

# Arapaho Accent<sup>1</sup>

Amy Fountain

The University of Arizona<sup>®</sup>  
Department of Linguistics

## 1. Introduction

Arapaho is an Algonquian language spoken by a population of about 3500 in Wyoming and Oklahoma (Salzmann 1983). The accent system of Arapaho is quite complex and presents a challenge to any theory of stress/accent which attempts to account for these phenomena in a derivational manner (Salzmann 1965, Tsay 1989). In this essay it is argued that Arapaho accent involves both lexical and derivational aspects. In section 2, the phonetic characteristics of Arapaho accent are outlined. Section 3 briefly overviews Idsardi's (1992) theory of the computation of stress. In section 4, the Arapaho data are presented and the crucial generalizations are stated. Section 5 contains an analysis of these facts, utilizing Idsardi's theory. An alternative analysis is offered in section 6, and finally in section 7 the theoretical implications of the Arapaho facts are discussed.

## 2. Arapaho Accent

Prominence in Arapaho is realized phonetically through both pitch and fortition of articulation. Some Arapaho words contain a single accent (i.e., *he:sno:úni* 'famine')<sup>2</sup>, others are characterized by seemingly binary foot structure (i.e., *nixómemí* 'lantern'). Accents may be realized with a falling tone pattern, as in *cí:té* 'foam', and these accents are marked with a hacek. Non-falling accents are realized primarily through fortition (Salzmann 1983).

## 3. Idsardi's Theory of the Computation of Stress<sup>3</sup>

Idsardi (1992) provides an algorithm for the construction of metrical grids which allows for the parsing of these grids into domains which may be bounded or unbounded. In this system, five parameter values are set for a given language. First, stress-bearing elements (moras or syllables) project markers (x's) onto line 0 of the metrical grid. Second, a left or right parenthesis may be projected onto line 0 at the left or right edge of certain kinds of elements (e.g., heavy syllables). Third, a left or right parenthesis may be projected at the left or right edge of the left- or rightmost element. This third step is referred to as "edge-marking". Edge-marking settings are listed in abbreviated form where the first letter represents the choice of parenthesis type, the second the choice of element edge and the third the choice of domain edge. The edge-marking setting RLR is to be read "project a right parenthesis to the left of the rightmost element in some domain".

Edge-marking is the mechanism which allows Idsardi's system to account for extrametricality effects, as well as pre- and post-stressing cases (where an unaccented domain

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<sup>2</sup>The official orthography of the Arapaho tribe is adopted here. Phonetic correspondences are as follows. Consonants: [c] is a spread-glottis palatal affricate; [ʒ] is a spread-glottis interdental fricative. All other consonant symbols are used in the standard manner. Vowels: [e] is a mid, front, lax vowel; [i] is a high, front, lax vowel; [o] is a mid, back, tense vowel; [u] is a high, back, lax vowel.

<sup>3</sup>The interested reader is referred to Idsardi (1992) for a full explication of this theory, and motivation for the parameters and constraints suggested within it. All aspects of Idsardi's theory which are necessary to this analysis are overviewed here, however.

seems to force an accent to appear on an adjacent, accentless, domain). Edge marking can occur on line 1 as well as on line 0.

The fourth parameter, "iterative constituent construction" (henceforth, ICC), allows iterative binary parsing, either from the right edge leftward or vice-versa. Under the ICC, the type of parentheses projected onto line 0 is constrained by the directionality of the parse. A left-to-right parse always places right parentheses on line 0, whereas a right-to-left parse always places left parentheses.

Finally, languages may mark heads on line 1 either at the right or the left edge of the domains identified by parenthesis projection/insertion. These parameters are applied to a simple stress-type system (Warao) in (1) below. In Warao, stress falls on even numbered syllables counting from the right edge of the word. Main stress falls on the penultimate syllable (Idsardi 1992:6).

(1)	The Warao Parameters:	Line 0: Line 1:	Edge:RRR Edge:RRR	ICC: R	Head:L Head:R
	Example:				
	Project x, Edge:RRR				
					yàpurùkitàneháse
					x x x x x x x x)
					yapurukitanehase
	ICC:R				(x x(x x(x x(x x
					yapurukitanehase
	Head:L				x x x x
					(x x(x x(x x(x x
					yapurukitanehase
	Line 1: Edge:RRR				x x x x)
					(x x(x x(x x(x x
					yapurukitanehase
	Head:R				x)
					x x x x)
					(x x(x x(x x(x x
					yapurukitanehase

Idsardi introduces a number of constraints on the construction of the grid. Constraints take the form of "avoid" clauses, and these disallow the construction of certain configurations on the grid. Ternary systems like Cayuvava, for example, are subject to "avoid (xx("". This causes the ICC to place a parenthesis one marker to the left of the marker that would have been selected under binary construction. An example of the application of "avoid (xx(" is included in (2). In Cayuvava, stress falls on every third mora counting from the right edge of the word, and on the initial mora in shorter words (Idsardi 1992:27).

(2)	The Cayuvava Parameters:	Line 0:	Edge:RLR	ICC:R	Avoid (xx(
	Example:	maráhahaéiki			
	Project x; Edge:RLR	x x x xxx)x marahahaeiki			
	ICC:R	x(x xx(xx)x marahahaeiki			
	Head:L	x x x(x xx(xx)x marahahaeiki			

With this brief explication of Idsardi's theory in mind, section 4 will examine the Arapaho data.

#### 4. Arapaho Nouns

The data analyzed here include only unaffixed nouns. Arapaho nouns show a wide variety of patterns of accent. Monosyllables are never accented, but all polysyllabic words contain at least one accent. Two-syllable words can exhibit an accent on the first or second syllable, or both, and the locus of accent is unpredictable according to syllable weight or mora count. This is illustrated in (3) below.

(3)	Mono- and disyllables:	
	Monosyllables: Unaccented	
	ho3	'arrow'
	Disyllables: Initial Accent	
	yó:kox	'willow'
	bétson	'elbow'
	Disyllables: Final Accent	
	wonót	'abdomen'
	bihí3	'dung'
	Disyllables: Initial and Final Accent	
	3éi3	'cartilage'

It is always the case that adjacent nonfalling accents occur on a CV.VC sequence. Falling accents only occur on long vowels which immediately precede an accented, consonant-initial syllable. Examples are given in (4).

(4)	Adjacent Accents:	
	3éi3	'cartilage'
	céito:	'earring'
	cíté:	'foam'
	nih'êmó'	'blackbird'

Three-syllable words contain one or two accents, and all of the possible accentual patterns are attested. The data in (5) contain examples of accentual patterns in three-syllable words.

(5) Three-syllable Words:

Initial Accent:

né:sortox	'eight'
nóxkuhurt	'button'

Medial Accent:

ni:zí:wo:	'handkerchief'
tecéno:	'gate'

Final Accent:

hemetít	'language'
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Two Accents:

céito:	'earring'
sé'temé3	'blood hound'
nih'è:nó'	'blackbird'

Forms longer than three syllables show all possible arrangements of accents, subject to the following restrictions. First, all four-syllable spans have at least one accent. Second, only long vowels can receive falling accents, and these may only surface when they precede accented short vowels. Third, all adjacent non-falling accents occur on CV.V sequences. Example forms are given in (6) through (9) below.

(6) Four-Syllable Words:

ni:sí3oó	'job'
tébexóno:	'chainsaw'
ni:3ó:te:'e:	'braid'
wohomónok	'thread'
ninôxúwut	'governor'
3í'o:ku:3ó:'	'fencepost'
kóúhuyo:'	'honey'

(7) Five-Syllable Words:

tóno'wû:hóe	'cellar'
hé:tese:'éi:t	'bald eagle'
touhómo'ó	'boot'
cinó:tono	'grain'
hehí:sé3omo	'laundry'
hi:hó:cebíte:	'butter'
séi'ko:tí'i	'cabbage'

(6) Six-Syllable Words:

he:téci:'éhi:	'gull'
bí:semi3ó:teryo:	'chrysalis'
woníseine:hí:s	'burr'
wonóhno:kútemó:	'handrake'

(7) Seven-Syllable Words:

ce:céibecéinó:	'candy'
hó:wohóo:htéihi	'centipede'
ko:kóúmi:sóúhu'	'dime'

A number of generalizations have emerged from these data. First, there is no span of unaccented syllables longer than 3 syllables. Second, falling accent only surfaces on long vowels which precede accented syllables. Third, adjacent non-falling accents only occur on CV.V sequences. Fourth, both alternating (bounded) and non-alternating (unbounded) accent patterns occur. Fifth, neither syllable weight nor position in a word predict placement of accent. Finally, monosyllabic forms are never accented. An adequate analysis of Arapaho accent must account for each of these generalizations.

## 5. The Analysis

The generalizations discussed above can be accounted for by an analysis positing that certain components of the accent system must be lexical, while others may be derivational in nature. It is assumed that lexical entries contain only material that is idiosyncratic about a form. Once these lexical properties are defined, the form can be realized through the application of language-invariant parameter settings.

That monosyllables are unaccented indicates a binary minima condition on accentable spans. Since bimoraic monosyllabic words do not receive an accent, it is hypothesized that the domain of stress is the syllable and not the mora. That binarity plays a critical role in the accentual system of Arapaho is evidenced further by the fact that there must be at least one accent on every four-syllable (two-foot) span.

Idsardi's theory allows two unique options for the analysis of Arapaho. First, the positions in which parentheses can be inserted through edge-marking also seem to be the positions in which lexically marked parenthesis must exist in Arapaho nouns. Since the data considered for this analysis consist only of unaffixed nouns, the pre- and post-stressing settings (RLL and LRR) are not attested here. Second, in the forms exhibiting alternating accents (binary feet), the placement of accents is sensitive to the placement of constituent boundaries from lexical marking

(either edge-marking or adjacent accent marking). In the forms exhibiting seemingly unbounded feet, accent always appears at least once in every bipodal string. This suggests that in some forms, accents created by the ICC may be "bled" or deleted at some stage in the derivation.

Third, adjacent stresses are unpredictable in terms of their position within a word, but not with regard to the segmental structures on which they can occur. The first of a pair of adjacent accents may fall on a long vowel or the second may fall on an onsetless syllable. Note that falling accents are always followed by non-falling accents, but there is no way to predict which non-falling accent will be preceded by a falling one. This suggests that lexical marking of adjacent accents is accomplished through the projection of a left parenthesis (since left parentheses force an accent to occur on a constituent to their right). It is therefore hypothesized that marked syllables project two parentheses. Each is a left parenthesis, and one is projected on either side of a marker in the following configuration: (x(.

A short vowel will never surface with a falling accent. If an accented short vowel is immediately followed by an accent, it is also immediately followed by an onsetless syllable. In other words, CV.CV strings will never receive two accents, but CV.V strings may. This situation seems analogous to the falling accent case in that adjacent accents are licit in this configuration, and are illicit in all other configurations except the falling accent case just described. Interestingly, the same form of lexical parenthesis insertion posited for the falling accent cases will account for these sequences as well. For this reason, it is asserted that all cases of adjacent accent are lexically marked, and these are the only lexical accents which are not subject to placement by edge-marking settings.

Words four syllables or longer which contain medial accents always show placement of these accents on alternating syllables rightward of (and sensitive to the placement of) lexically marked constituent boundaries. This suggests that the ICC is binary, rightward, and is sensitive to the placement of lexical parentheses. In order to illustrate this, let us look at the four-syllable words with penultimate accent.

If the ICC operates from left to right, it will place a right parenthesis after the second marker on line 0, resulting in the pattern xx)xx. If it operates from right to left, it will place a left parenthesis to the right of the second marker on line 0, xx(xx. In either case, we must assume that there is some method for limiting such a form to a single accent, and therefore to a single metrical constituent. This will be accomplished by an edge-avoidance constraint on the ICC. In order to get a penultimate accent, a constituent containing the penultimate marker must be created. Only ICC leftward accomplishes this. Further, in order for the accent to appear on the penultimate syllable, the constituent must be left-headed. Thus the ICC must operate from right to left, and feet thus constructed must be left-headed.

If the ICC is subject to the constraint "avoid #(x", a number of patterns will result, and these patterns are all attested in Arapaho words. These patterns are exemplified in (8) below. I assume that edge-marking parameters are lexically determined, and limited to just those Idsardi allows. I assume further that no lexical edge-marking need occur. Finally, I assume that adjacent accents are always lexically determined, and not subject to edge-marking parameters. All forms are subject to ICC:L

(8) Patterns Attested in Words Four Syllables and Longer:

Four-Syllable Cases:

Edge:None	x	
Adjacent Accents:None	x x(x x	
	ce'e ibes	'box'
Edge:None	x x	
Adjacent Accents:2nd/3rd	x(x( x x	
	nino:xuwut	'governor'

Edge:LLL	x x	
Adjacent Accents:None	(x x(x x	
	tebexono:	'chainsaw'
Edge:LLR	x x x	
Adjacent Accents:None	(x(x x(x	
	ho u3o o	'clothesline'

**Five-Syllable Cases:**

Edge:None	x x	
AdjacentAccents:None	x (x x(x x	
	hi:ho:cebite:	'butter'
Edge:RRL	x x	
AdjacentAccents:None	x) x x (xx	
	he:tese:'ei:t	'bald eagle'

**Six-Syllable Cases:**

Edge:RRL	x x x	
AdjacentAccents:None	(x x(xx (xx	
	be'e3einoo:	'cedar'

**Seven-Syllable Cases:**

Edge:LLL	x x x x	
AdjacentAccents:5th/6th	(x x(xx (x(x x	
	ho:wohoo:hteihi	'centipede'

This analysis enables us to capture all of the attested patterns except those in which footing does not appear to be iterative. Specifically, the remaining patterns are listed in (9) below.

(9) Non-iterative Patterns (in five-syllable or longer words):

- (a) initial and ultima accent
- (b) second syllable accent
- (c) second and ultima accent
- (d) penultimate accent

If the ICC is operative on all Arapaho forms, then it may be that medial accents are lost through a process of tier conflation. One possibility is the operation of conflation posited by Idsardi (1992:38), in conjunction with line 1 edge-marking. Conflation is an operation in which heads at line 0 are deleted while heads derived on line 1 are retained. If conflation applies to lexically marked forms after line 1 edge-marking, then the patterns in (9) can be accounted for. Derivations for these patterns are given in (10).

(10) Derivations Including Conflation After Line-1 Edge-marking:

Conflation	x	∅	
Edge:LLL-Line1	(x	x	
AdjacentAccents:None	x (xx	(x x	
	ci:nou:tono		'grain'
Conflation	x	∅	x
Edge:LLRandLRR-Line1	(x	x	(x
AdjacentAccents:None	x (xx	(x x	(x
	woniseine:hi:s		'burr'
Conflation	x	∅	x
Edge:LLLandLRR-Line1	(x	x	(x
AdjacentAccents:None	(x x(x	x(x	
	sicene:woxu'		'yucca'
Conflation	∅	x	
Edge:LRL-Line1	x	(x	
AdjacentAccents:None	x(x	x(xx	
	wo3onohoe		'paper'

In sum, the following information is argued to be lexically marked in Arapaho: (i) Long vowels and vowels preceding onsetless syllables may be lexically marked with a left parenthesis to the right and to the left of their markers on line 0. Otherwise, lexical markers can occur in all and only those positions corresponding to Idsardi's edge-marking parameter. (ii) Certain forms are marked to undergo conflation.

Beyond this lexical information, Arapaho has selected the following parameters for the assignment of accents: (i) The ICC operates leftward. (ii) Constituents are left-headed. (iii) Markers are projected from syllables. This analysis predicts that for forms not lexically marked, there should be no more than eleven distinct patterns. Critically, all of the formal possibilities are attested in the data, and all patterns not predicted can be accounted for by lexically marked adjacent stresses or conflation.

## 6. An Alternative Analysis

Problematic forms for any analysis undertaken using Idsardi's approach are those which fail to exhibit medial accents on syllables where it would seem that the ICC should place constituent boundaries. One way of dealing with these problem forms is to argue that the ICC simply fails to apply to them. Thus the lexical mark on such forms would instruct the ICC not to apply at all, rather than invoking tier conflation. This analysis misses a number of generalizations, however. First, it cannot account for the role of binarity in the failure to assign accent to monosyllabic words. Second, it cannot account for the limit of three unaccented syllables in a string; importantly this limit is not violated even in forms which do not demonstrate binarity of footing. These facts indicate that conflation is a more adequate mechanism for explaining the lack of medial accents in such forms.

## 7. Implications

Arapaho Accent provides a rigorous test for any theory of stress or accent systems. Although the Arapaho system appears chaotic, it is more constrained than a purely lexical analysis would suggest. It is clearly, however, too complex for a purely derivational theory to accommodate. The system provides interesting support for Idsardi's approach to metrical grids, especially with regard to edge-marking parameters. If accent systems generally make use of the possibilities provided by edge-marking, then the power of Idsardi's theory is in some part

justified. This analysis surely suggests that further study of systems such as the Arapaho one will be a fruitful area of research into the diversity of stress and accentual systems in the languages of the world.

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