Opacity in Batticaloa Creole Portuguese stress assignment: motivation for candidate-to-candidate faithfulness*

Andrew J. Koontz-Garboden
Indiana University at Bloomington

ABSTRACT: According to Smith (1977), stress assignment in Batticaloa Creole Portuguese (BCP) is fully predictable: stress falls on the last underlying long vowel of a word, or on the first short vowel of a word having no long vowel. BCP has phonemic vowel length, although long vowels only surface when they are stressed in a word-initial syllable. Elsewhere, they are shortened. Stress assignment in these cases involves opacity, a phenomenon that challenges output-oriented Optimality Theory (Prince and Smolensky 1993). Opaque stress assignment in BCP is analyzed within McCarthy's (1998) original formulation of Sympathy theory, his revised proposal of Sympathy theory (McCarthy 1999), and local conjunction. It is demonstrated that only McCarthy's original proposal for Sympathy theory can account for opaque stress assignment in BCP. This is taken as support for the notion of candidate-to-candidate faithfulness, the kernel of McCarthy's original Sympathy proposal.

1. Introduction

Batticaloa Creole Portuguese (BCP)[1, 2] has a system of stress assignment based not upon binary foot structure, but rather upon the prominence-based factors of syllable weight and peripherality. Such systems of stress assignment are not uncommon throughout the languages of the world, and can be accounted for relatively straightforwardly within Optimality Theory, as demonstrated by Walker (1995, 1996).[3] In addition to having a prominence-based stress system, BCP also exhibits what Zoll (1997) calls "conflicting

* I wish to acknowledge the many helpful comments of Laura Wilbur McGarrity, Stuart Davis, and especially of Daniel Dinnsen. Thanks are also due to Ian Smith for making additional data available. All errors are my own.
[1] All BCP data are taken from Smith (1977).
[2] For a concise discussion of the origins of creole Portuguese in Sri Lanka, see Holm (1989: 288-289).
[3] Within a rule-based analysis, BCP has unbounded quantity sensitive, left-headed stress with conflation of line 1 (secondary) stress. A foot-based analysis becomes quite complicated in OT, however. Baković (1998) develops a foot-based account of unbounded stress systems in OT, but can not account for systems with only one stressed syllable per word. Accounts based on prominence, however (Walker 1995, 1996; Zoll 1997) can.

directionality" and what others have called default-to-opposite-side stress assignment (see Baković 1998; Hayes 1995: 296; Prince 1985; Walker 1995, 1996). This is a relatively common phenomenon within prominence-driven stress systems whereby one edge of the word receives stress under certain circumstances, and elsewhere the other edge of the word is stressed. In Selkup, a language whose stress assignment is discussed by Zoll (1997: 276-281), it is the rightmost heavy syllable which receives stress; however, in the absence of a heavy syllable, the leftmost light syllable is stressed. Stress assignment in BCP is identical to that of Selkup with the addition of one crucial complication: long vowels, which cause a syllable to be heavy, are not permitted outside of the initial syllable in the phonetic representation. Paradoxically, however, vowel length is crucial in all positions throughout the word in the assignment of stress, just as in Selkup. Within a derivational framework, these facts can be accounted for with crucial rule-ordering relationships: stress assignment must precede rules which cause vowels to be delengthened when they are either unstressed or not in a word-initial syllable. In Optimality Theory (Prince and Smolenksy 1993), however, these facts are more difficult to account for due to the surface-oriented nature of the theory. Below, I argue that they offer crucial support for McCarthy's (1998) original formulation of Sympathy Theory. I demonstrate how these facts are accounted for within that formulation of Sympathy Theory, and further, show that McCarthy's (1999) recent revision of Sympathy can not account for opaque stress assignment in BCP. It is also demonstrated that local conjunction (Smolensky 1993, 1995) can not account for opaque BCP stress assignment either. Given these facts, I argue that opaque stress assignment in BCP offers support for a candidate-to-candidate faithfulness formulation of Sympathy Theory, as originally proposed by McCarthy (1998).

2. BCP vowel length and distribution

The vowel system of BCP can be seen in Table 1 below (adapted from Smith 1977: 37).

Table 1 BCP vowels

	Front		Central		Back	
	Short	Long	Short	Long	Short	Long
High	i	i:			u	u:
mid	e	e:	ə		o	o:
Low	æ	æ:		a:	ɔ	ɔ:

In order to prove that vowel length is indeed phonemic and must be posited in the underlying representation in BCP, Smith (1977: 64) documents near minimal pairs using only words of either Portuguese or Dutch origin.[4] These demonstrate the phonemic status of length in BCP.

Although vowel length is contrastive in BCP, it is only contrastive in the word-initial syllable. Outside of the word-initial syllable Smith (1977: 65) observes two different types of vowels: unstressed short vowels and stressed vowels which vary in length from half-long to short. There still exists evidence, however, that underlyingly, vowels may be long regardless of their position in the word. This is evidenced by alternations such as those given in (1)-(3) below.

[4] This is an important point, as BCP has come under heavy influence in recent years from Batticaloa Tamil, a language which also has phonemic vowel length. Near minimal pairs with lexical items originating from Dutch and Portuguese are much more convincing since the latter two languages do not have contrastive

(1) a. [ó:ytu] ‘eight’

b. [dizó˙ ytu] ‘eighteen’

(2) a. [kɔ́:ntə] ‘amount’

b. [diskɔ́˙ ntə~diskɔ́ntə] ‘discount’

(3) a. [té:m] ‘is’

b. [loté˙ m~lotém] ‘will be’

In (1)a, (2)a, and (3)a, the lexical items have long vowels which surface in the phonetic representation. When derivational morphology is added to these lexical items, as in (1)b, (2)b, and (3)b, the same vowels are shorter. According to Smith (1977: 65) vowels in non-initial syllables are either unstressed and short, or stressed and short or ‘half-long.’ Smith (1977: 66) says that the length of stressed vowels in non-initial position varies, but they tend to be fully short in rapid speech and in closed or word-final syllables. It seems likely that the variation in length that Smith (1977: 66) observes is what can be considered a normal incremental increase in length on stressed vowels.[5, 6] Given the variable nature of this phenomenon and its clear phonetic nature, I do not consider it further. I take this variation in length to be a not uncommon low-level phonetic phenomenon.

In addition to the ban on long vowels outside of the initial syllable, BCP does not have unstressed long vowels on the surface either. This can clearly be seen in (4), where (4)a has a long word-initial vowel. When derivational morphology is added, stress is

vowel length. The incorporation of vowel length into such lexical items demonstrates that vowel length is a productive part of the BCP lexicon.

[5] I am grateful to Daniel Dinnsen for making this observation.

[6] The fact that these vowels tend also to be phonetically shorter in closed or final syllables, suggests that the additional incremental length associated with stressed vowels may be spread to the following consonant.

assigned to a different syllable (specifically, the rightmost underlying heavy syllable), and the initial vowel is no longer long in the phonetic representation (see (4)b,c).

(4) a. [bá:rvə] 'beard'
b. [bərviyá] 'shave'
c. [bərvéru] 'barber'

In sum, then, it has been seen that BCP has phonemically long vowels, but that their surface distribution is defective: they may surface only when stressed and word-initial. Elsewhere length is neutralized.

3. Brief outline of BCP stress assignment

Before advancing an OT analysis of BCP stress assignment, a brief outline of how stress is assigned in BCP is in order. Smith (1977: 67) observes that stress placement is very predictable in BCP and can be stated in prose in the following manner: "stress falls on the last underlying long vowel of a word, or on the first vowel of a word having no long vowel." As would be predicted by such a generalization, stress may be assigned to *any* syllable, as seen in (5)-(8).[7]

[7] This is in line with the claims made by Walker (1996: 1) regarding the independence of foot structure and stress assignment in prominence-driven stress systems.

(5)	a.	/mi:də/-->[mí:də]	'measure'	H́L
	b.	/mi:di:/-->[midí]	'to measure'	HH́
	c.	/mi:di:do:r/-->[mididór]	'surveyor'	HHH́
(6)	a.	/kɔ:ntə/-->[kɔ́:ntə]	'amount'	H́L
	b.	/diskɔ:ntə/-->[diskɔ́ntə]	'discount'	LH́L
(7)		/sindəfərə/-->[síndəfərə]	'Monday'	ĹLLL
(8)		/kɔtɔ:liku/-->[kɔtɔ́liku]	'Catholic'	LH́LL[8]

We can draw several conclusions based upon the data in (5)-(8). First, as stated above, stress is very predictable, but at the same time may occur on any syllable in BCP. In (5)-(8) it occurs in word-initial, antepenultimate, penultimate, and ultimate position. Additionally, Smith's (1977: 67) generalization regarding the placement of stress is corroborated, most convincingly with the alternations in (5) and (6) where the position of the stressed syllable changes according to the position of the rightmost heavy syllable.[9] Also, it can be observed that when a word-initial heavy syllable is stressed, vowel length is maintained (see (6)a). Finally, outside of the initial syllable, length is neutralized, as seen in (5)b,c (6)b, and (8).

4. Transparent BCP stress assignment in OT

Before discussing cases of opaque stress assignment, it will be useful to develop an OT account of stress that can account for transparent stress assignment in BCP. The rightmost heavy else leftmost light pattern observed above is not uncommon in the languages of the world. Both Walker (1995, 1996) and Zoll (1997) have similar methods

[8] Contrary to Smith's (1977: 71) claim, antepenultimate stress does indeed occur. I thank Smith (p.c.) for providing me with this information and data.

of dealing with such languages in OT, neither of which appeals to foot structure. The two alignment constraints in (9), taken from Zoll (1997) account for the BCP facts quite well; it is the combination of syllable-weight and position that determine where stress will fall.

(9) Alignment constraints
a. ALIGN-R($\acute{\sigma}$, PWd)
Stressed syllable should be word-final
Formally: $\forall\ \acute{\sigma}\ \exists$ Prosodic Word such that the stressed syllable coincides with the rightmost syllable in the Prosodic Word

b. ALIGN-L($\acute{\sigma}_{\mu}$, PWd)
Light stressed syllable should be word-initial
Formally: $\forall\ \acute{\sigma}_{\mu}\ \exists$ Prosodic Word such that the light stressed syllable coincides with the leftmost syllable in the Prosodic Word

Zoll (1997) argues that (9)b is a licensing constraint (Ito, Mester, and Padgett 1995). This follows from her argument that light stressed syllables are more marked than heavy stressed syllables, and that light stressed syllables are therefore restricted to certain positions. These two constraints are in a specific>>general type relationship, and are therefore ranked as in (10).

(10) ALIGN-L>>ALIGN-R

As in Zoll's (1997) account, I assume that these constraints are violated gradiently, and that one violation mark is thereby incurred for each syllable that intervenes between the stressed syllable and the designated edge of the word.

In keeping with the fundamental OT assumption regarding richness of the base (Smolensky 1996, for example), there exists the possibility that lexical stress may be specified in the input in one form or another. It has been shown that for numerous languages (Greek and Spanish, for example) there must exist the possibility that some

[9] In BCP, only syllables with long vowels are heavy. This should not be surprising given Ahn's (2000)

sort of prosodic structure is specified in the input, and then realized as stress in the output. Given that this is a possibility in other languages, according to richness of the base it must be a possibility in *all* languages, since what is a possible input in one language *must* be a possible input in other languages. I subscribe to the claims recently put forward by Revithiadou (1999: 11-14) who claims that in the languages of the world there exist two types of stress systems: those with *fixed stress* and those with *free stress.* In free stress systems, stress is idiosyncratic, and must therefore be lexically specified.[10] In such languages, it is crucial that the faithfulness constraints that demand faithfulness with this lexical specification are high-ranking. In fixed stress systems, however, stress is fully predictable and is governed by prosodic markedness constraints. In such languages the possibility exists that inputs *could* be lexically specified. This assumption is not necessary, however, since the high-ranking prosodic markedness constraints demand that stress be assigned in a certain fashion, regardless of lexical specification. So, even if stress is lexically specified, this lexical specification is quite possibly not realized in the output. The low-ranking faithfulness constraints that refer to stress would be, in such cases, violated in favor of satisfying the higher ranking markedness constraints. This is the situation in BCP. It should therefore be kept in mind that while the possibility of lexical stress in BCP inputs exists, it makes no difference whether or not one assumes that the inputs are lexically specified or not (because, the prosodic markedness constraints in (9) dominate any faithfulness constraints that refer to stress). Given that a lexically specified input will incur more faithfulness violations in the output than a non-

---

findings that stress rules in unbounded stress systems always treat CVC syllables as light.

lexically specified input, I assume that BCP inputs are not lexically specified for stress. This assumption follows from the principle of lexicon optimization (Ito, Mester, and Padgett 1995). In the discussion that follows, I do not make reference to faithfulness constraints that refer directly to stress.

Having discussed the crucial domination of faithfulness by markedness, it can now be seen that together the two alignment constraints given in (9) can account for the simplest types of BCP stress: those where no long vowels are involved. An example of such a word is given in Tableau 1.

Tableau 1 Stress assignment in LLLL word 'Monday'

/sindəfərə/	ALIGN-L	ALIGN-R
a.☞ síndəfərə		***
b. sində́fərə	*!	**
c. sindəfə́rə	*!*	*
d. sindəfərə́	*!**	

As discussed by Zoll (1997: 276-277) stressed light syllables are "defective" and therefore only licensed in a specific position: word-initially. The ALIGN-L and ALIGN-R constraints are, then, in a sort of if...then relationship, whereby *if* there is a stressed light syllable, it must be word-initial. Otherwise, if there is no stressed light syllable, stress must be aligned with the right edge of the word. This is seen quite clearly in Tableau 1, where candidates b, c, and d are all eliminated by their violation of high ranking ALIGN-L. The winning candidate satisfies high ranking ALIGN-L at the expense of three violations of ALIGN-R.

[10] The nature of the lexical specification of stress is not relevant to the present discussion. Revithiadou (1999) conceives of it as a sort of autosegmental feature. The relevant discussion is taken up by Revithiadou (1999: chapter 1).

In order to account for the surface distribution of stressed long vowels, we must appeal to additional constraints. These are given in (11) and are discussed below.

(11) Constraints to account for length maintenance in σ_1 and loss elsewhere

a. WTIDENTσ_1: the weight of an output vowel standing in the word-initial syllable is the same as that of its input correspondent.

b. WTIDENT: the weight of an output vowel is the same as that of its corresponding input.

c. *VV: avoid long vowels

d. WSP: Heavy syllables are stressed

The maintenance of vowel length in the initial syllable can be accounted for by appealing to the notion of positional faithfulness (Beckman 1997, Lombardi 1999). WTIDENTσ_1 is a constraint of this type. I assume a universal specific>>general ranking of the positional faithfulness constraint and its more general counterpart. WSP is never violated in BCP, and is therefore undominated. Finally, *VV must crucially outrank WTIDENT, but at least be unranked with respect to WTIDENTσ_1 in order to get the positional faithfulness effect. As it turns out, I have found no motivation for a crucial ranking relationship. I therefore leave them unranked with respect to one another. This gives the final constraint ranking hierarchy shown in (12).

(12) Final constraint ranking
WSP>>WTIDENT σ_1,*VV>>ALIGN-L>>ALIGN-R,WTIDENT

The interaction of these constraints to properly assign stress and retain length in the initial syllable is seen in Tableau 2 below.

Tableau 2 Stress assignment in HLL word 'birds'

/a:viyəs/	WSP	WTIDENT σ1	*VV	ALIGN-L	ALIGN-R	WTIDENT
a.☞ á:viyəs			*		**	
b. áviyəs		*			**	*!
c. a:viyə́s	*!		*	*		
d. aviyə́s		*		*!		*

In Tableau 2 candidate c is immediately eliminated by its violation of high ranking WSP. The rest of the candidates all violate either *VV or WTIDENT σ_1, so the decision must then be passed down to the alignment constraints. Candidate d fatally violates ALIGN-L, leaving candidates a and b, both of which violate ALIGN-R twice. This leaves the decision up to WTIDENT, which candidate b fatally violates, leaving candidate a as the winner.

5. Opaque BCP stress assignment in OT

The account proposed above can not account for a certain class of words whose opaque stress falls on a non-initial light syllable. Examples of such cases are seen in the alternations given below in (13) and (14).

(13) a. mí:də 'measure' (e.g. a unit of measure)
b. midí 'to measure'
c. mididór 'surveyor'

(14) a. kɔ́:ntə 'amount'
b. diskɔ́ntə 'discount'

That stress assignment fails on words such as those in (13)b,c and (14)b can be seen in Tableau 3.[11]

[11] '🖪' marks the incorrectly selected optimal candidate.

Tableau 3 Stress assignment crashes in HH word 'measure'

/mi:di:/		WSP	WtIdentσ_1	*VV	Align-L	Align-R	WtIdent
a.☞	midí		*		*!		**
b.	midí:		*	*!			*
c.	mi:dí:	*!		**			
d.	mí:di:	*!		**		*	
e.	mídi		*			*	**!
f.	mí:di			*		*	*

In Tableau 3 candidates c and d are immediately eliminated by their violation of the high-ranking WSP. Candidate b is eliminated by the combination of violating both *VV and WtIdentσ_1. This leaves candidates a, e, and f. Candidate a, the actual output, crucially violates Align-L because it has a stressed light syllable which is outside of the initial syllable. Both candidates e and f violate Align-R, and so the decision is ultimately made by WtIdent which candidate e fatally violates twice. Candidate f is therefore incorrectly selected as the optimal candidate.

There is no re-ranking of constraints that can remedy this situation. Indeed, a re-ranking would have to involve some sort of crucial domination of Align-L by Align-R in order to eliminate candidates e and f while leaving candidate candidate a. This can not, however, be done due to the fact that proper transparent stress assignment depends upon the crucial domination of Align-R by Align-L. Additionally, such a re-ranking would involve some controversial assumptions about the ranking of specific constraints with respect to their more general counterparts.

The generalization that captures how stress assignment takes place in examples such as (13)b,c and (14)b is, as was discussed above, that stress is assigned to the rightmost *underlyingly* heavy syllable. This fact of BCP stress assignment, however, conflicts directly with the generalizations that long vowels only occur in the initial syllable, and that unstressed long vowels don't occur in the phonetic representation. From a derivational perspective, stress assignment must be ordered before rules that delengthen non-initial stressed vowels and unstressed long vowels.

Alternations such as those in (13) and (14) add an interesting twist to the stress assignment discussion unfolded in section 3, and present an interesting problem for highly parallel OT: in the above examples stress assignment *crucially* makes reference to phonological material which is not observed in the phonetic representation. In the terminology of McCarthy (1998: 1) we are confronted with an overlap of two different types of opacity: not surface-true and not surface-apparent. These two types of opacity are defined below in (15).

(15) Two types of opacity

a. Not surface-true
Some generalization G appears to play an active role in some language L, but nonetheless there are surface forms of L (apart from lexical exceptions) that violate G. Serialism explains this by saying that G is in force and hence true only at the stage of the derivation when it applies. Generalizations in force at subsequent derivational stages hide G's truth and, in the limit, may contradict it completely.

b. Not surface-apparent
Some generalization G appears to play an active role in shaping the surface form F, but the conditions that lead to G's applicability are not apparent from F. Serialism explains this by saying that the conditions on G are relevant only at the stage of the derivation when G applies. Generalizations in force at later stages may obliterate the conditions that made G applicable (e.g., by destroying the triggering environment for a rule).

From the perspective of not surface-true opacity, the generalization is that stress is assigned to the rightmost heavy syllable, or else to the leftmost light. On the surface, however, there are forms that violate this generalization. This occurs any time that a long vowel is underlyingly present in non-initial position. In such cases a stressed light syllable surfaces in a non-initial syllable, thereby violating the generalization that light stressed syllables are word-initial.

The opacity in BCP stress assignment can also be approached from the perspective of not surface-apparent opacity. From this point of view, the generalization is that stress is assigned to the rightmost heavy syllable, but the conditions that lead to this are obscured at the surface by the ban on non-initial long vowels and the ban on unstressed long vowels. Regardless of how these cases of stress assignment are viewed, they are clearly opaque in nature, and as was seen for Tableau 3, they can not be resolved by simple constraint re-ranking. Additional theoretical machinery is therefore needed.

6. A sympathetic approach to BCP stress assignment

McCarthy's (1998) recent work on opacity in OT offers a solution to the problem of opaque stress assignment outlined above. Under this proposal Sympathy is a faithfulness relationship between potential output candidates, as opposed to other types of faithfulness.[12] We return to Tableau 3 (reproduced below as Tableau 4) for discussion.

Tableau 4 Stress assignment crashes in HH word ' measure'

/mi:di:/	WSP	WTIDENTσ1	*VV	ALIGN-L	ALIGN-R	WTIDENT
a.☞ midí		*		*!		**
b. midí:		*	*!			*
c. mi:dí:	*!		**			
d. mí:di:	*!		**		*	
e. mídi		*			*	**!
f.✿ mí:di			*		*	*

12 McCarthy's (1998) original Sympathy proposal has been used to account for a range of opaque phonological phenomena. Representative studies are Davis (1997); de Lacy (1998); and Dinnsen, McGarrity, O'Connor, and Swanson (1998). See also several of the papers in Baertsch and Dinnsen (1999).

The fundamental problem for stress assignment in Tableau 4 is that reference needs to be made to *all* of the long vowels in the word, but by having unstressed long vowels in the output, undominated WSP is violated. Additionally, *VV is violated multiple times. It seems, then, that what needs to be preserved from one of the failed potential output candidates to the actual output is the position of the stressed syllable. In this way, stress assignment can make reference to all of the long vowels and thereby avoid the violation of ALIGN-L, which is fatal for the actual output, candidate a. Such a constraint is also needed by de Lacy (1998: 8) to account for opaque stress assignment in Cairene Classical Arabic. This constraint is given in (16).

(16) IDENT-❀O-σ́
preserve the placement of stress between the ❀-candidate and the output

As McCarthy (1998) notes, sympathy constraint must be crucially dominated in order to avoid the incorrect selection of the ❀-candidate as optimal. On the other hand, IDENT-❀O-σ́ must crucially dominate ALIGN-L because this is the constraint which the opaque candidate fatally violates in Tableau 4. Given these facts, IDENT-❀O-σ́ must be ranked with respect to the other constraints as shown below in (17).

(17) WSP>>IDENT-❀O - σ́, WTIDENT σ_1,*VV>>ALIGN-L>>ALIGN-R,WTIDENT

McCarthy (1998) argues that the selection of the ❀-candidate takes place by appealing to a low ranked faithfulness constraint, known as the selector constraint. Given the assumption that the faithfulness constraint is low ranking, the only real choice is WTIDENT. Intuitively, it makes sense that WTIDENT would be the selector constraint, since what is needed in order to properly assign stress is reference to *all long vowels*. By having WTIDENT as the selector constraint, it is insured that the ❀-candidate will always have all of the input long vowels intact. The placement of stress in the ❀-candidate is then governed by the prosodic markedness constraints ALIGN-L and ALIGN-R. Tableau 5 demonstrates the success of the Sympathy account for the previously failed candidate in Tableau 4.

Tableau 5 Sympathetic account of HH word 'measure'

/mi:di:/	WSP	IDENT-❀O-σ́	WTIDENT σ_1	*VV	ALIGN -L	ALIGN -R	✯WTIDENT
a.☞ midí			*		*		**
b. midí:			*	*!			*
c.❀ mi:dí:	*!			**			✓
d. mí:di:	*!	*		**		¡*	✓
e. mídi		*	*!			*	**
f. mí:di		*		*!		*	*

In Tableau 5 the two candidates which fatally violate high ranking WSP are the only two which preserve their vowel length in all positions, and are therefore the only two which satisfy the selector constraint ✯WTIDENT. In the selection of the ❀-candidate, candidate d is eliminated because it violates ALIGN-R, whereas candidate c does not. Candidate c is therefore selected as the ❀-candidate. Both candidates e and f (the two candidates which are incorrectly more harmonic than candidate a in Tableau 3 and Tableau 4) violate IDENT-❀O-σ́ due to the fact that they stress the initial syllable, whereas the ❀-candidate stresses the final syllable. The violation of this constraint is ultimately what leads to the non-selection of either of these candidates as optimal. Both candidates c and d still fatally violate WSP. Candidate b violates both WTIDENTσ_1 and *VV, whereas candidate a violates only WTIDENTσ_1. Candidate b is therefore eliminated, and candidate a is correctly selected as the optimal candidate.

In Tableau 5 what essentially occurs is that stress assignment takes place on the ❀-candidate and is then transferred via sympathy to the actual output. The addition of IDENT-❀O-σ́ to the second stratum of the hierarchy causes the selection of the optimal candidate to take place in the first two strata. This prevents the actual output's (candidate a) violation of ALIGN-L from being fatal.

In contrast to the alternative accounts discussed below, the proposal discussed in this section can account for all types of opaque stress assignment in BCP. Additionally, it does so without causing any problems for transparent stress assignment. This can be seen in the tableaux given below.

Tableau 6 Sympathetic stress in LHHL ' obedient'

/owdi:si:du/	WSP	IDENT-❀O-σ́	WTIDENT σ_1	*VV	ALIGN-L	ALIGN-R	✰WTIDENT
a.☞ owdisídu					**	*	**
b.❀ owdi:sí:du	*!			**		*	✓
d. owdí:si:du	*!	*		**		*¡*	✓
f. ówdisidu		*!				***	**

Tableau 7 Sympathy causes no problems in transparent stress assignment for LL word ' throat'

/gɔrgəl/	WSP	IDENT-❀O-σ́	WTIDENT σ_1	*VV	ALIGN-L	ALIGN-R	✰WTIDENT
a.☞❀ gɔ́rgəl						*	✓
b. gɔrgə́l		*!			¡*		✓

In Tableau 6 it is demonstrated that Sympathy can account for opaque stress assignment in forms that have neither fully left aligned, nor fully right aligned stress assignment. Tableau 7 demonstrates that Sympathy causes no problems for transparent stress assignment.

7. Alternatives to Sympathy

There exist at least two possible alternatives to the Sympathy account of opaque stress assignment in BCP: local conjunction of constraints (Smolenksy 1993, 1995; Kirchner 1996; Łubowicz 1998) and McCarthy's revised version of Sympathy (McCarthy 1999). I first discuss the problems with local conjunction, and then with revised Sympathy.

7.1 Problems with local conjunction

Given McCarthy's (1998) statements on opacity and local conjunction, it is not surprising that local conjunction can not account for the facts of BCP stress. Indeed, McCarthy (1998: 34) has stated the problem quite succinctly.

> The problem is that local conjunction of constraints is not an adequate theory of process interaction, but process interaction is a crucial element of opacity. There is no interaction, and hence no possibility of an opacity effect if two processes apply in distant loci within a single word.

This is quite the case in BCP stress assignment, where vowel delengthening and stress assignment interact with one another to yield opacity. The ALIGN constraints need to make reference to the entire word (one domain) in order to determine which syllable is stressed. The faithfulness constraints that govern vowel length, however, make reference only to the segmental domain. Thus, it should not be surprising that a local conjunction account can not account for the facts. There is no combination of constraints that can be locally conjoined to eliminate all of the "bad" candidates.

If we examine only the cases examined above it would appear, nevertheless, that we are presented with a situation that local conjuction should deal quite well with: a ranking paradox. As discussed above, for transparent stress assignment ALIGN-L must crucially dominate ALIGN-R, whereas for opaque stress assignment it appeared that ALIGN-R would have to dominate ALIGN-L. This is seen more clearly by examining the failed Tableau 4, which is reproduced below as Tableau 8.

Tableau 8 Stress assignment crashes in HH word 'measure'

/mi:di:/	WSP	WTIDENTσ1	*VV	ALIGN-L	ALIGN-R	WTIDENT
a.☞ midí		*		*!		**
b. midí:		*	*!			*
c. mi:dí:	*!		**			
d. mí:di:	*!		**		*	
e. mídi		*			*	**!
f.💣 mí:di			*		*	*

In Tableau 8 it appears that if we were to ignore domain considerations, a local conjunction of ALIGN-R with WTIDENT would be able to account for opaque stress assignment. Following Łubowicz (1998), ALIGN-R would somehow be triggered at a higher level by concomitant violation of WTIDENT. This, however, oversimplifies the problem, as opaque cases of stress assignment may at times incur violations of ALIGN-R, since stress may occur on *any* syllable. Such a case is shown below.

Tableau 9 Stress in LHHL 'obedient'

/owdi:si:du/	WSP	[ALIGN-R&WTIDENT]	WTIDENT σ1	*VV	ALIGN -L	ALIGN -R	WTIDENT
a.☞ owdisídu		*			*!*	*	**
b. owdi:sí:du	*!			**		*	
d. owdí:si:du	*!			**		**	
e.💣 ówdisidu		*				***	**

In Tableau 9 since the actual output also violates ALIGN-R it ends up violating the locally conjoined constraint. Ultimately, the outcome is the same as it is if no local conjunction were involved: the ALIGN constraints directly determine the stress assignment of the actual output. As was seen above in Tableau 6, such forms cause no problems for the

Sympathy account. As it turns out, no combination of locally conjoined constraints can solve the problem of opaque stress assignment in BCP. I do not take this as evidence that local conjunction should not be part of the theory; clearly there have been a number of convincing implementations of it (Kirchner 1996; Ito and Mester 1999; Łubowicz 1998; McGarrity 2000, among others). It simply can not, however, account for the peculiarities of opaque BCP stress assignment.

7.2 Revised Sympathy (McCarthy 1999)

Citing concerns with the ability of his original formulation of Sympathy Theory (McCarthy 1998) to account for unattested cases of the Duke-of-York Gambit (Pullum 1976), McCarthy (1999) radically revises Sympathy Theory. Below I briefly discuss how this proposal is different from the original proposal. I then show that the revised version can not account for BCP opaque stress assignment.

7.2.1 A brief introduction to revised Sympathy

The ultimate goal of the revision of Sympathy is to do away with the notion of candidate-to-candidate faithfulness to prevent the theory from overgenerating in Duke-of-York situations. So, rather than having a Sympathy constraint that demands a specific type of faithfulness (e.g. stressed syllables must be the same, etc.) between the ❀-candidate and the actual output, McCarthy (1999: 21-22) proposes that there is one ❀SYM constraint, which measures the number of faithfulness violations between the actual output and the ❀-candidate provided that there is a relationship of *cumulativity* between the ❀-candidate and the candidate under evaluation. There are three ways that a candidate can be cumulative with respect to the ❀-candidate

(18) the unfaithful mappings of candidate 1 and ❀-candidate are the same
(19) ❀-candidate has all of candidate 1's unfaithful mappings, and adds some more of its own
(20) candidate 1 has all of ❀-candidate's unfaithful mappings and adds some more of its own

The unfaithful mappings shared by ❀-candidate and candidate 1 must not only be of the same type of faithfulness, but of the same type of faithfulness at the same location. This point is unimportant for the present discussion given that the BCP ❀-candidate incurs no violations of faithfulness.

We briefly consider McCarthy's (1999: 22) Hebrew problem for illustration of the above points.

(21)

	dešʔ				faithful	
⊞deš		❀dešeʔ		MAX		DEP
	☞deše				both	

Note that the candidate standing at the top of the hierarchy in (21) is fully faithful, and as McCarthy (1999: 22) notes, all other candidates accumulate its unfaithful mappings (because the fully faithful candidate has no unfaithful mappings). The transparent output (marked with ⊞) is not cumulative with respect to the ❀-candidate; it does not accumulate the unfaithful mappings of the ❀-candidate. The opaque, actual output, however, is cumulative with respect to the ❀-candidate. It has a DEP violation at the same place as the ❀-candidate, and adds an additional unfaithful mapping (one which it happens to share with the transparent output; it could be any unfaithful mapping, though).

7.2.2 Revised Sympathy and BCP stress assignment

The primary change that needs to be made in going from McCarthy's (1998) original Sympathy account to revised Sympathy (McCarthy 1999) is changing the sympathy constraint. As discussed above, this involves the elimination of candidate-to-candidate faithfulness. The pertinent constraint, then, becomes ❀SYM. McCarthy (1999: 25) notes that since the ❀-candidate performs perfectly on ❀SYM, it must be crucially dominated. In the BCP hierarchy, ❀SYM will be crucially dominated by WSP, which the ❀-candidate will violate every time, due to the fact that it will always have unstressed long vowels. This gives the constraint hierarchy in (22).

(22) WSP>>❀SYM, WTIDENT σ_1,*VV>>ALIGN-L>>ALIGN-R,WTIDENT

The failed Tableau 4 is reproduced with revised Sympathy in Tableau 10 below.

Tableau 10 Cumulativity in BCP stress assignment of HH word 'to measure'

/mi:di:/		WSP	❀SYM	WTIDENT σ_1	*VV	ALIGN-L	ALIGN-R	✯WTIDENT
a.☞	midí		***!	*		*		**
b.	midí:		**	*!	*			*
c.❀	mi:dí:	*!			**			✓
d.	mí:di:	*!			**		¡*	✓
e.	mídi		***!	*			*	**
f.🀆	mí:di		*		*		*	*

In Tableau 10 the selector constraint is the same as the selector constraint in the original Sympathy account, and the ❀-candidate is therefore the same; it is the candidate that is fully faithful to underlying vowel length, and also stresses the rightmost heavy syllable. Both potential ❀-candidates fatally violate undominated WSP and, are therefore eliminated. The actual output (candidate a) incurs three ❀SYM violations. It incurs two WTIDENT violations and one WTIDENTσ_1 violation when compared to the ❀-candidate.

The third of these ❀SYM violations is fatal. The same happens to candidate e. Candidate b is eliminated by a combination of two ❀SYM violations and a WTIDENTσ_1 violation (or *VV violation).[13] This leaves candidate f which incurs only one ❀SYM violation and one *VV violation, and is therefore incorrectly selected as the optimal candidate.

Even if revised Sympathy could succeed in eliminating candidate f in Tableau 10, ultimately what would happen is that the selection of the winning candidate would be sent down to the ALIGN constraints. Because in opaque stress assignment the actual output (always) violates ALIGN-L, while other candidates (such as candidate e) do not, it will be eliminated. The problems are deeper than this, however. The basic problem is that the number of ❀SYM violations of the incorrectly selected candidate is less than that of the actual output. This will be the case every time because the actual output always has the maximum number of WTIDENT and WTIDENTσ_1 violations in cases of opaque stress assignment. Since the ❀-candidate is always a fully faithful one and ❀SYM measures the number of faithfulness violations between the ❀-candidate and the potential outputs, this causes serious problems. There will never be a candidate that performs worse on ❀SYM than the actual (opaque) output, which has *no* surface long vowels. There will always be candidates that have fewer ❀SYM violations than the actual output. Therefore, there is nothing that ❀SYM can do to favor the selection of the actual output, regardless of where it is ranked in the constraint hierarchy.

The problem for revised Sympathy in this particular case seems to be that there is nothing about ❀SYM that favors stress placement on one syllable or another. ❀SYM just evaluates the number of faithfulness violations between the potential outputs and the ❀-

[13] Basically any combination of three violations or more in the stratum which contains ❀SYM, WTIDENTσ_1,

candidate, but there is nothing about faithfulness that favors stress placement on the correct syllable.[14] This seems like a problem which must make reference to a candidate-to-candidate faithfulness type relationship if it is to be properly accounted for within Optimality Theory.

9. Conclusion

Stress assignment in BCP exhibits what Zoll (1997) calls conflicting directionality. Additionally, interaction of positional faithfulness (WTIDENT σ_1) and markedness (WSP, *VV) yields a system whereby long vowels surface only when stressed and in the initial syllable. Elsewhere, underlying long vowels participate in the process of stress assignment, but are realized phonetically as short vowels. Depending upon the perspective one takes, stress assignment in such cases was seen to involve either not-surface true or not-surface apparent opacity in the terminology of McCarthy (1998). Whereas McCarthy's (1998) original formulation of Sympathy Theory can account for opaque stress assignment in BCP quite elegantly, neither local conjunction of constraints

and *VV is fatal.

[14] Even if stress were lexically specified by brute force, the problem would still not be solved. This is illustrated in Tableau (i), where stress is lexically specified in the input, and a faithfulness to input stress constraint, labeled IDSTRESS, is included in the tableau.

Tableau (i) Stress lexically specified by brute force for HH word 'to measure'

/mi:dí:/	WSP	❀SYM	WTID σ_1	*VV	ALIGN -L	ALIGN -R	✯WTID	ID STRESS
a.☞ midí		***	*		*!		**	
b.⊞ midí:		**	*	*			*	
c.❀ mi:dí:	*!			**			✓	
d. mí:di:	*!	**		**		¡*	✓	**
e. mídi		*****!	*			*!	**	**
f. mí:di		***		*		*!	*	**

nor McCarthy's (1999) more recent formulation of Sympathy Theory can do so. This is taken as motivation for the candidate-to-candidate faithfulness relationship proposed by McCarthy (1998).

References

(ROA=Rutgers Optimality Archive, http://ruccs.rutgers.edu./roa.html)

Ahn, Mee-Jin. 2000. *Phonetic and functional bases of syllable weight for stress assignment*. Unpublished University of Illinois Ph.D. dissertation.

Baertsch, Karen and Daniel Dinnsen (eds). 1999. *Optimal green ideas in phonology: Indiana University working papers in linguistics volume 1*. Bloomington, IN: IULC.

Baković, Eric. 1998. Unbounded stress and factorial typology. To appear in Artstein, Ron and Madeline Holler. (eds). *Rutgers linguistics working papers*. [also ROA-244-0298].

Beckman, Jill. 1997. Positional faithfulness, positional neutralisation and Shona vowel harmony. *Phonology* 14: 1-46.

Davis, Stuart. 1997. A sympathetic account of nasal substitution in Ponapean reduplication. *Phonology at Santa Cruz* 5: 15-28.

de Lacy, Paul. 1998. Sympathetic stress. Ms, University of Massachusetts, Amherst. [ROA-294-0199].

Dinnsen, Daniel, Laura Wilbur McGarrity, Kathleen O'Connor, and Kim Swanson. 1998. On the role of sympathy in acquisition. Ms, Indiana University.

Hayes, Bruce. 1995. *Metrical stress theory: principles and case studies.* Chicago and London: University of Chicago Press.

Holm, John. 1989. *Pidgins and creoles volume II: reference survey*. Cambridge: Cambridge University Press.

Itô, Junko and Armin Mester. 1999. On the sources of opacity in OT: coda processes in German. Ms, University of California, Santa Cruz. [ROA-347-0999].

Itô, Junko, Armin Mester, and Jaye Padgett. 1995. Licensing and underspecification in optimality theory. *Linguistic Inquiry* 26: 571-613.

Kirchner, Robert. 1996. Synchronic chain shifts in optimality theory. *Linguistic Inquiry* 27: 341-351.

Kiparsky, Paul. 1971. Historical linguistics. In W. Dingwall (ed.) *A survey of linguistic science*. College Park, MD: University of Maryland Press.

Kiparsky, Paul. 1973. Phonological representations. In Osamu Fujimura (ed.) *Three dimensions of linguistic theory*. Tokyo: Taikusha.

Lombardi, Linda. 1999. Positional faithfulness and voicing assimilation in optimality theory. *Natural language and linguistic theory* 17: 267-302.

Łubowicz, Anna. 1998. Derived environment effects in OT. Ms, University of Massachusetts, Amherst. [ROA-239-0198].

McCarthy, John. 1998. Sympathy and phonological opacity. (Revised April 1998; to appear in *Phonology*). [ROA-252-0398].

McCarthy, John. 1999. Sympathy, cumulativity, and the Duke-of-York gambit. In Baertsch, Karen and Daniel Dinnsen (eds). [also ROA-315-0499].

McGarrity, Laura Wilbur. 2000. On the interaction of stress and epenthesis in Yimas. Paper presented to the Indiana University phonology reading group. March 2, 2000.

Pullum, Geoffrey. 1976. The Duke-of-York gambit. *Journal of linguistics* 12: 83-102.

Prince, Alan. 1985. Improving tree theory. *Berkeley Linguistics Society* 11: 471-490.

Prince, Alan and Paul Smolensky. 1993. *Optimality theory: constraint interaction in generative grammar*. Ms. Rutgers University and University of Colorado.

Revithiadou, Anthi. 1999. *Headmost accent wins: head dominance and ideal prosodic form in lexical accent systems*. The Netherlands: Holland Academic Graphics. [also ROA-388-04100].

Smith, Ian. 1977. *Sri Lanka Creole Portuguese phonology*. Unpublished Cornell University Ph.D. dissertation.

Smolensky, Paul. 1993. Harmony, markedness, and phonological activity. Paper presented at Rutgers Optimality Workshop-1. [ROA-87-0000].

Smolensky, Paul. 1995. On the internal structure of the constraint component of UG. Handout of talk presented at UCLA, April 7, 1995. [ROA-86-0000].

Smolensky, Paul. 1996. The initial state and richness of the base in Optimality Theory. Baltimore, MD: Johns Hopkins University Technical report 96-4. [also ROA-154-1196].

Walker, Rachel. 1995. Mongolian stress: typological implications for nonfinality in unbounded systems. *Phonology at Santa Cruz* 4: 85-102.

Walker, Rachel. 1996. Prominence-driven stress. [ROA-172-0197].

Zoll, Cheryl. 1997. Conflicting directionality. *Phonology* 14: 263-286.

Department of Lingustics and
Department of Spanish and Portuguese
Indiana University / BH848
Bloomington, IN 47405

[agarbode@indiana.edu]