An OT account of variability in Walmatjari stress*

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0. Introduction

Constraints have been around in phonology for a number of years, but Optimality Theory (OT: Prince & Smolensky, 1993) offers a new view of constraints greatly reducing the role played by rules and providing an explicit mechanism for ranking constraints.

Idsardi (1992) argues that an exclusively constraint-based grammar is problematic because it can allow multiple outputs for a single underlying form if the constraint hierarchy is incomplete. For example, a constraint hierarchy with respect to stress that is incomplete in that it only excludes final stress provides a unique output for monosyllabic and disyllabic inputs, but allows for different stress patterns for forms with more than two syllables.

In this paper, I argue that multiple outputs do occur in stress systems and that constraints are an appropriate way to characterize such systems. This demonstration constitutes an argument for a constraint-based theory like that of OT. The organization of this paper is as follows. First, the essentials of Idsardi's framework and argument are reviewed. Second, the relevant facts of Walmatjari are presented. Third, an analysis of variable stress in Walmatjari is offered in terms of an incomplete constraint hierarchy. Fourth, an analysis of exceptional nonvarying stress in Walmatjari is provided.

1. Idsardi's framework and argument

There are a number of versions of metrical theory out there and a plethora of arguments to choose between them. In this paper, I adopt Idsardi's framework. First, some of the arguments mentioned support Idsardi's theory. Second, Idsardi's argument against constraint-based phonology is couched in terms of his own theory and it is thus fairer and simpler to address this argument in the terms of that theory.

The essentials of this theory are as follows. First, a partially constituentized grid representation is adopted. Metrical terminals are denoted with x's and constituents are indicated with parentheses. Unlike other constituentized grid theories like Halle & Vergnaud (1987) however, a constituent needs only a single edge marked. Thus the representations in (1a) and (1b) are equivalent.

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(1)

a.		b.
x x x)	≈	(x x x)
(x x x	≈	(x x x)
x(x x	≈	x(x x)
x)x x	≈	(x)x x
x x)(x	≈	(x x)(x)
x x)x)	≈	(x x)(x)

Idsardi offers an explicit theory of how such parentheses are placed and the resulting constituents interpreted and headed.

The theory Idsardi develops includes both rules and constraints, but in his conclusion, Idsardi considers the question of whether an exclusively constraint-based theory would be adequate. He argues that it would not because, unless the set of applicable constraints were universal, one would expect to find languages exhibiting variable stress.

Consider, for example, stress in Warao (Osborn, 1966), where stress falls on even-numbered syllables counting from the right end of the word.[1]

(2) yiwàranáe yàpurùkitàneháse

Let us assume that constituents are left-headed, marked with left parentheses, and that parentheses are inserted freely.[2] This system can then be captured with the following four constraints.

(3)

Warao		
	a	Avoid (x#
	b	Avoid (x(
	c	Avoid xxx
	d	Avoid #xx

Constraint (3a) prevents final degenerate feet. Constraint (3b) prevents medial degenerate feet.[3] Constraints (3c) and (3d) prevent trisyllabic lapses and initial disyllabic lapses.

These generalizations are somewhat redundant and these redundancies can be eliminated if the constraints are abbreviated as in (4) below.

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[1]Idsardi cites only the following two unglossed examples.

[2]These assumptions are not critical to the argument.

[3]Cf. the "strict binarity" hypothesis of Hayes (1987) and Kager (1992).

(4) ab Avoid $(x\begin{Bmatrix}\#\\(\end{Bmatrix}$

cd Avoid $\begin{Bmatrix}x\\\#\end{Bmatrix}xx$

Constraint (4ab) prevents degenerate feet, and constraint (4cd) prevents disyllabic lapses.

The application of these constraints to a hypothetical trisyllabic word is given in (5) below.[4] Notice how no particular ranking of the constraints is necessary as failure on any one constraint is sufficient to exclude a candidate.

(5)

		a	b	c	d
	1 x x x			*	*
	2 (x x x			*	
☞	3 x(x x				
	4 x x(x				*
	5 (x(x x	*			
	6 (x x(x		*		
	7 x(x(x	*	*		
	8 (x(x(x	*	*		

Idsardi points out the following interesting fact. If any one of these constraints were to be removed, THERE WOULD BE TWO OUTPUT FORMS. Consider, for example, what would happen if constraint (3a) were removed from the hierarchy (or ranked below some other constraint which rendered it inapplicable). Eliminating this constraint would entail that all polysyllabic forms have two possible stress patterns.

(6)	with (3a)	without (3a)		
	x	(x		
	(x x	(x x	or	x(x
	x(x x	x(x x	or	(x x(x
	(x x(x x	(x x(x x	or	x(x x(x
	x(x x(x x	x(x x(x x	or	(x x(x x(x

This, he contends, is a problem because "... stress systems in human languages do not appear to work in this fashion. Rather, for each grid length there is one particular stress pattern"(p.87). If true, this would constitute an interesting

[4]For ease of interpretation, the unabbreviated constraints are used. An asterisk indicates at least one violation of the relevant constraint and the pointing finger indicates candidates selected by the constraint hierarchy. Constraint ranking and number of violations of each constraint are not indicated as they are never relevant for the discussion.

argument against constraint-based stress theory. However, I argue in the following section that this is not true.

2. Walmatjari

Stress in Walmatjari (Hudson & Richards, 1969) exhibits just the variability predicted by the constraint-based model discussed. The facts are as follows. First, there are no monosyllabic content words.[5] Disyllabic words have stress on the first syllable.

(7) yápa 'child'
ŋáṛpu 'father'
pálma 'creek'
ŋápa 'water'

Trisyllabic words are stressed on either the first or second syllable.

(8) káŋani ~ kaŋáni 'carried'
máṇalu ~ maṇálu 'we ... him'
yútanti ~ yutánti 'sit'
yűřanti ~ yuránti 'drown'

There are three types of quadrisyllabic words. Some have fixed initial stress with a secondary stress on the penult (9a). Some exhibit a fixed antepenult stress (9b). Finally, some vacillate between these two patterns (9c).

(9) a. ŋákaljàlja 'cockatoo'
tjíninjàṛa 'midday'
máṭuwàřa 'river'
páṛayànta 'climb'
b. tjalánana 'dispersing'
c. páljmanàna ~ paljmánana 'touching'
ṭúṇmanàna ~ ṭuṇmánana 'burying'

Five-syllabled words again exhibit variability. One class of words bears fixed initial main stress and penult secondary stress (10a). A second class of words

[5]An interesting analysis of this fact is offered by Cho (1994).

exhibits fixed initial main stress and antepenult secondary stress (10b). Finally, a third class of words vacillates between these two patterns (10c).

(10)	a.	wálakuwàn̪̈ti	'sons'
		yűr̃antinjàna	'drowning'
	b.	njántukù̱ra̱lu	'his'
		r̥ánjtjikàr̆alanj	'hides'
	c.	njúmukkutj̈i̱ni ~ njúmukkùtjii̱ni	'caused to bathe'
		púl̥katjar̆inja ~ púl̥katjàr̆inja	'became big'

Only one six-syllabled word is cited and it has an initial main stress and antepenult secondary stress.

(11)	wálakuwàn̪̈ti̱lu	'sons' SUBJ

The patterns are summarized in table (12). Rows indicate word length in terms of syllables. The columns indicate the available stress patterns.

(12) Summary

2	á a	
3	a á a	á a a
4	á a à a	a á a a
5	á a a à a	á a à a a
6	?	á a a à a a

3. Variable stress

The variability observed is a counterexample to Idsardi's claim. The generalizations are as follows. First, there is never final stress. Second, there are never adjacent stresses. Third, there is always a stress on one of the first two syllables. Finally, there are never more than two stressless syllables in a row. These generalizations are formalized as constraints in (13).

(13)	a	Avoid (x#
	b	Avoid (x(
	c	Avoid xxxx
	d	Avoid #xx

These constraints can also be abbreviated, as in (14), which correspond to less redundant generalizations.

(14) ab Avoid $(x\begin{Bmatrix}\#\\(\end{Bmatrix}$

cd Avoid $\begin{Bmatrix}xx\\\#\end{Bmatrix}xx$

Constraint (14ab) excludes degenerate feet. Constraint (14cd) prevents initial disyllabic lapses and medial trisyllabic lapses.

How the constraints would apply to a hypothetical trisyllabic form is diagrammed in (15).[6]

(15)

		a	b	c	d
	1 x x x				*
☞	2 (x x x				
☞	3 x(x x				
	4 x x(x	*			*
	5 (x(x x		*		
	6 (x x(x	*			
	7 x(x(x	*	*		
	8 (x(x(x	*	*		

Notice how the hierarchy is incomplete in that it does not select between (15.2) and (15.3).[7]

The candidates for a four-syllabled form are given in (16).

(16)

		a	b	c	d
	1 x x x x			*	*
☞	2 x(x x x				
	3 x x(x x				*
	4 x x x(x	*			*
	5 x(x(x x		*		
	6 x(x x(x	*			
	7 x x(x(x	*	*		*
	8 x(x(x(x	*	*		

		a	b	c	d
	9 (x x x x			*	
	10 (x(x x x		*		
☞	11 (x x(x x				
	12 (x x x(x	*			
	13 (x(x(x x		*		
	14 (x(x x(x	*	*		
	15 (x x(x(x	*	*		
	16 (x(x(x(x	*	*		

Again, the hierarchy does not converge on a single output but allows both (16.2) and (16.11).

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[6] Again, the unabbreviated constraints are used for perspicuity.

[7] Constraint (13c) is inapplicable in (15), but plays a role in later tableaux.

The lack of variability with disyllabic forms follows automatically. This is diagrammed in (17).

(17)

		a	b	c	d
	1 x x				*
☞	2 (x x				
	3 x(x	*			
	4 (x(x	*	*		

Here the hierarchy is sufficiently complete so as to allow only one candidate. The analysis presented thus accounts directly for why words of certain lengths exhibit variability, but words of different lengths do not.

We have yet to account for the variability observed with five-syllabled forms and six-syllabled forms. The tableau in (18) shows how the constraint set provided so far predicts three possible stress patterns for five syllable words. Only two are attested, (18.18) and (18.19), yet a third is predicted by the hierarchy so far: (18.11).

(18)

		a	b	c	d
	1 x x x x x			*	*
	2 x x(x x x				*
	3 x x x(x x				*
	4 x x x x(x	*		*	*
	5 x x(x(x x		*		*
	6 x x(x x(x	*			*
	7 x x x(x(x	*	*		*
	8 x x(x(x(x	*	*		*
	9 x(x x x x			*	
	10 x(x(x x x		*		
*☞	11 x(x x(x x				
	12 x(x x x(x	*			
	13 x(x(x(x x		*		
	14 x(x(x x(x	*	*		
	15 x(x x(x(x	*	*		
	16 x(x(x(x(x	*	*		

		a	b	c	d
	17 (x x x x x			*	
☞	18 (x x(x x x				
☞	19 (x x x(x x				
	20 (x x x x(x	*		*	
	21 (x x(x(x x		*		
	22 (x x(x x(x	*			
	23 (x x x(x(x	*	*		
	24 (x x(x(x(x	*	*		
	25 (x(x x x x		*	*	
	26 (x(x(x x x		*		
	27 (x(x x(x x		*		
	28 (x(x x x(x	*	*		
	29 (x(x(x(x x		*		
	30 (x(x(x x(x	*	*		
	31 (x(x x(x(x	*	*		
	32 (x(x(x(x(x	*	*		

The generalization that will exclude (18.11) is that nonperipheral feet are excluded when there is more than one foot. This constraint is (preliminarily) formalized as (19e) below.

(19) a Avoid (x#
b Avoid (x(
c Avoid xxxx
d Avoid #xx
e Avoid x(x x(

Confirmation of (19e) comes from a consideration of six-syllabled spans. The constraint hierarchy offered in (19) correctly reduces the candidate list to the one pattern attested if (19e) is generalized to exclude binary or ternary nonperipheral feet.[8] The case excluded by the generalization of (19e) is (20.19).

(20i)

		a	b	c	d	e
1	x x x x x x			*	*	
2	x x x x x(x	*		*	*	
3	x x x x(x x			*	*	
4	x x x x(x(x	*	*	*	*	
5	x x x(x x x				*	
6	x x x(x x(x	*			*	*
7	x x x(x(x x		*		*	
8	x x x(x(x(x	*	*		*	

(20ii)

		a	b	c	d	e
9	x x(x x x x			*	*	
10	x x(x x x(x	*			*	
11	x x(x x(x x				*	*
12	x x(x x(x(x	*	*		*	*
13	x x(x(x x x		*		*	
14	x x(x(x x(x	*	*		*	*
15	x x(x(x(x x		*		*	
16	x x(x(x(x(x	*	*		*	

[8]Figure (20) is broken up to make it easier to read (and to print!).

(20iii)

			a	b	c	d	e
	17	x(x x x x x			*		
	18	x(x x x x(x	*		*		
*☞	19	x(x x x(x x					
	20	x(x x x(x(x	*	*			
	21	x(x x(x x x					*
	22	x(x x(x x(x	*				*
	23	x(x x(x(x x		*			
	24	x(x x(x(x(x	*	*			

(20iv)

			a	b	c	d	e
	25	x(x(x x x x		*	*		
	26	x(x(x x x(x	*	*			
	27	x(x(x x(x x		*			*
	28	x(x(x x(x(x	*	*			*
	29	x(x(x(x x x		*			
	30	x(x(x(x x(x	*	*			*
	31	x(x(x(x(x x		*			
	32	x(x(x(x(x(x	*	*			

(20v)

			a	b	c	d	e
	33	(x x x x x x			*		
	34	(x x x x x(x	*		*		
	35	(x x x x(x x			*		
	36	(x x x x(x(x	*	*	*		
☞	37	(x x x(x x x					
	38	(x x x(x x(x	*				*
	39	(x x x(x(x x		*			
	40	(x x x(x(x(x	*	*			

(20vi)

			a	b	c	d	e
	41	(x x(x x x x			*		
	42	(x x(x x x(x	*				
	43	(x x(x x(x x					*
	44	(x x(x x(x(x	*	*			*
	45	(x x(x(x x x		*			
	46	(x x(x(x x(x	*	*			*
	47	(x x(x(x(x x		*			
	48	(x x(x(x(x(x	*	*			

(20vii)

		a	b	c	d	e
49	(x(x x x x x		*	*		
50	(x(x x x x(x	*	*	*		
51	(x(x x x(x x		*			
52	(x(x x x(x(x	*	*			
53	(x(x x(x x x		*			*
54	(x(x x(x x(x	*	*			*
55	(x(x x(x(x x		*			*
56	(x(x x(x(x(x	*	*			*

(20viii)

		a	b	c	d	e
57	(x(x(x x x x		*	*		
58	(x(x(x x x(x	*	*			
59	(x(x(x x(x x		*			*
60	(x(x(x x(x(x	*	*			*
61	(x(x(x(x x x		*			
62	(x(x(x(x x(x	*	*			*
63	(x(x(x(x(x x		*			
64	(x(x(x(x(x(x	*	*			

Constraint (19e) is reformalized as (21e) below.

(21) a Avoid (x#
b Avoid (x(
c Avoid xxxx
d Avoid #xx
e Avoid x(...(

Notice that generalizing (19e) like this leaves no way for seven-syllabled words to satisfy the full hierarchy. Interestingly, the grammar provides no examples of seven-syllabled words.[9]

To summarize thus far, Walmatjari exhibits variable stress in words of specific lengths. The variability is narrowly constrained, so that words exhibiting variation exhibit only a set number of patterns. This double variability can be captured straightforwardly with a constraint hierarchy that is incomplete. It is "incomplete" in the sense that the hierarchy does not produce only a single output for any input.

[9]See Hammond (1991) for further discussion of this seven syllable limit from a very different perspective.

4. Fixed stress

The final question to be addressed is why only certain lexical items exhibit variability. Recall, for example, that not all four-syllabled words vary in their stress (9a, b). I propose that the nonvarying words exhibit additional lexical marking in the form of underlying parentheses. These parentheses restrict the applicability of the constraint hierarchy so that only a single output is produced. Consider, for example, the range of possible lexical markings for four-syllabled words. For simplicity, let us assume that a word can receive at most one lexical bracket.[10]

(22) a x x x x
b [x x x x
c x[x x x
d x x[x x
e x x x[x

The placement of these lexical brackets will further restrict how subsequent brackets can be placed. Case (22a), which gives rise to varying stress, we have already considered in (16) above. The other cases are presented below. Case (22b) corresponds to (9a), resulting in stress on the first and third syllables.

(23)

			a	b	c	d	e
	1	[x x x x			*		
	2	[x x x(x	*				
☞	3	[x x(x x					
	4	[x x(x(x	*	*			*
	5	[x(x x x		*			
	6	[x(x x(x	*	*			*
	7	[x(x(x x		*			*
	8	[x(x(x(x	*	*			*

Case (22c) corresponds to (9b), resulting in second syllable stress.

[10]Lexical brackets are marked as square brackets for ease in reading the diagrams.

(24)

			a	b	c	d	e
☞	1	x[x x x					
	2	x[x x(x	*				*
	3	x[x(x x		*			*
	4	x[x(x(x	*	*			*
	5	(x[x x x		*			
	6	(x[x x(x	*	*			*
	7	(x[x(x x		*			*
	8	(x[x(x(x	*	*			*

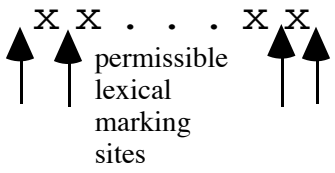
Case (22d) has the same output as (22b).

(25)

			a	b	c	d	e
	1	x x[x x				*	
	2	x x[x(x	*	*		*	*
	3	x(x[x x		*			*
	4	x(x[x(x	*	*			*
☞	5	(x x[x x					
	6	(x x[x(x	*	*			*
	7	(x(x[x x		*			*
	8	(x(x[x(x	*	*			*

This marking would be excluded by principles of Idsardi's model, however, which exclude lexical edge marking which is not at the edge of the word or at most one grid mark in from the edge.

(26)



Finally, (22e) has no output and is thus excluded as a lexical marking for a quadrisyllabic word in Walmatjari.

(27)

		a	b	c	d	e
1	x x x[x	*			*	
2	x x(x[x	*	*		*	*
3	x(x x[x	*				*
4	x(x(x[x	*	*			*
5	(x x x[x	*				
6	(x x(x[x	*	*			*
7	(x(x x[x	*	*			*
8	(x(x(x[x	*	*			*

Thus all possible lexical markings for four-syllable spans either occur or are excluded by the constraint hierarchy in (22).

The same point holds for spans of other lengths. Free placement of lexical parentheses results in fixed stress of precisely the types attested.[11]

5. Conclusion

I have argued in this note that Walmatjari exhibits precisely the variability that is compatible with an incomplete constraint hierarchy. I have argued that such a system can be elegantly described with constraints of the sort Idsardi discusses. These allow us to account for i) the commonalities among the stress patterns exhibited by words of any length, ii) why certain lengths exhibit variability, iii) what patterns are exhibited by words that vary, and iv) words that do not vary.

[11]The only exception is the trisyllabic span where the analysis predicts the possibility of fixed stress, yet all trisyllables apparently exhibit varying stress.

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