On the typological predictions of fixed vs. complementary rankings of stress constraints[*]

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1. “Top-down” or “primary accent first” in derivational theory

Traditional approaches to metrical stress theory have worked under the assumption that the location of primary stress is dependent upon the prior assignment of secondary stress. However, some researchers have challenged this assumption, claiming that these two types of stresses are assigned independently of one another, with primary stress being assigned first. For example, van der Hulst (1984) proposes a theory of “Primary Accent First”, where a rule assigning primary accent (or stress) would apply before any secondary or rhythmic stresses are assigned. Hayes (1995) refers to this type of stress assignment as “top-down” parsing.

For instance, in Cahuilla (Uto-Aztecan; Seiler 1977), primary stress always falls on the initial syllable. Secondary stresses follow an alternating count of moras. In words with all light syllables, stress falls on all odd-numbered syllables, as in (1a). However, if the initial syllable is heavy (containing either a long vowel or a syllable closed with [ʔ]), the second syllable is also stressed, and the alternating count continues thereafter (1b).

(1) Cahuilla

a. light syllable roots		b. initial heavy syllable	
tákalìčem	‘one-eyed ones’	páʔlì	‘water.OBJ’
táxmuʔàt	‘song’	qáːnkìčem	‘palo verde (pl.)’

Hayes (1995) accounts for the stress pattern of this language within metrical stress theory by first assigning an End Rule Left which places primary stress on the first syllable, followed by a foot construction rule that builds moraic trochees from left to right, as shown in (2). Thus, in Cahuilla, secondary stress placement crucially relies upon the prior assignment of primary stress.

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(2)	(x)	(x)	a. *Word Layer Construction:* End Rule Left
	◡ ◡ ◡ ◡	– ◡ ◡	
	takaličem	qaːnkičem	
	(x)	(x)	b. *Foot Construction:* build moraic trochees from left to right
	(x .)(x .)	(x) (x .)	
	◡ ◡ ◡ ◡	– ◡ ◡	
	tákalìčem	qáːnkìčem	

In addition to languages like Cahuilla, van der Hulst (1984, 1999) also discusses languages that have been analyzed within Lexical Phonology (Kiparsky 1982, 1985) as having a lexical rule of primary stress assignment and a postlexical rule of secondary stress assignment. Such languages support his claim that primary stress is assigned before secondary stress since lexical rules must apply before postlexical rules. He points out that secondary stress location often has properties that are characteristic of postlexical rules, such as optionality and a lack of exceptions, while primary stress assignment is not optional and often has exceptions and subregularities which are characteristic of lexical rules (1999:72). He gives as examples languages like Spanish, Italian, and Chamorro, where primary stress falls on one of the last three syllables of the word in an unpredictable fashion (as such, they must be lexically marked), and secondary stress alternates predictably on every other preceding syllable.

2. Stringency and the stress constraints: Stressed vowel lengthening

The precedence relation of primary accent first can be captured within Optimality Theory (McCarthy & Prince 1993, Prince & Smolensky 1993) by ranking constraints pertaining specifically to primary stress in a stringency relation with constraints referring to stress in general.

Constraints referring to the head foot of the word bearing primary stress (henceforth, C1) are more specific than constraints referring to any stress foot, regardless of whether it contains a primary or secondary stress (C2). As such, violations of C1 will necessarily imply violations of C2, but not vice versa. Because the violations of C1 will always be in a proper subset of the violations of C2, C1 will always impose a less stringent test on any candidate than C2 does. Due to the nature of this relationship, rankings based on stress constraints in a stringency relation make certain predictions about the kinds of stress patterns that would be expected to occur and not to occur in the world's languages.

For instance, phonological processes can interact with primary and secondary stress assignment in such a way as to produce a typology of different stress patterns. Many languages exhibit a phonological process of lengthening of vowels in stressed open syllables. A typology of the four logically possible stress patterns predicted by the interaction of vowel lengthening and stress assignment is given in (3).

(3) Patterns predicted by interaction of vowel lengthening and stress

a. Vowel lengthening in *both primary and secondary* stressed syllables
b. Vowel lengthening in *neither primary nor secondary* stressed syllables
c. Vowel lengthening in *primary but not secondary* stressed syllables
d. Vowel lengthening in *secondary but not primary* stressed syllables

An example of a language that lengthens vowels in both primary and secondary stressed syllables (3a) is Chimalapa Zoque (Mixe-Zoque; Knudson 1975). In this language, primary stress falls on the penult while secondary stress fall on the initial syllable in words containing more than two syllables. A general process lengthens vowels in all stressed open syllables. As vowel length is not contrastive, all long vowels are derived by this rule.

(4) Chimalapa Zoque

hóːho	'palm tree'
mɨ̀nkéʔtpa	'he is coming again'
pàːtáːnus	'large cooking banana'
wɨ̀ːtuʔpaynɨ́ksɨ	'he is coming and going'
mɨ̀nsukkeʔtpaʔɨ́tti	'they were going to come again'

Within Optimality Theory, stressed vowel lengthening is accounted for by ranking a markedness constraint requiring stressed syllables to be heavy (STRESS-TO-WEIGHT) above a faithfulness constraint that demands preservation of input vowel weight (WEIGHT-IDENT). These constraints and their ranking are given in (5).

(5) Constraints:

STRESS-TO-WEIGHT (S-to-W): Stressed syllables must be heavy.
WEIGHT-IDENT: Preserve input vowel length.

Ranking: S-to-W >> WEIGHT-IDENT

The tableau in (6) demonstrates how these constraints and their ranking evaluate words in Chimalapa Zoque.

(6) Stressed vowel lengthening in Chimalapa Zoque: S-to-W >> WT-IDENT

/patanus/	S-to-W	WT-IDENT
a. pàtánus	*!*	
b. pàtáːnus	*!	*
c. L pàːtáːnus		**

Candidate (a) violates the markedness constraint twice, since neither stressed syllable is heavy. Even though it fully satisfies the faithfulness constraint, its low ranking allows the candidate to be eliminated from competition. Candidate (b), which only lengthens the vowel in the primary stressed syllable, still incurs one fatal violation of the markedness constraint, due to its failure to lengthen the vowel in the secondary stressed syllable. Candidate (c) fully satisfies the markedness constraint, at the expense of violating faithfulness, by lengthening the vowels in both the primary and secondary stressed syllables, thereby allowing it to be chosen as the optimal candidate.

Another possible pattern predicted by the interaction of vowel lengthening and stress assignment involves no vowel lengthening in any stressed syllables (3b). In Maranungku (Daly; Tryon 1970), stress assignment follows a strictly binary, left-to-right trochaic pattern. All vowels, whether stressed or unstressed, are short.

(7) Maranungku

tíralk	‘saliva’	láŋkaràtetì	‘prawn’
mérepèt	‘beard’	wélepènemànta	‘kind of duck’
yáŋgarmàta	‘the Pleiades’		

To account for languages like Maranungku, with no stressed vowel lengthening, the ranking of S-to-W and WT-IDENT is the opposite of that for Chimalapa Zoque; namely, the faithfulness constraint must outrank the markedness constraint, as shown in the tableau in (8).

(8) No stressed vowel lengthening in Maranungku: WT-IDENT >> S-to-W

/merepet/	WT-IDENT	S-to-W
a. L mérepèt		**
b. méːrepèt	*!	*
c. méːrepèːt	*!*	

Because the faithfulness constraint is ranked high, candidate (a), which is fully faithful to the input vowel length, is chosen as the optimal candidate. The other candidates, with lengthening in one or both of the stressed syllables, fare better with respect to the markedness constraint, but are eliminated due to its ranking below faithfulness in the hierarchy.

Other languages demonstrate an asymmetry in how primary and secondary stressed syllables behave with respect to vowel lengthening (3c). In Wargamay (Pama-Nyungan; Dixon 1981), vowel length is phonemic; however, long vowels may only occur in the initial syllable. If the first syllable of a word has a long vowel, it receives primary stress (9a). If the first syllable does not contain a long vowel, then primary stress falls on the initial syllable in even-parity words (9b) and on the second syllable in odd-parity words (9c). Secondary stresses alternate after the primary stress, but may not fall on the final syllable.

According to Dixon, short vowels bearing primary stress may be "phonetically lengthened, e.g. [muŋá·nda]" (1981:20). However, vowels in secondary stressed syllables do not undergo lengthening.

(9) Wargamay

a.	múːba	'stone fish'	b.	mú·ŋan	'mountain-ABS'
	ɡíːbaɽa	'fig tree'		ɡí·ɟawùlu	'freshwater jewfish'
c.	gagá·ra	'dilly bag'			
	muŋá·nda	'mountain-LOC'			
	ɟuɽá·gay-mìri	'Niagara-Vale-FROM'			

Because primary stressed syllables behave differently than secondary stressed syllables, it is necessary to explode the markedness constraint S-to-W into a more specific version of the constraint that demands that only primary stressed syllables be heavy (10). This specific version of the constraint stands in a stringency relation with the general S-to-W constraint.

(10) $S_{\acute{\sigma}}$-to-W: Primary stressed syllables must be heavy. [1]

To account for the asymmetrical behavior of primary and secondary stressed syllables with respect to vowel lengthening, the faithfulness constraint WT-IDENT must be ranked intermediately between the specific $S_{\acute{\sigma}}$-to-W and the general S-to-W. The ranking of WT-IDENT above S-to-W ensures that vowel

[1] See Nagy & Napoli (1996) for a similar constraint, which they call HeavySyllable: Syllables with primary stress are bimoraic.

lengthening is, in general, prohibited. However, ranking the primary-stress specific $S_{\acute{\sigma}}$-to-W constraint above the faithfulness constraint allows vowel lengthening in a restricted set of contexts, namely, in all primary stressed syllables. The tableau in (11) demonstrates how this ranking accounts for the Wargamay pattern.

(11) Lengthening in primary stressed syllables only: $S_{\acute{\sigma}}$-to-W >> Wt-Ident >> S-to-W

/ɟuɽagay-miri/	$S_{\acute{\sigma}}$-to-W	Wt-Ident	S-to-W
a. ɟuɽágay-mìri	*!		**
b. ☞ ɟuɽáˑgay-mìri		*	*
c. ɟuɽáˑgay-mìˑri		**!	

Candidate (a) is eliminated due to its failure to lengthen the vowel in the primary stressed syllable. While candidates (b) and (c) both lengthen the primary stressed vowel, candidate (c) is eliminated since it also lengthens the secondary stressed vowel, thereby incurring one extra violation of Wt-Ident.

The fourth logically possible stress pattern – the converse or complementary pattern of Wargamay in which vowels lengthen in syllables bearing secondary stress, but not in syllables bearing primary stress (3d) – is unattested. This actually falls out from the stringency relationship between the stress constraints, as shown in the tableau in (12).

(12) Unattested pattern of lengthening in secondary stressed syllables only

/ɟuɽagay-miri/	$S_{\acute{\sigma}}$-to-W	Wt-Ident	S-to-W
a. ɟuɽágay-mìri	*		**
b. ɟuɽáːgay-mìri		*	*
c. ɟuɽáːgay-mìːri		**	
d. 💣 ɟuɽágay-mìːri	*	*	*

There is no ranking of these constraints that will yield (12d), with lengthening in secondary stressed syllables only, as the optimal candidate (as indicated by the 💣). This candidate has a proper superset of the violations that the complementary candidate in (12b) has, with lengthening in primary but not secondary stressed syllables. In other words, candidate (12b) *harmonically bounds* candidate (12d) and will always fare better with respect to the constraint hierarchy, no matter what the ranking.

Due to the nature of the stringency relation between the C1 and C2 constraints, a factorial typology of a primary-stress-specific constraint, a general stress constraint, and an interacting constraint will yield only three attested patterns out of four logically possible stress patterns.

(13) Factorial typology of stressed vowel lengthening [2]

Ranking	Context for stressed vowel lengthening	Example
a. C1 >> C2 >> **F**	Both primary and secondary stressed syllables	Chimalapa Zoque
b. C1 >> **F** >> C2	Primary stressed syllables only	Wargamay
c. **F** >> C1 >> C2	Neither primary nor secondary stressed syllables	Maranungku
d. Impossible	Secondary stressed syllables only	Unattested

3. Apparent counterexample: Complementary patterns of quantity sensitivity

There are languages that do have complementary patterns, whereby one pattern is found in one language and its exact converse is found in another. This seems like it should not be possible based on the stringency relationship of the C1 and C2 constraints, as demonstrated in the previous section.

Consider languages involving various patterns of quantity sensitivity. The influence of quantity sensitivity on stress location can be accounted for within OT by ranking the WEIGHT-TO-STRESS PRINCIPLE among the stress constraints.

(14) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy syllables must be stressed.

A typology of the four logically possible stress patterns predicted by the interaction of quantity sensitivity and stress assignment is given in (15).

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[2] In the cases demonstrated in this section, the interacting constraint is a Faithfulness constraint, WT-IDENT. However, other examples can be found where the interacting constraint is a Markedness constraint. See, for example, vowel lowering in Chamorro (Crosswhite 1998) in which the C1 and C2 constraints are $*\text{PEAK}_{\text{WORD}}$/i,u >> $*\text{PEAK}_{\text{FOOT}}$/i,u and the interacting markedness constraint is PERIPHERAL ('vowels should be peripheral'). These constraints achieve an asymmetrical pattern of high vowel lowering in primary stressed syllables but not (or only optionally) in secondary stressed syllables.

(15) Factorial typology of quantity sensitivity

Ranking	Context for quantity sensitivity
a. C1 >> C2 >> **WSP**	QI primary stress, QI secondary stress
b. C1 >> **WSP** >> C2	QI primary stress, QS secondary stress
c. **WSP** >> C1 >> C2	QS primary stress, QS secondary stress
d. ???	QS primary stress, QI secondary stress

An example of a language with quantity insensitive primary and secondary stress (15a) is Maranungku, described previously in (7) and repeated here in (16).

(16) Maranungku

tíralk	'saliva'	láŋkaràteɨ̀	'prawn'
mérepèt	'beard'	wélepènemànta	'kind of duck'
yáŋgarmàta	'the Pleiades'		

In Maranungku, primary and secondary stress are both quantity insensitive; stress follows a left-to-right binary trochaic pattern regardless of the weight of the syllables. An OT account of this language would have WSP ranked low in the hierarchy, below the C1 and C2 stress constraints, so that there would be no effects of quantity sensitivity on stress placement.

In Fijian (Austronesian; Schütz 1985), primary and secondary stresses pattern together in that they are both quantity sensitive. Consider the data in (17).

(17) Fijian

a.	láko	'go'	b.	seŋái	'no'
	βináka	'good'		kiláː	'know'
c.	taràusése	'trousers'	d.	mìnisìtiríː	'minister'
	mìːsìniŋ͡gáni	'machine gun'		terènisìsitáː	'transistor'

If the final syllable is light, primary stress falls on the penult (17a). If the final syllable is heavy (containing a diphthong or a long vowel), it receives primary stress (17b). Secondary stresses fall on all remaining heavy syllables in the word (17c), as well as on every other light syllable preceding the primary stress (17d). Because the placement of both primary and secondary stress can be affected by the weight of the syllable, WSP must be ranked high above both the C1 and C2 constraints responsible for the placement of primary and secondary stress.

In Finnish (Alber 1997, Elenbaas & Kager 1999, Kager 1992), however, primary and secondary stresses behave asymmetrically with respect to quantity sensitivity. Primary stress is quantity insensitive – it always falls on the initial syllable of the word regardless of its weight (18a). Secondary stress, on the other hand, is quantity sensitive – it falls on alternate non-final syllables after the primary stress (18b) unless a light syllable would be stressed preceding a heavy syllable. In such cases, the heavy syllable is assigned secondary stress, creating a ternary pattern (18c).

(18) Finnish

a.	#'Lσ…	ló.pe.tè.ta	'finish.NEG'
		rá.kas.tèl.laan.ko	'to love, question'
	#'Hσ…	pér.ke.le	'devil'
		téu.ras.tà.mo	'slaughterhouse'
b.	'σσ 'LL'LL	á.loit.tè.li.jà.na	'as a beginner'
	'σσ 'LL'LLL	ó.pet.tè.le.mà.na.ni	'as something I have been learning'
c.	'σσ L'HL	rá.kas.tu.nèi.ta	'infatuated lovers'
	'σσ L'HL	má.te.ma.tiik.ka	'mathematics.NOM'
	'σσ L'HLL'HL	vá.lis.tu.màt.to.mi.àn.ne	'your uneducated'

The basic constraints relevant to an OT account demonstrating the effects of quantity sensitivity on the Finnish stress pattern are given in (19).

(19) Constraints for Finnish:

ALIGNHD-L:	Align the left edge of the head foot with the left edge of the word.
ALIGNFT-L:	Align the left edge of all stress feet with the left edge of the word.
WSP:	Heavy syllables must be stressed.

The C1 constraint relevant to the placement of primary stress is the ALIGNHD-L constraint, which demands left-alignment of the main stress foot of the word. The general C2 constraint is ALIGNFT-L, which demands left-alignment of all stress feet, regardless of whether they contain a primary or a secondary stress. The interacting constraint is the markedness constraint WSP.

To account for the fact that primary stress falls on the initial syllable in Finnish, regardless of whether it is light or heavy, ALIGNHD-L must be ranked above the WSP, as shown in (20).

(20) Initial primary stress, regardless of syllable weight: ALIGNHD-L >> WSP

/rakastuneita/	ALIGNHD-L	WSP
a. L (rá.kas.)tu.(nèi.ta)		*
b. ra.(kás.tu.)(nèi.ta)	*!	

Candidate (a) with initial primary stress wins, even though it fails to stress the heavy second syllable, because of the high ranking of ALIGNHD-L. Candidate (b), with primary stress on the heavy second syllable thereby satisfying WSP, is eliminated due to its imperfect left-alignment of the main stress foot.

To account for the effects of quantity sensitivity on secondary stress placement, WSP must outrank the constraint responsible for left-alignment of all stress feet (ALIGNFT-L). This allows a heavy syllable to receive secondary stress, even if that results in a shift of stress away from the left edge of the word, as shown in (21).

(21) Left-alignment of secondary stresses can be disturbed by a heavy syllable: WSP >> ALIGNFT-L

/rakastuneita/	WSP	ALIGNFT-L
a. L (rá.kas.)tu.(nèi.ta)	*	***
b. (rá.kas.)(tù.nei.)ta	**!	**

Candidate (a) is selected as optimal because it skips the light third syllable stresses the heavy fourth syllable, thereby incurring one fewer violation of WSP than candidate (b), even though it results in an extra violation of ALIGNFT-L.

By transitivity, the overall ranking of these constraints for Finnish is ALIGNHD-L >> WSP >> ALIGNFT-L, or C1 >> WSP >> C2. The Finnish example and the Wargamay example discussed in section 2 both demonstrate that when an interacting constraint is ranked intermediately between the C1 and C2 constraints in the hierarchy, the effect is to have primary and secondary stress behave asymmetrically with respect to some phonological process.

Given the discussion in section 2 of the nature of the stringency relationship between C1 and C2 constraints, we would not expect to find the complementary pattern of Finnish, namely, a language in which primary stress is quantity sensitive and secondary stress is quantity insensitive. However, such languages are attested.

In Inga (Quechuan; Levinsohn 1976), if the final syllable is light, primary stress falls on the penult (22a); however, if the final syllable is heavy (i.e., closed with a sonorant), it receives primary stress (22b). Secondary stresses alternate before the primary stress in a quantity insensitive manner (22c).

(22) Inga

a.	sára	‘corn’	b.	yawár	‘blood’
	wámra	‘child’		yukán	‘he had’
	kaŋkúna	‘they are’		àpamúy	‘to bring’
	rèmendáŋga	‘to put right’			

c. simìntiryùmapàdurkárka ‘he knew how to carry him to the cemetery’

To achieve the effect of quantity sensitive primary stress, WSP would have to be ranked above the C1 constraint governing placement of primary stress. However, the high ranking of WSP above the C2 constraint would also cause secondary stress placement to be sensitive to syllable weight, a fact not supported by the Inga data. How can we account for the Inga pattern, if no reranking of the WSP and the stress constraints in the stringency relation will yield a pattern with quantity sensitive primary stress and quantity insensitive secondary stress? In the next section, I entertain several solutions, discussing the advantages and disadvantages of each, as well as the implications such solutions have for Optimality Theory.

4. Solving the Inga pattern

4.1 Complementary constraints

One possible solution to the Inga problem is to consider that C1 and C2, instead of being in a special/general stringency relationship, are in a complementary, or non-overlapping, relationship. For example, it may be necessary to refer to primary-stress-specific constraints and *non-primary* stress constraints, or constraints that refer only to secondary stress to the exclusion of primary stress. Such constraints would not be in a special/general relationship since they refer to complementary, non-overlapping contexts.

Such a solution has its advantages. Using complementary C1 and C2 constraints would be able to account for the Inga pattern, simply by ranking the secondary-stress-specific constraint above the WSP – to achieve the pattern of quantity insensitive secondary stress – while ranking the primary-stress-specific constraint below the WSP to account for quantity insensitive primary stress (C2 >> WSP >> C1).

However, introducing secondary-stress-specific constraints into CON would increase the power of the theory and would allow for the overgeneration of unattested stress patterns such as Anti-Wargamay discussed in section 2. By ranking $S_{\grave{\sigma}}$-to-W (‘Secondary Stress to Weight’) above WT-IDENT, which in turn would be ranked above $S_{\acute{\sigma}}$-to-W (‘Primary Stress to Weight’), it would be possible to account for a language with vowel lengthening in secondary stressed syllables but not in primary stressed syllables. Since such languages are unattested, this would be an undesirable effect.

4.2 The introduction of additional constraints

The special/general relationship of C1 and C2 can be maintained if additional constraints are included in the ranking to account for the Inga pattern.

For instance, to account for the effects of quantity sensitivity on primary stress assignment in English, Pater (2000) ranks FTBIN (‘Feet must be binary under a syllabic or moraic analysis’) above the C1 constraint (ALIGNHD-R), instead of referring to any “principle of quantity sensitivity *per se*” (Pater 2000:241). The following tableau demonstrates that this works to account for quantity sensitive primary stress in Inga as well.

(23) Quantity sensitive primary stress in Inga: FTBIN >> ALIGNHD-R[3]

/sara/ ‘corn’	FTBIN	ALIGNHD-R
a. L (sára)		*
b. sa(rá)	*!	
/yawar/ ‘blood’		
c. (yáwar)		*!
d. L ya(wár)		

For an input with a final light syllable, candidate (a) with one well-formed binary trochaic foot is selected as optimal even though the head of the word is one syllable away from the right edge of the word. Candidate (b) fatally violates FTBIN by having an ill-formed monomoraic foot. For an input with a final heavy syllable, candidate (d), with stress on the final syllable, is selected as optimal because it satisfies both FTBIN and ALIGNHD-R. Candidate (c) is eliminated by its failure to have a perfectly right-aligned head.

Because this analysis achieves the effect of quantity sensitivity on primary stress without the need for a high-ranking WSP, this allows WSP to be ranked below the C2 constraint (ALIGNFT-R) to achieve the quantity insensitive secondary stress pattern. As such, the overall ranking necessary to account for the Inga pattern would be: FTBIN >> ALIGNHD-R >> ALIGNFT-R >> WSP.

[3] In this tableau, I mark violations of ALIGNHD-R following Pater (2000), who takes headship to be transitive, so that the head of the PrWd refers not just to the foot that bears main stress, but also to the syllable that is the head of that foot.

The advantages to such an analysis are that it is possible to account for Inga-type languages with quantity sensitive primary stress and quantity insensitive secondary stress while maintaining the special/general nature of the C1 and C2 constraints. This, then, limits the power of the theory in a way that analyses with complementary C1/C2 constraints cannot.

5. The conundrum

The problem with any solution that accounts for the Inga pattern is that it raises the question of whether such a solution would also predict the pattern that is unattested in the vowel lengthening case. For instance, if you bring in an additional constraint to the ranking to get the fourth logically possible pattern in the quantity sensitive languages (i.e., Inga), it seems that you should be able to do the same to (incorrectly) get the unattested pattern for the vowel lengthening languages (i.e., Anti-Wargamay). Is there some principled distinction between the quantity sensitive cases and the vowel lengthening cases that would explain their behavioral asymmetry and would achieve the desired results without overgenerating unattested patterns?

5.1 Substance of the constraints

The substance or nature of the additional constraint (FTBIN) that is brought into the ranking to account for the Inga pattern is of particular interest. FTBIN partially overlaps with the constraint that interacts with C1 and C2, namely WSP, in that they are both markedness constraints and they both make crucial reference to bimoraic structures. Because the placement of stress depends upon the moraic structure of the syllables, having two constraints that can be placed in different strata in the hierarchy allows for greater flexibility in the ranking and subsequently a wider range of possible stress patterns.

However, in the cases of vowel lengthening, the constraint that interacts with C1 and C2 is a faithfulness constraint, WT-IDENT. It is difficult to see what separate, independently motivated constraint could be brought in to the ranking that partially overlaps with WT-IDENT and could be ranked high enough to prevent lengthening in primary stressed syllables, while still allowing WT-IDENT to be ranked low enough to permit lengthening in secondary stressed syllables. If such a constraint does not exist in CON, this would help to explain the absence of such a pattern.[4]

[4] See McCarthy (2002:116-117) for a discussion of how knowing what kinds of constraints are not in CON can be as important in explaining typological universals as knowing what is in CON.

5.2 Prosody-driven melody vs. melody-driven prosody

In addition to the substance of the constraints involved in the ranking, I propose that the incongruities apparent in the interaction of different phonological processes with stress assignment are due to a fundamental dichotomy: whether it is the prosody that drives the melody, or the melody that drives the prosody. In the vowel lengthening cases, the prosody is driving the melody: the vowel lengthens because it is stressed. In the quantity sensitivity cases, the melody is driving the prosody: the syllable is assigned stress if it is heavy.

If it is this distinction between the language types that explains their asymmetrical behavior, it makes certain predictions about how other kinds of phonological processes will be expected to interact with stress assignment. For instance, phonological processes that can be driven by stress location (e.g., vowel lowering, gemination, aspiration, vowel/glide formation, etc.) will be expected to interact with stress in an asymmetrical way so as to produce three of the four typological stress patterns; the fourth, as in the vowel lengthening case, will be unattested. However, phonological processes that influence the location of stress (e.g., epenthesis) will be expected to interact with stress in such a way as to generate the full range of stress patterns.

6. Conclusion

In this paper, I have shown that some phonological processes (e.g., vowel lengthening) interact with primary and secondary stress assignment in an asymmetrical way, generating three out of four logically possible stress patterns. Within optimality theory, this falls out from the stringency relation between specific primary stress-related constraints and general stress constraints. However, other phonological processes (e.g., quantity sensitivity) interact with stress assignment in such a way as to generate all four logically possible stress patterns, a fact that does not seem possible given the stringency relation of the stress constraints. An alternative analysis was entertained, proposing that the C1 and C2 constraints are not in a special/general relationship, but rather one of a complementary, non-overlapping nature. However, this had the undesirable result of overgenerating unattested patterns in the case of vowel lengthening. It was demonstrated that the constraints in the stringency relation could be maintained and that the Inga pattern of quantity sensitive primary stress and quantity insensitive secondary stress could be accounted for if additional constraints were included in the overall hierarchy. It was argued that no such additional constraints could be introduced into the hierarchy to get the unattested pattern of vowel lengthening in secondary stressed syllables only. Furthermore, it was suggested that the differential behavior of the two language types is due to whether it is the melody that is driving the prosody, or whether the prosody drives the melody. Future research may determine whether the predictions that fall out from such an analysis are borne out.

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