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Gradient Symbolic Representations in the output: A case study from Moses Columbian Salishan stress*

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1. Introduction

The assumption of Gradient Symbolic Representations (=GSR, Smolensky & Goldrick 2016, Rosen 2016) allows a new representational account for lexical idiosyncrasies in the phonology. In this paper, I strengthen the argument for GSR with a case study from lexical stress in Moses Columbia Salish (=MCS) where six different morpheme classes compete for realization of main stress. The account for MCS illustrates two core properties of a GSR account that are hard to capture under alternative analyses: True gradience and diverging phonological behaviour for more than one phonological process. True gradience refers to the fact that phonological elements can have different degrees of strength ranging between the full activity 1 and the non-presence of an element 0. This is an important departure from existing proposals of strength in the phonology which only rely on a binary distinction into 'strong' and 'weak' (Inkelas 2015, Vaxman 2016a,b, Sande 2017). The complex system of lexical stress in MCS follows if morphemes have a total of six different degrees of underlying stress-strength. The property of diverging phonological behaviour for more than one phonological process refers to the representational nature of this proposal: If the fact that certain morphemes behave differently for one phonological process is attributed to a difference in the activity of certain phonological elements in their underlying representation, other processes referring to the same phonological elements may treat those morphemes differently as well. It is argued that this property is borne out in MCS: Not only main stress assignment but also vowel deletion treats the same morphemes in a unified manner. In addition, the analysis of stress in MCS relies on Harmonic Grammar (=HG Legendre et al.

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1990, Potts et al. 2010) since the interaction of certain morpheme types shows a threshold effect where stress can be on a dispreferred position but not too far away from it. Such cumulativity is straightforwardly predicted in HG from constraint ganging. I present the complex lexical stress system of MCS in section 2 before I turn to the theoretical account in section 3. After giving some background on GSR in 3.1, I present the account for main stress assignment in MCS in 3.2. Section 3.3 shows how the account can easily be extended to capture another morpheme-specific asymmetry for vowel deletion. In section 4, I briefly discuss two alternative accounts of the MCS stress system and argue that the present proposal is superior in terms of theoretical economy and empirical coverage respectively. I conclude in section 5.

2. Data: Lexical Stress in MSC

Moses Columbia Salish (=MCS) is an Interior Salish language, spoken primarily by around forty speakers with varying fluency in North-Central Washington (Willett 2003, 3). The sources for the following data and generalizations are Czaykowska-Higgins (1985, 1993a,b, 2011) and Willett (2003). As in most Salishan languages, the surface vowels in MCS forms are predictable from a complex system of vowel epenthesis, vowel deletion, and vowel reduction. Crucial for understanding the following data is that there is epenthesis to license otherwise unsyllabified resonants or to provide a stressable vowel for vowel-less roots (Czaykowska-Higgins & Willett 1997). The vowel quality of epenthetic vowels is predictable from the following consonant quality (e.g. /a/ before /ʔ,h/ but /ə/ before coronals (Czaykowska-Higgins 1993a, 219)). In addition, there is vowel reduction for unstressed vowels.[1] Every word in MCS has a single main-stressed vowel and the default position for stress is the rightmost underlying vowel as can be seen in (1a) with some roots in isolation. If there are no underlying vowels in a word, stress is on the initial epenthetic vowel (1b); the system hence employs an interesting default-to-opposite stress pattern (Gordon 2000). If no other source is specified, all the following examples are taken from Czaykowska-Higgins (1993a) and the page numbering is given in the last line.[2]

(1)	a.	hananík	'jackrabbit' (205)	b.	k'm=lqst=xn	k'ə́məlqstxən	'lower leg' (222)
		q'aláx̣	'fence' (205)		tj'=lqs	tíj'əlqs	'wheelbarrow' (222)

All unstressed vowels following the stressed vowel and some vowels preceding it are deleted (2), a process that is discussed in more detail in 3.3. To ease readability, all roots are underlined in the following.[3]

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[1] These are two of the four possible sources for /ə/ in MCS (Willett 2003, 65+66) that is assumed to be non-phonemic in most Salishan languages (Czaykowska-Higgins & Kinkade 1998, 10).

[2] /y/ is replaced with IPA /j/.

[3] Note that there are monoconsonantal suffixes in many of the data that are not explicitly discussed: They can't bear stress and don't interact in an interesting way with stress-assignment.

(2) kasħújcnmncn
kas-ħuj=cin-min-t-si-n
unrealized-irritate=mouth-relational-Tr-2Sg.O-1SgS
‘I’m going to bother you (by mouth)’ (202)

In addition to the phonological preference for rightmost and leftmost stress respectively, stress in MCS is lexically determined by an intricate competition between morphemes with different stress-preferences. This lexical competition system is reminiscent of the stress in Sanskrit or Lithuanian (Halle & Vergnaud 1987a) and very similar in all Interior Salishan languages except Lillooet (Idsardi 1991, Czaykowska-Higgins & Kinkade 1998). Both roots and affixes in MCS fall into multiple arbitrary classes that have preferences for being stressed or not. The most basic distinction is the two-way distinction into dominant ‘D’ and recessive ‘R’ suffixes and strong ‘S’ and weak ‘W’ roots. The data in (3) shows what happens if different of these morpheme types are combined: D-suffixes are stressed if they are preceded by an S- or W-root (3a+d) and followed by an R-suffix (3c+f). The S-root, on the other hand, is stressed if it is followed by an R-suffix (3b) whereas the R-suffix is stressed if it is preceded by a W-root (3e).

(3) a. p’isƛ’aʔákst (S-**D́**)
p’isƛ’ʔ=akst
pl.big=hand
‘big hands’ (229)

b. sacím’xəx^{w} (**Ś**-R)
sac-ʔim’x-mix
Ipfv-move-Ipfv
‘he’s moving’ (208)

c. kasp’iqcncútəx^{w} (S-D-**D́**-R)
kas-p’iq=cin-cut-mix
Unr-cook=food-Refl-Ipfv
‘he’s going to cook’ (209)

d. ncəkcəkqínn (W-**D́**)
n-ck∼ck=qin-n-t-ø-n
Loc-Red∼hit=Top-Ctr-Tr-3O-1SgS
‘I hammered it repeatedly’ (215)

e. sq’ij’míx (W-**Ŕ**)
s-q’j’=mix
Nmlz-write=people
‘school children’ (216)

f. cħaw’jíknəx^{w} (W-**D́**-R)
ʔac-ħw’j=ikn-mix
Stat-make=back-Ipfv
‘he’s making a bow’ (215)

Assignment of stress in the interaction of these four morpheme types hence apparently follows from a preference hierarchy D-Sfx ≫ S-root ≫ R-Sfx ≫ W-roots. The preference for rightmost stress we saw in (1)-a can also be observed in morphologically complex forms. Whenever multiple suffixes of the type that is expected to be stressed in a form cooccurr, stress is always on the rightmost (cf. (3c) with two D-suffixes).

The two root types can be cross-classified with a further distinction that is abbreviated ‘E’[4] resulting in the four root types S, SE, W, and WE. E-roots are stressed if they are directly followed by one D-suffix (4a), but loose their stress if at least one other suffix intervenes (4b). The intervening suffix in (4b) is a D-suffix but the same effect is observed for intervening R-suffixes or monoconsonantal suffixes (cf. footnote 3).

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[4] In Czaykowska-Higgins (1993a), this abbreviates ‘extrametricality-assigning’. Though my account does not rely on this concept, I stick to the name.

(4) a. japk^{w}ánksn (**SÉ**-D)
jap-k^{w}an=akst-n-t-ø-n
Loc-grab=hand-Ctrl-Tr-3O-1SgS
‘I grab so. by the hand’ (229)

b. kɬk^{w}ncnáksn (SE-D-**D́**)
kɬ-k^{w}an=cin=akst-n-t-ø-n
Loc-grab=mouth=hand-Ctrl-Tr-3O-1SgS
‘I grab so. by wrist’ (231)

Finally, there are two additional suffix types. So-called R*-suffixes behave like R-suffixes in most respects but they attract stress even though they are not the rightmost in a sequence of R-suffixes as can be seen in (5a-c). In terms of competition between morpheme types, R*-suffixes can be said to loose their stress to D-suffixes and S-roots but are slightly stronger than ‘normal’ R-suffixes and win against those. And finally there are D*-suffixes that behave like D-suffixes in most contexts but are stressed when they are directly adjacent to an SE/WE-root (5e+f), in contrast to the D-suffixes in (4a). Absolutely parallel to characterizing R*-suffixes as slightly stronger R-suffixes, D*-suffixes seem to be slightly stronger in their preference to be stressed than ‘normal’ D-suffixes.

(5) a. k^{w}úɬnmn (**Ś**-R*)
k^{w}uɬn-min-t-ø-n
borrow-relational-Ctr-Tr-3O-1SgS
‘I’m borrowing it’ (251)

b. cqənaʔqímncn (W-D-**D́**-R*-R)
cq=anʔ=qin-min-t-si-n
hear=ear=head-relational-Tr-2Sg.O-1SgS
‘I heard about you’ (251)

c. jərmístm (WE-**Ŕ***-R)
jr-min-stu-ø-m
push-relational-Caus-3O-1PlS
‘We push him’ (252)

d. ptx̣ujútijaʔʃn (S-**D́***-R)
ptix̣uj=utjʔ-stu-ø-n
spit=?-Caus-3O-1SgS
‘I spittled on them’ (270)

e. wak^{w}túɬn (SE-**D́***)
wak^{w}-tuɬ-t-ø-n
hide-redirective-Tr-3O-1SgS
‘I hid it from s.o.’ (256)

f. t’əɬwíl’x (W-**D́***)
t’ɬ-wil’x
dirty-inch
‘sth. used until it got dirty’ (256)

The full picture of the six morpheme classes and the stress patterns resulting from their interaction is summarized in (6). (6a-e) show all root types combined with D- and R-suffixes, (6f-i) adds contexts with R*-suffixes, and (6j-l) contexts with D*-suffixes. The only combination of R* and D* is given in (6m). There are some patterns for which there is no data, left blank in the table.[5] Some combinations are also simply unattested which is also due to the fact that not all morpheme types are equally frequent.[6]

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[5] For the combinations WE-R-R and WE-D-R, Czaykowska-Higgins (1993a) states that WE-R-**Ŕ** and WE-D-**Ŕ** are expected. This is in contrast to the predictions of my account in 3. In the absence of any data to decide this conflict, I leave this divergence for future research.

[6] The countings from the morpheme lists in the appendix of Czaykowska-Higgins (1993a) are as follow: D=21, W=20, SE=18, S=11, D*=8, R=8, WE=6, R*=2.

(6) *Lexically determined stress: Summary*

	S	W	SE	WE
a.	**Ś**(-R)-R	W(-R)-**Ŕ**	**SÉ**(-R)-R	**WÉ**-R
b.	S-**D́**	W-**D́**	**SÉ**-D	**WÉ**-D
c.	S-**D́**-R(-R)	W-**D́**-R(-R)	**SÉ**-D-R(-R)	
d.	S-D(-D)-**D́**	W-D(-D)-**D́**	SE-D(-D)-**D́**	WE-D(-D)-**D́**
e.			SE-R-**D́**	
f.	**Ś**-R*	W-**Ŕ***		
g.		W-**Ŕ***-R		
h.		W(-D)-**D́**-R*	**SÉ**-D-R*(-R)	
i.		W-R*-**D́**		
j.			SE-**D́***	WE-**D́***
k.			SE-D-**D́***	
l.	S-**D́***-R			
m.			SE-**D́***-R*	

The challenges posed by this intricate system of lexical stress are thus that 1) it is based on a competition between a minimally six-point preference hierarchy for different morpheme classes (7), and 2) there is a locality threshold for stress that remains on E-roots if one D-suffix follows but moves to the D-suffix if at least one other suffix intervenes. This threshold effect is marked with a wavy line in (7).

(7) D* ≫ SE/WE ∼ D ≫ S ≫ R* ≫ R ≫ W

3. Analysis

3.1 Background: Gradient Activity

The assumption of Gradient Symbolic Representations (=GSR) states that phonological elements can have different degrees of presence in an underlying representation, expressed as numerical activities (Smolensky & Goldrick 2016, Rosen 2016). Morphemes hence can contain identical phonological elements that differ in their activity. This can predict that these elements behave differently in the phonology and thus result in idiosyncratic exceptions on the surface. The harmony evaluation in GSR is formally modeled inside HG where constraints are weighted, not ranked (Legendre et al. 1990, Potts et al. 2010). This allows to directly implement cumulativity which will prove to be important for an account of lexical stress in MCS. The system of GSR inside Harmonic Grammar is abbreviated GHG (=Gradient Harmonic Grammar). In terms of constraint violations inside GHG, any change in activity for a phonological element is a faithfulness violation, following from (8)[7]. In the toy example (9), the first coda consonant /k/ is only weakly active and has an

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[7] This is a departure from the GHG system in Smolensky & Goldrick (2016) and Rosen (2016) where MAX is a rewarding constraint.

activity of 0.6 whereas the second coda consonant /p/ is fully active and has an activity of 1. Recall that these activities are part of the underlying representation and hence arbitrary properties of specific lexical items. Activity thus manifests itself in the phonological behaviour of elements and leads the learner to assume different activity levels. For the example (9), it means that the weaker coda is 'easier' to delete: non-realization only results in a Max-violation of -0.6 (9b) and not in a violation of -1 (9c). Deletion of weakly active codas to satisfy NoCoda hence becomes optimal whereas fully active codas are preserved. Note that strengthening an underlyingly weak consonant to a fully active one implies Dep-violations.[8]

(8) a. MaxS: Assign violation X for any segmental activity X in the input that is not present in the output.

b. DepS: Assign violation X for any segmental activity X present in the output but not in the input.

(9)

$t_1ak_{0.6}t_1a_1p_1$	Max 3	NoCoda 2	Dep 1	
a. $t_1ak_1.t_1a_1p_1$		-2	-0.4	-4.4
☞ b. $t_1a.t_1a_1p_1$	-0.6	-1		-3.8
c. $t_1ak_1.t_1a_1$	-1	-1	-0.4	-5.4
d. $t_1a.t_1a_1$	-1.6			-4.8

3.2 Lexical stress in MSC

For the present account, it is assumed that underlying stress is the presence of a prosodic foot in the underlying representation of a morpheme. Recall that default stress in MCS is on the final syllable; the system is hence assumed to be iambic and feet are right-headed. An underlyingly stressed segment in MCS is hence simply integrated under a syllable that is integrated under a foot as the second syllable.

The most basic distinction of morpheme types in MCS is thus the one into morphemes that have an underlying foot and those that don't. In addition, underlying feet are assumed to have different activities. All morpheme types I assume for MCS are summarized in (10): Whereas SE and WE-roots have an underlying foot with the full activity of 1, the foot of D*-suffixes has a slightly lower activity of 0.9, the one of D-suffixes an activity of 0.8, the foot inside S-roots an activity of 0.6, and the foot inside R*-suffixes an activity of 0.4. R-suffixes and W-roots have no underlying feet. With the exception of the identical representation of R- suffixes and W-roots, this hence more or less directly translates the preference hierarchy (7) into different underlying strengths.

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[8] In the following, I leave it open whether elements can – in contrast to the original system in Smolensky & Goldrick (2016) and Rosen (2016) – remain weakly active in the output as well and violate markedness constraints gradiently since the account of MCS does not rely on this assumption.

(10) *Representations*

Fully active φ	← Weaker φ →				No φ
SE/WE	D*	D	S	R*	R/W
φ_1 φ_1 SE WE	$\varphi_{0.9}$ D*	$\varphi_{0.8}$ D	$\varphi_{0.6}$ S	$\varphi_{0.4}$ R*	R W

That this simple representational assumption indeed correctly predicts the intricate stress system of MCS from standard phonological constraints inside HG is shown in the following. The two relevant faithfulness constraints are MAX-φ demanding realization of an underlying foot and DEP-φ penalizing insertion of an epenthetic foot (equivalents to MAX-S and DEP-S, defined in (8)). It is implicit in the following that reassociation of an underlying foot is excluded by undominated faithfulness constraints on, for example, association lines and every stress shift hence necessarily results in a violation of MAX-φ and DEP-φ.[9]

The markedness constraints relevant for stress placement in MCS are given in (11).[10] Given that feet are iambic (ensured by undominated RHT:I (Kager 1999); not given in the tableaux), the constraint RIGHTMOST preferring right-aligned feet ensures the default final stress. It has to be noted that there are two versions of RIGHTMOST which are crucial: One counting morphemes (11a) and one counting intervening vowels (11b).[11] In addition, there is a preference for stress to be on the root (11c).

(11) a. RM_{COL} ('Stress is on the rightmost morpheme!'): Assign a violation mark for every morphemic colour α that intervenes between the right word edge and the stressed vowel that is not of morphemic colour α.

b. RM_{V} ('Stress is on the rightmost vowel!'): Assign a violation mark for every V that intervenes between the right word edge and the stressed vowel that is not of morphemic colour α.

c. $\acute{\text{V}}_{\text{RT}}$ ('Stress is on the root-vowel!'): Assign a violation mark for every main-stressed vowel that is not preceded and followed by root-segments.

The weightings of these five constraints now predict three basic mechanisms for stress assignment in MCS.[12] For one, default stress in the absence of underlying stress (=feet) is on the *rightmost underlying vowel* due to (11b) (cf. the data (1)-a). It is important that

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[9] Though nothing hinges on this concrete implementation and stress shift could very well be reassociation of one underlying foot. MAX-φ would be replaced with a faithfulness constraint for association between feet and syllables in this alternative account.

[10] The constraints are formulated with reference to morphological 'colours' or morphological affiliation. The phonology is hence able to detect whether phonological elements belong to the same or different morphemes or no morpheme at all (van Oostendorp 2006).

[11] An additional difference is that RM_{V} is sensitive to all vowels in a containment-based system where deletion is impossible (Prince & Smolensky 1993, Trommer & Zimmermann 2014, Zimmermann 2017). This is apparent since all underlying vowels following the stressed one are deleted: RM_{V} is nevertheless violated by those phonetically unrealized vowels that always remain part of the structure in containment.

[12] The crucial arguments are of course relative weighting relations between the constraints. To ease readability, I give one possible set of concrete constraint weights in the following.

RM$_V$ is only sensitive to morphologically coloured and hence underlying vowels. In the absence of any underlying vowel, stress will hence be on the root due to (11c) (cf. the data in (1)-b).[13] The conflicting directionality in MCS is hence an effect from the interaction between (11a) counting only underlying vowels and (11c) preferring stress to be on the root and hence the leftmost stressable morpheme. The additional RM$_{COL}$ counting intervening morphemes ensures that stress is on the rightmost morpheme of the type that is expected to be stressed in a word. This is crucial for strings of D-suffixes (cf. the data in (3)-c). In addition, this preference for stress on the rightmost morpheme is important if W-roots and R-suffixes are combined. Neither of these morphemes is underlyingly stressed and the default preference for rightmost stress will ensure stress on the rightmost R-suffix (cf. the data in (3)-e).

Second, a single *lexical foot will always overwrite the default* preferences for rightmost stress. In terms of constraint weightings, Max-φ has a higher weight than RM$_{COL}$ and RM$_V$ and realization of the underlying stress will hence always be optimal compared to default stress at the right edge. This is illustrated in (12) where a weak root combines with a dominant and a recessive suffix. Default stress on the rightmost vowel (12a) avoids a violation of RM$_{COL}$ but induces a violation of both Max-φ and Dep-φ since an underlying foot is deleted and an epenthetic one inserted in a new position. Realization of the underlying stress in (12b) induces a violation of RM$_{COL}$ (not of RM$_V$ since the R-suffix does not contain an underlying vowel) but perfectly satisfies Max-φ. This candidate is optimal since the only other possible stress position on the initial syllable (12c) is worse for RM$_{COL}$, RM$_V$, Max-φ, and Dep-φ and only improves on $\acute{V}_{RT}$. Note that all of the following tableaux are abstract to ease readability and only include the abbreviations for the different morpheme types. Epenthetic material is marked with a grey background.

(12) *Realization of the only underlying* φ

W $\overset{\varphi_{0.8}}{\text{D}}$ R	Max-φ 100	$\acute{V}_{RT}$ 30	RM$_{COL}$ 30	RM$_V$ 16	Dep-φ 5	
a. W D $\overset{\varphi_1}{\text{R}}$	-0.8	-1			-1	-115
☞ b. W $\overset{\varphi_{0.8}}{\text{D}}$ R		-1	-1			-60
c. $\overset{\varphi_1}{\text{W}}$ D R	-0.8		-2	-1	-1	-161

The third crucial mechanism for stress assignment in MCS is competition. Recall that every word in MCS can only have a single main stress. In terms of metrical structure, only a single foot can hence be realized. In contexts where morpheme concatenation results in multiple feet for a word, they hence compete for realization and Max-φ will always favor *realization of the more active foot*. This is shown in (13) for a context where an S-root is followed by a D-suffix and an R*-suffix. All these morphemes are underlyingly stressed

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[13] Prefixes are never stressed in MCS, even if they contain the only underlying vowel (Czaykowska-Higgins 1993a, 225). It is thus assumed that prefixes are added in a later stratum and are invisible for stress assignment.

and hence contain an underlying foot. Those underlying feet, however, have different activities and Max-φ hence prefers their realization to different degrees. Stress on the R*-suffix (13a) implies a violation of Max-φ by 1.5 since the foot of the S-root with activity 0.6 and the foot of the D-suffix with activity 0.9 remain unrealized. For RM_{V} and RM_{Col}, this option is perfect but a violation of $\acute{\text{V}}_{\text{RT}}$ is implied. Stressing the S-root (13c) avoids this violation of $\acute{\text{V}}_{\text{RT}}$ but induces two violations of RM_{Col} (since two morphemes intervene) and one violation of RM_{V} (since one underlying vowel intervenes). It also implies Max-φ violations of 1.3 since the foot of the R*-suffix (activity 0.4) and the D-suffix (activity 0.9) are deleted. Realization of the foot with the highest activity hence becomes optimal (13b) though this implies violations both of $\acute{\text{V}}_{\text{RT}}$ and RM_{Col}. This follows since the weight of Max-φ is so much higher than the weight of these markedness constraints.

(13) *Preservation of the φ with the highest activity*

$\overset{\varphi0.6}{\text{S}}$ $\overset{\varphi0.9}{\text{D*}}$ $\overset{\varphi0.4}{\text{R*}}$	Max-φ 100	$\acute{\text{V}}_{\text{RT}}$ 30	RM_{Col} 30	RM_{V} 16	Dep-φ 5	
a. S D* $\overset{\varphi0.4}{\text{R*}}$	-1.5	-1				-180
☞ b. S $\overset{\varphi0.9}{\text{D*}}$ R*	-1	-1	-1			-160
c. $\overset{\varphi0.6}{\text{S}}$ D* R*	-1.3		-2	-1		-206

In principle, the system hence predicts that it is always the foot with the highest activity that is realized, directly implementing the competition between hierarchically ordered morpheme types we saw in (7).

Interestingly, the threshold effect for E-roots in their interaction with D-suffixes also follows from the constraint weights we already established. It arises if feet compete for realization that are rather close in their activity value. In those cases, Max-φ is not as decisive as in other contexts and the effects of RM_{Col} and RM_{V} become more important. More concretely, stress on an E-root is more preferred than stress on a D-suffix by both Max-φ and $\acute{\text{V}}_{\text{RT}}$: The foot of an E-root is slightly more active (1 vs. 0.8) and the morpheme is also a root. On the other hand, stressing the D-suffix is preferred by RM_{Col} since the suffix is obviously closer to the right edge than the root. If a D-suffix directly follows an E-root (14), the combined weight of $\acute{\text{V}}_{\text{RT}}$ and the 0.2 x Max-φ difference is still enough to overcome the violation of RM_{Col}: Stress on the E-root becomes optimal (14b).

(14) *Gang effect I: Stress on E-root with one D-suffix*

$\overset{\varphi1}{\text{SE}}$ $\overset{\varphi0.8}{\text{D}}$	Max-φ 100	$\acute{\text{V}}_{\text{RT}}$ 30	RM_{Col} 30	RM_{V} 16	Dep-φ 5	
a. SE $\overset{\varphi0.8}{\text{D}}$	-1	-1				-130
☞ b. $\overset{\varphi1}{\text{SE}}$ D	-0.8		-1	-1		-126

If, however, at least one suffix intervenes between an E-root and a D-suffix, stress would be too far away from the right edge and is realized on the D-suffix instead (15a). The additional violation of $\mathrm{RM}_{\mathrm{COL}}$ in (15c) hence trumps the combined weight of 0.2 Max-φ and $\acute{\mathrm{V}}_{\mathrm{RT}}$ in (15a). This gang effect that is naturally predicted in HG is summarized in (16)

(15) *Gang effect II: Stress on D-suffix if more suffixes intervene*

φ1 φ0.8 SE R D	Max-φ 100	$\acute{\mathrm{V}}_{\mathrm{RT}}$ 30	$\mathrm{RM}_{\mathrm{COL}}$ 30	RM_{V} 16	Dep-φ 5	
☞ a. φ0.8 SE R D	-1	-1				-130
b. φ1 SE R D	-1.8	-1	-1	-1	-1	-261
c. φ1 SE R D	-0.8		-2	-1		-156

(16) *Gang Effect for E-roots*

a. $0.2 \text{ x Max-}\varphi + \acute{\mathrm{V}}_{\mathrm{RT}} \gg \mathrm{RM}_{\mathrm{COL}} + \mathrm{RM}_{\mathrm{V}}$ Cf. (14)

b. $2 \text{ x } \mathrm{RM}_{\mathrm{COL}} + \mathrm{RM}_{\mathrm{V}} \gg 0.2 \text{ x Max-}\varphi + \acute{\mathrm{V}}_{\mathrm{RT}}$ Cf. (15)

The representations in (10) hence predict the position of main stress in MCS from three basic mechanisms: 1) default final stress for underlying vowels, 2) competition between feet of different activity, and 2) a threshold effect that stress can't be too far away from the right edge if the activity differences between the competing feet are too small.

3.3 Further predictions: Vowel deletion

This account that locates the source for different phonological behaviour of morphemes in their underlying representation predicts that more than one phonological process might be sensitive to these representational (activity) differences. And indeed, there is additional evidence from vowel deletion for the representations assumed in (10).

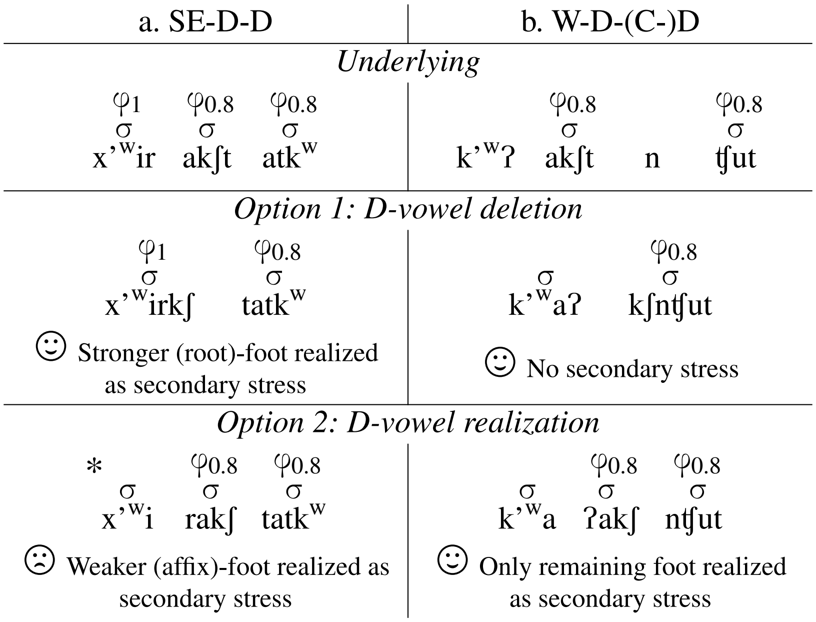
It was said above that unstressed underlying vowels are always deleted if they follow the stressed vowel and might be deleted if they precede the stressed vowel (cf. (2)). There is at least one generalization regarding possible vowel deletion that refers to the same morpheme types we identified for behaving differently for main stress assignment. The unstressed vowel of a D-suffix is deleted between an SE-root and a stressed D-suffix (17a) but only variably (=for some speakers) deleted between a W-root and a stressed D-suffix (17b). In addition, all those unstressed suffix vowels that are not deleted and precede the main stress, are realized with an optional secondary stress (17b).

(17) a. $\text{SE-D}_{\text{ø}}\text{-D}_{\text{ø}}\text{-}\boldsymbol{\acute{\mathrm{D}}}$
kɬc'awʔlq^{w}qnákstm
kɬ-c'awʔ=alq^{w}=qin=akst-m
Loc-wash=pole=Top=arm-Mid
'wash wrists' (246)

b. $\text{W-}\grave{\mathrm{D}}_{\text{V/ø}}\text{-}\boldsymbol{\acute{\mathrm{D}}}$
niʔk'əmàn'kákst
niʔ-k'm=ank=akst
Loc-surface.of=flat=hand
'palm of hand' (249)

Under an account in terms of underlying feet with different activity, the vowel deletion asymmetry and the secondary stress asymmetry are different sides of the same coin. More concretely, secondary stress is in fact what saves those vowels from deletion under positional faithfulness that protects vowels inside feet. To capture this secondary stress, the account proposed so far only needs to allow that two feet are in fact possible in a word[14] and that the non-final one is optionally realized as secondary stress. The different activities of the feet then become crucial again since there potentially arises competition for being realized as the one possible secondary stress-foot.[15] This competition is exactly what predicts the asymmetry we saw in (17) for D-suffix vowels following W- and SE-roots. If an E-root precedes a D-suffix and neither of them is main-stressed, both these feet compete for realizations as secondary stress. Since the E-root has an underlying foot with higher activity than the D-suffix foot, the former will always win the competition. This is illustrated in (18) where the crucial context is (18a-2): secondary stress and subsequent vowel preservation on the D-suffix is impossible since it implies deletion of a more active foot for an SE-stem (given that only two feet per word are possible). For a D-suffix preceding a W-root (18b-2), on the other hand, this repair is easily possible since no other foot competes with the D-suffix foot.

(18) *Possibility of a second foot and V-deletion avoidance*



The formal implementation of this intuition relies on the fact that RM_{COL} and RM_{V} specified for main stress are irrelevant for the additional secondary stress feet that potentially

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[14] It was an implicit assumption so far that only a single foot is possible in a word; ensured by, for example, ER-L/R (McCarthy 2003).

[15] Given the generalization that vowel deletion is optional after W-stems, one could expect two 'rescued' vowels in a sequence W-D_V-D_V-$\acute{\mathbf{D}}_{\mathbf{V}}$. Interestingly, the only example of this type in Czaykowska-Higgins (1993a) realizes only one of the vowels of the D-suffixes preceding the main stressed ones; consistent with a maximum of two feet per word (cf. (46d), p.245 Czaykowska-Higgins 1993a).

precede the final main stress foot. The activity alone will thus decide which foot is realized. More concretely, the winning candidate with main stress will avoid as much Max-φ violations as possible as is sketched in (19) for the SE-D-D context.

(19)

φ_1 $\varphi_{0.8}$ $\varphi_{0.8}$ V V V	Max-φ 100	
☞ a. φ_1 $\varphi_{0.8}$ V̀ ø V́	-0.8	-80
b. $\varphi_{0.8}$ $\varphi_{0.8}$ ø V̀ V́	-1	-100

4. Alternative accounts

I am aware of two alternative accounts of MCS stress. In Revithiadou (1999), an OT-account is presented where conflicts between lexical accents are resolved with reference to morphological structure. More concretely, the accent of the morphological head wins (HdFaith $\gg$ Faith). The asymmetry for suffixes in MCS then follows from their different morphological structure, namely the fact that lexical suffixes are part of a compound or predicate structure. This is a very interesting account that aims to relate the different behaviour of morphemes to independent differences between them. However, it is not the aim of Revithiadou (1999) to derive all the stress generalizations we saw that include 6 crucially different morpheme classes. It is easy to see that the full set of data cannot follow in this system without additional assumptions since it only allows a binary division between morphological head vs. non-head.

In Czaykowska-Higgins (1993a), a cyclic account inside the metrical framework of Halle & Vergnaud (1987a,b) is proposed. The crucial contrast for suffixes in MCS is the one between cyclic (=D) and non-cyclic (=R) suffixes. Only the former trigger cyclic stress deletion and new assignment of stress. In addition, E-roots assign extrametricality to adjacent morphemes; certain morphemes hence trigger specific additional rules. To capture the additional types of R*- and D*-suffixes, lexical accent for certain morphemes is also assumed. This intricate account of the complex stress system hence relies on cyclic rule application, rules that are sensitive to specific morphemes, and representational differences between stressed and unstressed suffixes. In contrast, the account proposed here only relies on a single representational difference between phonological elements, namely the activity of underlying feet. The phonological grammar itself is insensitive to specific morphological differences: What seems to be lexical idiosyncrasy is hence reduced to differences in phonological representation.

5. Summary

I argued in this paper that the assumption of underlying activity for phonological elements combined with Harmonic Grammar allows a straightforward representational account for the lexical stress system in MCS. This account strengthens the argument for GSR since it shows that the prediction of more than two different activity grades for phonological elements in one language is borne out. It also shows that accounts implementing some concept of strength based on a binary distinction into ‘strong’ and ‘weak’ as Revithiadou (1999) or Vaxman (2016a,b) are not sufficient for the whole typology of lexical stress systems. That the same classes of morphemes pattern together both for main stress assignment and vowel deletion asymmetries (cf. 3.3) was argued to be another strong argument for a representational account of lexical idiosyncrasies or exceptionality. Under an account where idiosyncratic behaviour of morphemes follows from, for example, indexed constraints (e.g. Alderete 2001, Pater 2009, Finley 2009), it remains a coincidence that the same morphemes pattern together for different phonological processes.

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