</i>	<i>má:éču.íid</i>	'knowing'/'causative'

These examples indicate that false geminates can occur in a variety of positions in a word.

(26) Adjectival reduplication²⁰

	Singular–Plural	Repetitive	Gloss
(26a)	<i>ǰúma.l</i>	<i>ǰúǰúǰma.l</i>	'low'
(26b)	<i>wádadk</i>	<i>wáǰapdadk</i>	'shiny'
(26c)	<i>šópo.l</i>	<i>šóǰšpo.l</i>	'short'
(26d)	<i>síwoǰk</i>	<i>síǰiswoǰk</i>	'tuft-shaped'
(26e)	<i>ǰíwu.l</i>	<i>ǰíǰíǰíwu.l</i>	'constricted'

The reduplicant is a CVC, with only the rhyme portion of the syllable representing copied segments, most easily described as a heavy syllable (one with a moraic consonant). Interestingly, and in contrast to most of the other reduplicative patterns seen above, this one results in an open–closed syllable pattern that does not strengthen the initial syllable but rather results in a closed peninitial syllable. There is a lack of determinacy in an analysis of this pattern, given the proliferation of prosodic types and both quantity-sensitivity and -insensitivity in Tohono O'odham. This lends ambiguity to any attempt to assign a prosodic category by virtue of the prosodic inconsistency characteristic of the language.

As mentioned above, every lexical category reduplicates in Tohono O'odham, and we shall see below that postpositions also display reduplication. This subtype is similar to the adjectival reduplication, but it incorporates an additional vowel. This pattern can be analyzed as either a ?VCV shape that is infixal or a CV?V prefixal reduplicant. In either case, the C and V copy the initial CV of the word. In prosodic terms, this can be analyzed as a bimoraic foot or a disyllabic foot with a prespecified laryngeal onset. Note that (27d) presents a similar contrast as (26), showing that at least one attested word deviates from the general shape. It should be noted that postpositions are a closed class of words, so the examples come from a short set of vocabulary items. Highlighting the differences with earlier patterns, we see that rather than the phoneme *p* appearing in the base when the reduplicant has a *w*, we find the glottal stop instead.

(27) Postposition reduplication

	Singular–Plural	Repetitive	Gloss
(27a)	<i>wí:m</i>	<i>wíǰíwím</i>	'with'
(27b)	<i>wúí</i>	<i>wúǰuwuí</i>	'to, toward, facing'
(27c)	<i>dá:m</i>	<i>dáǰadam</i>	'above, on top'
(27d)	<i>wípo</i>	<i>wíǰíppo</i>	'between, among'

The complexity of these examples suggests that a fuller and more exhaustive treatment of reduplication in Tohono O'odham is in order, but they do

²⁰ Again, the stative marker *s=* has been suppressed in some of these examples.

bolster the claim that the prosodic morphology contributes to the prosodic inconsistency of the language.

5. Conclusions. The focus of this paper has been empirical, but the repercussions of these issues bear on larger theoretical debates concerning moraic representations, quantitative processes, and prosodic influences on word formation. Drawing together data from a wide variety of phenomena, I laid out in **3** and **4** above two potentially contradictory sets of patterns from the phonology of Tohono O’odham. Section **3** documented several patterns from the rhythmic domain that showed insensitivity to quantity. Section **4** presented different patterns that suggest the opposite, that this system is quantity-sensitive. To broadly characterize these findings: the stress system of this language is quantity-insensitive, while the prosodic morphology is quantity-sensitive. Even more interesting is the fact that many of the latter processes converge to enhance the initial stress by strengthening the stressed vowel using strategies to create coda consonants, geminates, or vowel length. The ultimate result of these conflicting prosodies is one where stress is determined independently of quantitative factors, but quantitative factors bolster the stressed syllable. This provides evidence that while the Weight-to-Stress Principle is of no importance in Tohono O’odham, the Stress-to-Weight Principle suggests a mechanism that drives many of the quantitative processes in the prosodic morphology. Also, as shown in **4.4**, processes like gemination can surface in non-strengthening contexts, producing a reduplicative system that is rich in the prosodic possibilities.

This paper details four specific results. First, it has shown a distinct divide in the role of quantity based on whether one examines the prosody (stress, meter) or the prosodic morphology (minimal word, reduplicative patterns, morphological truncation). Second, it has shown that a number of the quantity-sensitive patterns in the prosodic morphology of Tohono O’odham serve to enhance the metrically prominent initial syllable. Third, it has complemented and extended our understanding of prosodic inconsistency, especially with regard to the role played by prosodic morphology in languages with conflicting information on moraic representations.

Finally, these findings have led to a novel typological finding—that Tohono O’odham constitutes the first language described as partitioning its rhythm as quantity-insensitive but its prosodic morphology as quantity-sensitive. Because prosodic morphological processes like reduplication augment forms, it might be expected that augmentative processes could serve to strengthen already existing metrical forms. Earlier work (Fitzgerald 1998) argued that reduplication in Tohono O’odham created “vacuous” syllables to fill positions in song meter. The analysis of patterns in this paper has shown that reduplication plays a vital role in enhancing existing phonological contrasts, here seen in the stress system of Tohono O’odham.

REFERENCES

- AUSTIN, PETER. 1981. *A Grammar of Diyari, South Australia*. Cambridge: Cambridge University Press.
- BROSELOW, ELLEN. 1995. Skeletal positions and moras. *The Handbook of Phonological Theory*, ed. J. Goldsmith, pp. 175–205. Cambridge, Mass.: Wiley-Blackwell.
- EVANS, NICHOLAS. 1995. Current issues in Australian languages. *The Handbook of Phonological Theory*, ed. J. Goldsmith, pp. 723–61. Cambridge, Mass.: Wiley-Blackwell.
- FABB, NIGEL. 1997. *Linguistics and Literature*. Oxford: Blackwell.
- FITZGERALD, COLLEEN M. 1997. *O'odham rhythms*. Ph.D. dissertation, University of Arizona.
- _____. 1998. The meter of Tohono O'odham songs. *IJAL* 64:1–36.
- _____. 1999a. Loanwords and stress in Tohono O'odham. *Anthropological Linguistics* 41:1–33.
- _____. 1999b. Unfaithful bases and syncope in Tohono O'odham reduplication. Paper presented at the Eighteenth West Coast Conference on Formal Linguistics, University of Arizona, Tucson.
- _____. 2000. Vowel hiatus and faithfulness in Tohono O'odham reduplication. *Linguistic Inquiry* 31:713–22.
- _____. 2001a. The morpheme-to-stress principle in Tohono O'odham. *Linguistics* 39:941–72.
- _____. 2001b. Across-the-board effects in Tohono O'odham meter. Ms., University at Buffalo, SUNY.
- _____. 2002a. Tohono O'odham stress in a single ranking. *Phonology* 19:253–71.
- _____. 2002b. Distributive reduplication in Tohono O'odham. Paper presented at the Thirty-first Annual Meeting of the Linguistic Association of the Southwest, Los Angeles.
- _____. 2002c. Prosodic inconsistency in Tohono O'odham distributive reduplication. Paper presented at the Western Conference on Linguistics, University of British Columbia, Vancouver.
- _____. 2002d. Metrical consistency in two poetic genres of Tohono O'odham. Paper presented at the Organized Session on Diachronic Poetics, Annual Meeting of the Modern Language Association, New York.
- _____. 2003. Word order and discourse genre in Tohono O'odham. *Formal Approaches to Function in Grammar: In Honor of Eloise Jelinek*, ed. A. Carnie, H. Harley, and M. Willie, pp. 179–89. Philadelphia: John Benjamins.
- _____. 2004. How many reduplications are there in Tohono O'odham? Paper presented at the Workshop on American Indigenous Languages, University of California, Santa Barbara.
- _____. 2006. Iambic meter in Somali. *Formal Approaches to Poetry*, ed. Elan Dresher and Nila Friedberg, pp. 193–207. Berlin: Mouton de Gruyter.
- _____. 2009. Proliferating prosodies in Tohono O'odham reduplication(s). Paper presented at the Seventeenth Manchester Phonology Meeting, University of Manchester, England.
- FITZGERALD, COLLEEN M., AND AMY V. FOUNTAIN. 1995. Subtractive morphology, Tohono O'odham and optimality theory. Paper presented at the Annual Meeting of the Linguistic Society of America, New Orleans.
- GOLSTON, CHRIS, AND TOMAS RIAD. 2000. The phonology of Classical Greek meter. *Linguistics* 38:99–167.
- GORDON, MATTHEW. 1999/2006. *Syllable weight: Phonetics, phonology, typology*. Ph.D. dissertation, University of California, Los Angeles. [Slightly revised version published in 2006, New York: Routledge.]
- _____. 2002. A phonetically-driven account of syllable weight. *Language* 78:51–80.
- _____. 2004a. Positional weight constraints in optimality theory. *Linguistic Inquiry* 35:692–703.
- _____. 2004b. A phonological and phonetic study of word-level stress in Chickasaw. *IJAL* 70:1–32.

- HAEFER, J. RICHARD. 1977. Papago Music and Dance. Occasional Papers, vol. 3. Many Farms, Ariz.: Navajo Community College Press.
- HAMMOND, MICHAEL. 1993. Heavy trochees in Choctaw morphology. *Phonology* 10:325–36.
- HANSON, KRISTIN, AND PAUL KIPARSKY. 1996. A parametric theory of poetic meter. *Language* 72:287–335.
- HAYES, BRUCE. 1987. A revised parametric theory. *Proceedings of the Northeastern Linguistic Society* 17:274–89.
- _____. 1989. Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20:253–306.
- _____. 1995. *Metrical Stress Theory*. Chicago: University of Chicago Press.
- HILL, JANE H., AND OFELIA ZEPEDA. 1992. Derived words in Tohono O'odham. *IJAL* 58:355–404.
- _____. 1998. Tohono O'odham (Papago) plurals. *Anthropological Linguistics* 40:1–42.
- HYMAN, LARRY. 1985. *A Theory of Phonological Weight*. Dordrecht: Foris.
- KAGER, RENÉ. 1992*a*. Are there any truly quantity-insensitive systems? *Proceedings of the Berkeley Linguistics Society* 18:123–32.
- _____. 1992*b*. Shapes of the generalized trochee. *Proceedings of the West Coast Conference on Formal Linguistics* 11:298–312.
- LOMBARDI, LINDA, AND JOHN MCCARTHY. 1991. Prosodic circumscription in Choctaw morphology. *Phonology* 8:37–72.
- MATHIOT, MADELEINE. 1967. The cognitive significance of the category of the nominal number in Papago. *Studies in Southwestern Ethnolinguistics*, ed. Dell Hymes and William E. Bittle, pp. 197–237. The Hague: Mouton.
- _____. 1973. *A Dictionary of Papago Usage*. 2 vols. Bloomington: Indiana University.
- MCCARTHY, JOHN, AND ALAN PRINCE. 1986. *Prosodic morphology*. Ms., University of Massachusetts, Amherst and Brandeis University.
- _____. 1990. Foot and word in prosodic morphology: The Arabic broken plural. *Natural Language and Linguistic Theory* 8:209–84.
- _____. 1993. *Prosodic morphology I*. Ms., University of Massachusetts, Amherst and Rutgers University.
- _____. 1995. *Faithfulness and reduplicative identity*. Ms., University of Massachusetts, Amherst and Rutgers University.
- MCGREGOR, WILLIAM. 1990. *A Functional Grammar of Gooniyandi*. Amsterdam: John Benjamins.
- MİYASHITA, MIZUKI. 1998. Weight asymmetries in Tohono O'odham. Ms., University of Arizona, Tucson.
- _____. 2004. O'odham collateral reduplication. Paper presented at the Workshop on American Indian Languages, Santa Barbara.
- MUNRO, PAMELA, AND JASON RIGGLE. 2004. Productivity and lexicalization in Pima compounds. *Proceedings of the Berkeley Linguistics Society* 30:114–26.
- MUNRO, PAMELA, AND CHARLES H. ULRICH. 1984. Structure-preservation and Western Musko-gean rhythmic lengthening. *Proceedings of West Coast Conference on Formal Linguistics* 3:191–202.
- NICKLAS, THURSTON DALE. 1974. *The elements of Choctaw*. Ph.D. dissertation, University of Michigan.
- POSER, WILLIAM. 1989. The metrical foot in Diyari. *Phonology* 6:117–48.
- _____. 1990. Evidence for foot structure in Japanese. *Language* 66:78–104.
- PRINCE, ALAN. 1990. Quantitative consequences of rhythmic organization. *Proceedings of the Chicago Linguistic Society* 26:355–98.
- PRINCE, ALAN, AND PAUL SMOLENSKY. 1993. *Optimality theory: Constraint interaction in generative grammar*. Ms., Rutgers University and University of Colorado.

- RIGGLE, JASON. 2006. Infixing reduplication in Pima and its theoretical consequences. *Natural Language and Linguistic Theory* 24:857–91.
- SAXTON, DEAN. 1982. Papago. *Studies in Uto-Aztecan Grammar* 3, ed. R. Langacker, pp. 92–266. Dallas: Summer Institute of Linguistics and University of Texas at Arlington.
- SAXTON, DEAN; LUCILLE SAXTON; AND SUSIE ENOS. 1989. *Dictionary: Papago/Pima–English, O'otham–Milgahn*. Tucson: University of Arizona Press.
- STEELE, SUSAN. 2008. Situating morphology. *IJAL* 74:313–64.
- STERIADE, DONCA. 1991. Moras and other slots. *Proceedings of the Formal Linguistics Society of Midamerica* 1:254–80.
- TRANEL, BERNARD. 1992. CVC light syllables, geminates, and moraic theory. *Phonology* 8:291–302.
- ULRICH, CHARLES. 1986. Choctaw morphophonology. Ph.D. dissertation, University of California, Los Angeles.
- _____. 1994. A unified account of Choctaw intensives. *Phonology* 11:325–39.
- WALLACE, MARGARET, transcriber. 1981. *O'odham Ha-Ñeñei (Papago Songs)*. Waitsburg, Wash.: San Simon School, Coppei House Publisher.
- WORLD ATLAS OF LANGUAGE STRUCTURES. < <http://wals.info/>>.
- ZEPEDA, OFELIA. 1995. *Ocean Power: Poems from the Desert*. Tucson: University of Arizona Press.
- _____. 1997. *Jewed 'I-Hoi: Earth Movements*. Tucson: Kore Press.