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RESEARCH

Branchingness constraints on heads and dependents in Munster Irish stress

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This paper readdresses the bounds between rhythm and constituency. It argues in favor of an arboreal representation of the metrical grid in which both metrical prominence, that is, grid marks, and prosodic categories are conflated into the same dimension even at the level of the syllable. These constituentized metrical grids are subject to branchingness constraints on heads and dependents. The research focus is on Munster Irish stress, which illustrates an intricate system of stress assignment. Stress in Munster Irish is assigned to the first syllable in strings containing light (L) syllables, ˈLLLL. Sequences of a H syllable followed by a L syllable always attract primary stress to the H syllable regardless of the position of the sequence within the phonological string, ˌLLLˈHL (cf. ˈLLLˌHH). These facts suggest that uneven trochees (ˈHL) always attract primary stress and therefore might exist as a legitimate metrical grouping. Initial primary stress is also avoided if the third syllable counting from the left edge of the word is H. Thus, a word like /LLH/ is parsed with optional initial secondary stress and primary stress on the H syllable, ˌLLˈH (cf. ˈLLLˌH). The contrast between ˌLLˈH and ˈLLLˌH suggests that some kind of trimoraic constituent determining the location of word stress is necessary.

Keywords: Munster Irish; stress; syllable; metrical grid; branchingness constraints

1 Data

In this paper we focus on stress assignment in the Munster variety of Irish (MI) spoken in the Dingle Peninsula.[1] Most recent data sources are Doherty (1991), Green (1996), Rowicka (1996), Gussmann (1997), Ó Sé (2000, 2008) and Iosad (2013) (see all these references for older sources).[2] The data we present come from Iosad (2013), unless otherwise specified.

In MI long vowels and diphthongs, but not syllables closed by a consonant, count as heavy (H).[3] Morphological structure does not affect the position of stress. Stress is initial in words that contain no H syllable in the first three syllables of the word (1a–c), and no initial light (L) syllable can be stressed if immediately followed by a H syllable (1e–g), meaning that H syllables attract stress. Sequences of a H and a L syllable attract stress to the H syllable (2). In a sequence of two H syllables word-initially, the second H syllable receives main stress (3). If a H syllable is preceded by a word-initial sequence of two L syllables, primary stress falls on the H syllable (4).

[1] Modern Celtic languages are divided into two subfamilies: Gaelic and Brittonic. The Gaelic languages comprise Irish, Scottish Gaelic and Manx. The Brittonic languages include Welsh and Breton.

[2] We abstract away from palatalized consonants in our phonetic transcriptions.

[3] The sequence [ax] counts as a heavy syllable only if its nucleus forms a second syllable. For other cases of exceptional stress, see Iosad (2013).

(1) Word-initial stress

a.	ˈLL	ˈkarɪg	‘rock, boulder’
b.	ˈLLL	ˈklagərnəx	‘clattering’
c.	ˈLLLL	ˈarəməkəx	‘tender’
d.	ˈLLLH	ˈimɪləkɑːn	‘navel’
e.	LˈH	kaˈliːn	‘girl’
f.	LˈHL	kɪˈmɑːdən	‘(s)he observes’
g.	LˈHH	bɪˈhuːntiːxt	‘villainy’

(2) Stress-attracting HL

a.	ˈHL	ˈɑːlɪn	‘nice’
b.	ˈHLL	ˈkuːrəməx	‘careful’
c.	LLˈHL	fodərˈluəsəx	‘bustling’

(3) Peninitial stress

a.	HˈH	diːˈviːn	‘idle’
b.	HˈHL	oːˈgɑːnəx	‘young man’
c.	HˈHH	uːˈrɑːniː	‘songs’

(4) Post-peninitial stress

a.	LLˈH	kanəˈhoːr	‘buyer’
b.	LLˈHH	əməˈdɑːntiːxt	‘foolishness’

Secondary stress is discussed by Doherty (1991) and Ó Sé (2000). The description by Ó Sé (2000) is summarized by Iosad (2013) as follows. The first syllable “often” receives secondary stress if the third syllable is stressed, which can only be the case if the first two syllables are L (5a). “Sometimes” a third H syllable receives secondary stress if there is initial main stress (5b, c). However, in the presence of two HL sequences (/HLHL/), Ó Sé (2000), as reported by Iosad (2013), identifies the leftmost HL sequence as receiving main stress. According to Green (1996), however, whether it is the rightmost or leftmost HL sequence that attracts primary stress depends on dialectal variation. In this analysis we follow Green (1996) and Rowicka (1996), who follows Green, and consider that it is the second HL which receives main stress (5d), (the transcription is taken from Rowicka 1996).[4] Finally, a fourth H syllable “often” receives secondary stress if main stress is initial (5e).

(5) Secondary stress

a.	(ˌ)LLˈH	(ˌ)kanəˈhoːr	‘buyer’	
b.	ˈHL(ˌ)H	ˈuːdə(ˌ)rɑːs	‘authority’	
c.	ˈHL(ˌ)HH	ˈuːtə(ˌ)mɑːliː	‘bungler’	
d.	ˌHLˈHL	ˌfogəˈroːfər	‘will be announced’	Rowicka (1996)
e.	ˈLLL(ˌ)H	ˈforəmə(ˌ)duːl	‘envious’	

It is also important to present some data from Green (1996) that does not appear in Iosad (2013). Green (1996) presents some four- and five-syllable words in which a final HL sequence receives primary stress. Given the pattern described in (5a), we can assume that optional secondary stress is possible also in these forms. We add secondary stress

[4] No phonetic measurements are available to refute the traditional literature, and future research is needed to elucidate the status of HLHL words.

in between parentheses in the transcriptions in (6), although it is not present in Green (1996), who abstracts away from secondary stress in his analysis.

(6) Words with final HL (Green 1996)

a.	(ˌ)LLˈHL	(ˌ)fodərˈluəsəx	‘bustling’
b.	(ˌ)LLLˈHL	(ˌ)adərəˈgaːlə	‘mediation (GEN)’
c.	(ˌ)LLHˈHL	(ˌ)iməgeːˈnuːlə	‘distant (PL)’

Stress assignment in MI can thus be summarized as follows:

- The unmarked stress pattern in MI is word-initial.
- However, stress is non-initial if:
  - the peninitial and/or the post-peninitial syllable contain(s) a H syllable, in which case main stress is assigned to the leftmost H syllable; if there is only one H syllable, stress is attracted to it.
- Secondary stress is assigned to any initial L syllable or non-initial H syllable after main stress.

The remainder of the paper is organized as follows. Section 2 presents the representational assumptions assumed in our analysis of the data. Section 3 develops an OT analysis of the data based on branchingness constraints on metrical heads and dependents. Section 4 briefly offers an alternative account based on internally layered feet (Martínez-Paricio & Kager 2015), and briefly discusses the analysis of MI stress by Iosad (2013). Section 5 concludes the paper.

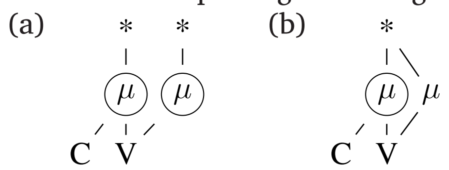
2 Representational assumptions

Our claim in this paper is that prosodic constituency and metrical prominence are conflated into the same dimension (Hammond 1984; Halle & Vergnaud 1987; Hayes 1995 *vs.* Liberman & Prince 1977; Hyde 2012) even at the level of the syllable (see Hermans & Torres-Tamarit 2014 for an application of this hypothesis to ternary rhythm). We therefore suggest eliminating the syllable as a prosodic category that mediates between moras and the metrical dimension.

This move implies that the relationship between *phonetic syllables* (sequences of segments organized around a nucleus of higher sonority) and *phonological syllables*, grid marks at the first line of the metrical dimension in our model, is not necessarily isomorphic.

Due to the fact that all prominent positions in each metrical level have constituent status, and that every constituent is headed and can optionally take a dependent, a bimoraic vowel can be parsed in two different ways. In (7a), each mora heads its own grid mark at the first level of the metrical dimension, that is, one long vowel corresponds to two phonological syllables. However, in (7b), the second mora is the dependent of the phonological syllable. Therefore, only in (7a) is there an asymmetric many-to-one relation between phonological syllables and phonetic syllables. Circled moras indicate their head status. Heads are represented with straight lines and dependents with stranded lines.

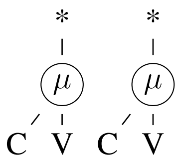
(7) Possible mora parsings of a long vowel



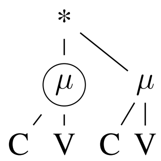
Following the same rationale, a sequence of two monomoraic phonetic syllables can also be parsed in two different ways. In (8a), each mora projects its own phonological syllable, as opposed to (8b), in which the second mora is the dependent of the sole phonological syllable. Therefore, only in (8b) is there an asymmetric one-to-many relation between phonological syllables and phonetic syllables.

(8) Possible mora parsings of two monomoraic phonetic syllables

(a)



(b)

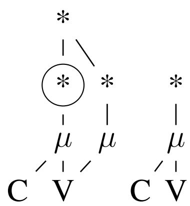


These mismatches between phonetic and phonological syllables make it possible to characterize in a simple way the difference between various foot types as driven by branchingness constraints (see Dresher & van der Hulst 1998 for branchingness constraints).

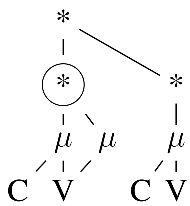
The difference between an even (moraic) trochee (9a) and an uneven trochee (9b) is that only the latter requires the foot's head to branch (see Mellander 2003 for a justification of uneven trochees). This branchingness condition on the foot's head makes it possible to parse the last CV sequence into the foot as its dependent. Heads of feet are circled.

(9) Even (moraic) trochee *vs.* uneven trochee

(a)



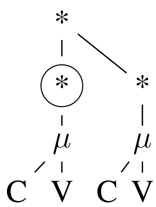
(b)



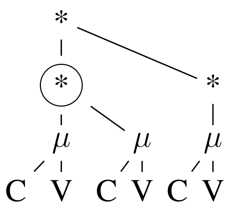
Also, the difference between a binary (10a) and a ternary foot (10b) is that only the latter requires the foot's head to branch. Crucially, ternary rhythm in this model does not require recursive structures, but just abandoning the assumption that there is a one-to-one relationship between phonetic syllables and the units at the first line of the metrical dimension (*cf.* Martínez-Paricio and Kager 2015).

(10) Binary *vs.* ternary foot

(a)

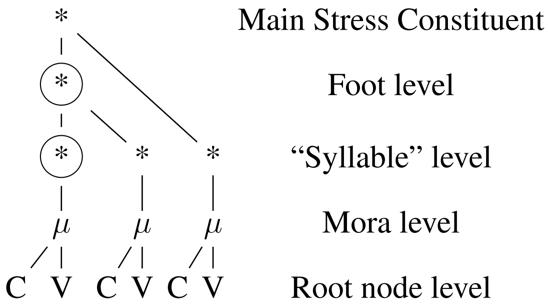


(b)



To recapitulate, we basically propose to extend Hammond's (1984) arboreal grid model of conflation to the level of the syllable; we eliminate the syllable node and give the grid units at the first line of the metrical plane the status of a phonological syllable. As illustrated in (11), we also consider main stress a constituent in itself, as in the early days of metrical phonology (Liberman & Prince 1977).

(11) Metrical tree structure



Our goal in this paper is to test this model against stress assignment in MI. MI displays intriguing cases of displacement of otherwise unmarked word-initial stress. We will show that any analysis of MI stress must account for the fact that a sequence of two monomoraic phonetic syllables and a bimoraic phonetic syllable that contains a long vowel can behave identically as far as metrical phonology is concerned, and that feet are large enough to accommodate up to three moras. We will accomplish this by means of asymmetric one-to-many relations between phonological syllables and phonetic syllables, expressed in terms of identical structures at the first level of the metrical grid for both CVCV and CV: sequences as a response to branchingness constraints on heads.

3 Analysis

The analysis of MI stress is based on branchingness constraints on heads and dependents. Branchingness constraints state that heads of constituents must branch, on the one hand, and that dependents of constituents must not branch, on the other. The basic idea is that only metrical head positions license structural complexity, measured here in terms of branchingness. Branchingness constraints evaluate the relation between mother-daughter (immediate) constituents at each level of the metrical dimension (12). A promising advantage of these constraints is that three different families of constraints, namely the extrametricality-favoring constraint Non-Finality (in the sense of Hyde 2007, 2011), the foot size constraint Foot-Binarity (Prince 1983; McCarthy & Prince 1986/1996) and the weight constraints Stress-to-Weight and Weight-to-Stress (Prince 1990), can be dispensed with and unified under branchingness constraints.

(12) Branchingness constraints

a. HeadFoot'sHead-∧
Assign one violation mark for every head foot's head (main stressed phonological syllable) that does not branch.

b. HeadFoot'sDependent-|
Assign one violation mark for every head foot's dependent that branches.

c. MSC'sHead-∧
Assign one violation mark for every main stress constituent's head that does not branch.

d. MSC'sDependent-|
Assign one violation mark for every main stress constituent's dependent that branches.

e. Foot'sHead-∧
Assign one violation mark for every foot's head that does not branch.

f. Foot'sDependent-|
Assign one violation mark for every foot's dependent that branches.

The analysis also makes use of alignment constraints. The alignment constraint definitions in (13) are written informally. They could be formalized according to the format of Hyde (2012), who can account for distance sensitivity without gradient violations.

(13) Alignment constraints
- a. HEADFOOT-Right
  Assign one violation mark for every level 1 constituent that intervenes between the right edge of the head foot and the right edge of the word.
- b. HEADFOOT-Left
  Assign one violation mark for every level 1 constituent that intervenes between the left edge of the head foot and the left edge of the word.
- c. MSC-Right
  Assign one violation mark for every level 1 constituent that intervenes between the right edge of the main stress constituent and the right edge of the word.
- d. MSC-Left
  Assign one violation mark for every level 1 constituent that intervenes between the left edge of the main stress constituent and the left edge of the word.

The rhythm constraints in (14) will also be necessary, as well as the two PARSE constraints in (15). Rhythm constraints standardly refer to peaks and troughs in the metrical grid. In this proposal, in which prosodic categories and grid marks are conflated into the same dimension, rhythm constraints refer to this hybrid constituent.

(14) Rhythm constraints
- a. *CLASH (α)
  Assign one violation mark if heads of pairs of constituents at level α are adjacent.
- b. *LAPSE (α)
  Assign one violation mark if at least one constituent of a pair of constituents at level α is not the head of an $\alpha+1$ constituent.
- c. LAPSE-AT-END (α)
  Assign one violation mark if at least one constituent of a non-word-final pair of constituents at level α is not the head of an $\alpha+1$ constituent.

(15) PARSE constraints
- a. PARSE (1)
  Assign one violation mark for every constituent at level 1 that is not parsed.
- b. PARSE (2)
  Assign one violation mark for every constituent at level 2 that is not parsed.

Finally, the analysis will rely on the domination of a markedness constraint that we call *μ/DEPENDENT, which prohibits moras directly dominating nuclei to occupy the dependent position of a first level grid mark (the second mora of long vowels is not subject to this constraint because although they dominate nuclei they occupy a dependent position with respect to it). In other words, this constraint disfavors parsing two phonetic syllables into one phonological syllable (16a).

(16) *μ/Dependent
Assign one violation mark for every mora directly dominating a nucleus that occupies the dependent position of a level 1 grid mark.

In the remainder of this section, we first present the constraint strata that accounts for MI stress, followed by the list of constraint ranking arguments that can be retrieved from candidate comparison (17). Then, these constraint ranking arguments are illustrated in various tableaux. These tableaux include all the constraints that receive at least one violation from any candidate considered. Dotted and straight lines in all tableaux respect the constraint strata, and W's and L's are included in the cells of loser candidates to better illustrate ranking arguments.

(17) MI constraint-based grammar

a. Constraint strata

Strata 1:	HeadFoot'sHead-∧	(HdFtHd)
	HeadFoot'sDependent-|	(HdFtDep)
	MSC'sDependent-|	(MSCDep)
	Foot'sDependent-|	(FtDep)
	*Clash	
	Lapse-at-End	(Lps-End)
	≫	
Strata 2:	MSC'sHead-∧	(MSCHd)
	Foot'sHead-∧	(FtHd)
	Parse (2)	(Prs2)
	≫	
Strata 3:	MSC-Right	(MSCR)
	Parse (1)	(Prs1)
	*μ/Dependent	(*μDep)
	≫	
Strata 4:	HeadFoot-Left	(HdFtL)
	MSC-Left	(MSCL)
	≫	
Strata 5:	HeadFoot-Right	(HdFtR)
	*Lapse	(*Lps)

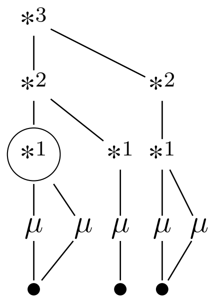
b. Ranking arguments

MSC-Right ≫ HeadFoot-Left, MSC-Left (tableau (22))
MSC'sDependent-| ≫ Parse (2), HeadFoot-Left, MSC-Left (tableau (20))
*Clash ≫ Parse (1), HeadFoot-Left, MSC-Left (tableau (21) and (25))
*Clash ≫ Foot'sHead-∧, Parse (2) (tableau (26))
Lapse-at-End ≫ MSC-Right (tableau (22))
Parse (2) ≫ MSC-Right, Parse (1) (tableau (22))
HeadFoot-Left ≫ HeadFoot-Right, *Lapse (tableau (23))
HeadFoot'sHead-∧ ≫ MSC'sHead-∧, Parse (2), HeadFoot-Left, MSC-Left (tableau (26))

Regarding the alignment of feet, we propose that in MI the head foot (*i.e.* the head of the main stress constituent) is left-aligned as long as the main stress constituent is right-aligned. This generalization is expressed with the ranking MSC-Right over HeadFoot-Left. Also, the head foot's head (*i.e.* the main stressed phonological syllable) must always branch and no immediate dependent can ever branch in MI; this is expressed by the undominated position of HeadFoot'sHead-∧, HeadFoot'sDependent-|, MSC'sDependent-| and Foot'sDependent-|. From now on, we use the shortened version of the constraints, those that appear in the tableaux below.

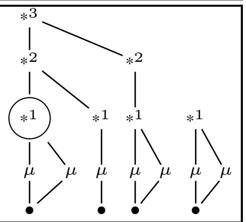
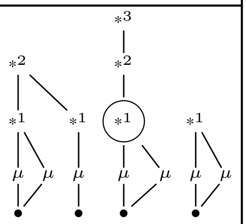
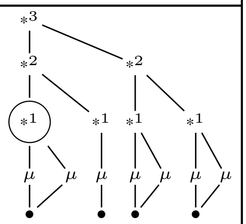
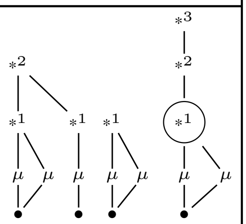
First, consider an input form /HLH/. The two alignment constraints MSCR and HdFtL and all branchingness constraints are satisfied if stress is initial and secondary stress is final (18). The head foot is left-aligned and the main stress constituent is right-aligned because it takes as its dependent the second foot. Because the second foot does not branch, the branchingness constraint MSCDep is satisfied. In MI all branchingness constraints against branching immediate dependents are undominated; they are always satisfied. The head foot's head also branches because it parses the two moras of the first vocalic nucleus, a long vowel. This form does not violate any relevant constraints and it therefore harmonically bounds all other potential parsings. If binary, feet are always left-headed in MI; only trochaic feet will be considered when comparing competing candidate forms. From now on, the segmental tier will be represented by dots that refer to vocalic nuclei and circled grid marks highlight the head foot's head. In superscripts, the integers 1, 2 and 3 refer to phonological syllables, feet, and the main stress constituent, respectively.

(18) /HLH/ → [ˈH.L.ˌH]



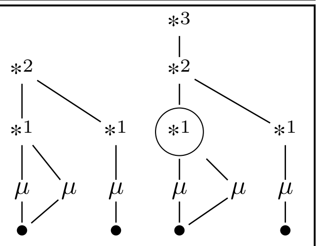
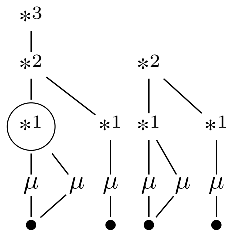
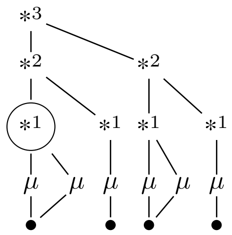
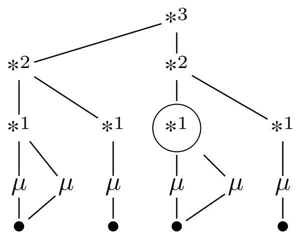
The mapping from an input string like /HLHH/ onto its output form is similar to (18) except that the last heavy syllable is left unparsed (candidate (a) in (19)), which misaligns the MSC from the right word edge. Right-aligning the MSC, as in candidate (c), fatally violates two constraints against branching dependents, MSCDep and FtDep, which are undominated. Although placing the main foot on the last syllable as in candidate (d) satisfies MSCR, it violates Lps-End, because there is a word-internal pair of level 1 constituents neither of which is the head of a level 2 constituent, and also MSCHd, because the main foot is monosyllabic, and Prs2, because the initial foot is not parsed by the MSC. The internal lapse can be avoided if the main foot is one syllable away from the right edge, as in candidate (b), but this option also violates MSCHd and Prs2. Therefore, the winning candidate is candidate (a), with initial main stress and secondary stress on the penultimate H syllable, which violates MSCR, Prs1, and HdFtL, but satisfies all other constraints placed higher in the hierarchy. No ranking arguments are discovered if these candidates are compared.

(19) /HLHH/ → [ˈH.L.ˌH.H]

HLHH	MSCDep	FtDep	Lps-End	MSCHd	Prs2	MSCR	Prs1	HdFtL	MSCL	HdFtR	*Lps
a. ☞ 						*	*			**	
b. 				*W	*W	*	*	*W*	*W*	*L	
c. 	*W	*W				L	L			**	
d. 			*W	*W	*W	L	*W	*W**	*W**	L	*W

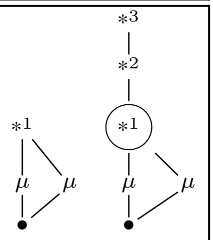
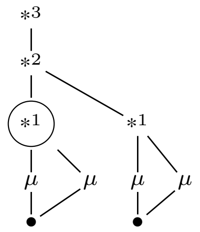
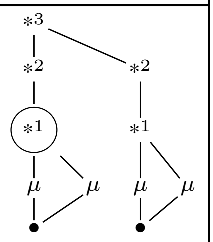
In /HLHL/ input forms, assigning initial primary stress and right-aligning the main stress constituent is not an optimal solution, as shown by candidate (c) in (20). This candidate violates MSCDep because the MSC's dependent branches; candidate (d) is ruled out for the same reason. By comparing these two candidates with the winning candidate (a), with initial secondary stress and main stress on the rightmost H syllable, it is established that MSCDep dominates Prs2; it is preferable to leave a foot unparsed than to allow the dependent of the MSC to branch. Candidate (b) satisfies MSCDep but places the main foot on the first H syllable. This candidate therefore violates MSCR, which dominates both HdFtL and MSCL, which occupy the same stratum in the grammar. To conclude on this, satisfying both HdFtL and MSCR implies a violation of MSCDep, which prohibits a branching MSC's dependent. In order to avoid such a violation, the head foot must necessarily misalign with the left word edge. This implies that MSCDep dominates HdFtL and MSCL, which are violated by the actual output form.

(20) /HLHL/ → [ˌH.L.ˈH.L]

HLHL	MSCDep	Prs2	MSCR	HdFtL	MSCL	HdFtR
a. ☞ 		*		**	**	
b. 		*	*W*	L	L	*W*
c. 	*W	L		L	L	*W*
d. 	*W	L		L	L	

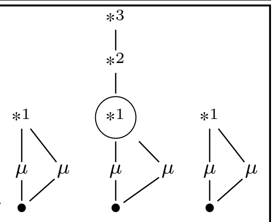
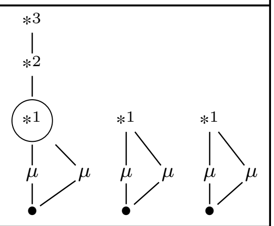
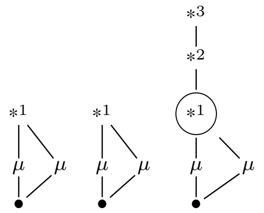
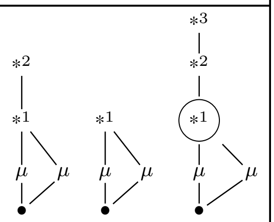
Similarly, the requirement to avoid a violation of HdFtDep, which disfavors a branching head foot's dependent, causes the main stress to misalign with respect to the left word edge in /HH/ input forms (compare candidate (a) in (21) with candidate (b)). However, there is one possible parsing that avoids a violation of HdFtDep, which is to assign secondary stress to the second H syllable (21c) and parse this foot into the MSC, as seen in candidate (c). However, this possibility violates *Clash because there is a pair of adjacent grid marks at level 2 whose heads are also adjacent. Therefore, the rhythm constraint *Clash dominates the alignment constraints HdFtL and MSCL, as well as Prs1. A candidate with initial stress that leaves the second H syllable unparsed (not represented in (21)) is ruled out because MSCR dominates HdFtL.

(21) /HH/ → [H.ˈH]

HH	HdFtDep	FtDep	*Clash	MSCHd	Prs1	HdFtL	MSCL	HdFtR
a. ☞ 				*	*	*	*	
b. 	*W	*W		L	L	L	L	
c. 			*W	*	L	L	L	*W

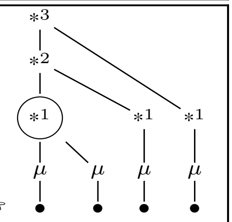
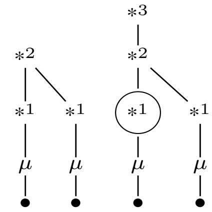
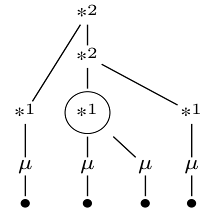
In /HHH/ input forms, main stress is also assigned to the second syllable (candidate (a) in (22)). According to the constraint hierarchy proposed, MSCR dominates HdFtL. This ranking would select candidate (c) as the most optimal candidate, with final stress. However, non-final lapses are disfavored by Lps-End. Candidate (c) is therefore ruled out because it violates Lps-End, which dominates MSCR. Candidate (d), like candidate (c), also satisfies MSCR, but avoids the non-final lapse by parsing the first H syllable into its own foot. However, this solution violates Prs2, which dominates MSCR and Prs1, two of the constraints violated by the winning candidate (a). If non-final lapses are prohibited and parsing of level 2 constituents must be maximized, we are left with candidates (a) and (b). Only candidate (a) fares better than candidate (b) in terms of MSCR because only one level 1 constituent mediates between the right edge of the MSC and the right word edge, as opposed to candidate (b), which places main stress on the initial H syllable and therefore violates MSCR once more.

(22) /HHH/ → [H.ˈH.H]

HHH	LPS-END	MSCHD	PRS2	MSCR	PRS1	HDFTL	MSCL	HDFTR	*LPS
a. ☞ 		*		*	**	*	*	*	
b. 		*		**W	**	L	L	**W	*W
c. 	*W	*		L	**	**W	**W	L	*W
d. 		*	*W	L	*L	**W	**W	L	

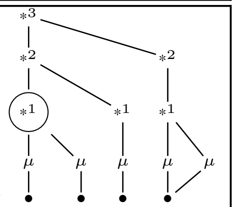
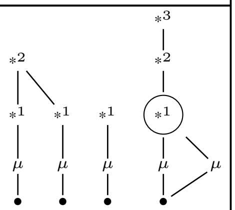
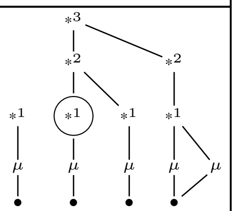
As has already been shown, in MI the head foot's head, that is, the main stressed phonological syllable, must always branch. In the presence of a bimoraic long vowel, stress is attracted to it in order to satisfy HDFTHD. However, what happens in the absence of a bimoraic syllable? Let us consider /LLLL/ input forms. The requirement to satisfy this constraint allows for initial stress and right alignment of the MSC if and only if the first two monomoraic phonetic syllables are parsed into the same level 1 constituent, as shown by candidate (a) in (23). The winning candidate violates μDEP, a constraint against moras that occupy a dependent position with respect to level 1 constituents. If mismatches between phonetic and phonological syllables were not allowed in the language, we would expect penultimate main stress, as in candidate (b). Candidate (c) shows that HDFTL dominates both HDFTR and *LPS.

(23) /LLLL/ → [ˈLL.L.L]

LLLL	HdFtHd	FtHd	Prs2	*μDep	HdFtL	MSCL	HdFtR	*Lps
a. ☞ 				*			*	*
b. 	*W	*W*	*W	L	*W*	*W*	L	L
c. 				*	*W		L	L

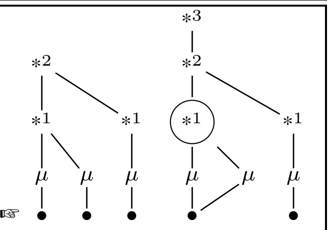
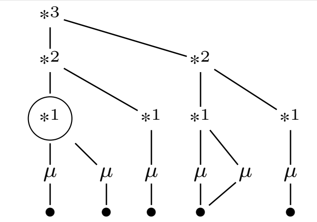
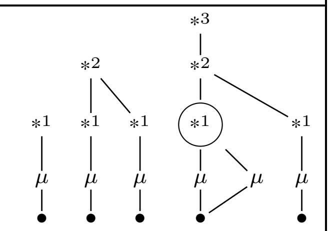
Main stress is also initial in /LLLH/ input forms, but in this case the last H syllable receives secondary stress. The winning candidate in (24) satisfies all branchingness constraints and aligns both the MSC to the right and the head foot to the left. And this is again possible only if the first two light phonetic syllables behave as one phonological syllable. Candidates (b) and (c) violate some of the constraints ranked higher at the first two strata.

(24) /LLLH/ → [ˈLL.L.ˌH]

LLLH	HdFtHd	Lps-End	MSCHd	FtHd	Prs2	Prs1	*μDep	HdFtL	MSCL	HdFtR	*Lps
a. ☞ 							*			*	
b. 		*W	*W	*W	*W	*W	L	*W**	*W**	L	*W
c. 	*W			*W		*W	L	*W	*W	*W	

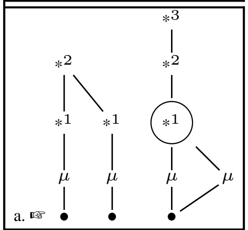
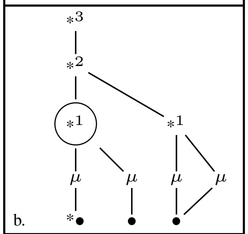
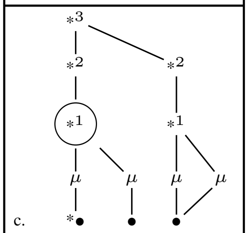
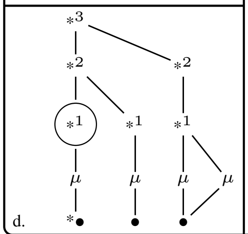
At this point in our analysis it is crucial to compare the previous input-output mapping (/LLLH/ → [ˈLL.L.ˌH]) with how an input like /LLLHL/, with a final HL sequence, maps onto its surface form. In the latter case, main stress is no longer initial but penultimate, that is, on the H syllable, and the initial L syllable receives secondary stress, as seen in candidate (a) in (25). Trying to left-align the head foot, as candidate (b) shows, and still right-align the MSC, induces a fatal violation of MSCDEP, because the MSC's dependent cannot branch; MSCDEP dominates HDFTL, MSCL, and also PRS2. Candidate (c), with the secondary foot only parsing two but not three phonetic syllables as candidate (a) does, is ruled out because it violates FTHD and PRS1.

(25) /LLLHL/ → [ˌLL.L.ˈH.L]

LLLHL	MSCDEP	FTHD	PRS2	PRS1	*μDEP	HDFTL	MSCL	HDFTR
a. ☞ 			*		*	**	**	
b. 	*W		L		*	L	L	*W*
c. 		*W	*	*W	L	***W	***W	

Finally, consider a /LLH/ input form. As opposed to /LLLH/, which has initial main stress ([ˈLL.L.ˌH]), assigning initial main stress and still satisfying the branchingness constraint HDFTHD incurs a fatal violation of the constraints HDFTDEP and FTDEP, as shown by candidate (b) in (26). If the last H syllable is assigned secondary stress, as in candidate (c), HDFTDEP is satisfied but the constraint *CLASH rules it out; *CLASH dominates the constraints FTHD, PRS2, HDFTL, and MSCL. Candidate (d), with initial main stress and final secondary stress, satisfies the constraint against branching dependents but, crucially, it does not satisfy the constraint that forces the main stressed syllable to branch. Therefore, the most optimal parsing of such an input is candidate (a), with initial secondary stress and final stress on the H syllable. By comparing these candidates, it can be established that HDFTDEP dominates MSCHD, PRS2, HDFTL, and MSCL.

(26) /LLH/ → [ˌL.L.ˈH]

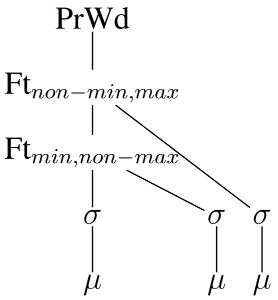
LLH	HdFtHd	HdFtDep	FtDep	*Clash	MSCHd	FtHd	Prs2	*μDep	HdFtL	MSCL	HdFtR
a. ☞ 					*	*	*		**	**	
b. 		*W	*W		L	L	L	*W	L	L	
c. 				*W	*	L	L		L	L	*W
d. 	*W				L	*	L		L	L	*W

4 Discussion of alternative approaches

4.1 Internally layered feet

Martínez-Paricio & Kager (2015) have developed an analysis of the continuum between binary and ternary rhythm using ternary feet with minimal internal layering. Internally layered feet are minimal, non-maximal binary feet to which a syllable is adjoined to create a non-minimal, maximal foot, as illustrated in (27).

(27) Internally layered foot



An analysis based on internally layered feet can easily account for the MI stress data analyzed so far. If we assume that in MI maximal feet are maximally trimoraic and minimal feet are minimally bimoraic, we can assign the prosodic parsings in (28) to different input strings.

(28) Prosodic parsings with internally layered feet

a. Word-initial main stress
  - i. LL → (ˈLL)
  - ii. LLL → ((ˈLL)L)
  - iii. LLLL → ((ˈLL)L)L
  - iv. LLLH → ((ˈLL)L)(ˌH)
  - v. LH → (L(ˈH))

b. Stress-attracting HL
  - i. HL → ((ˈH)L)
  - ii. HLL → ((ˈH)L)L
  - iii. HLH → ((ˈH)L)(ˌH)
  - iv. HLHL → ((ˌH)L)((ˈH)L)

c. Peninitial stress
  - i. HH → (H)(ˌH)
  - ii. HHL → (H)((ˈH)L)
  - iii. HHL → (H)(ˈH)(H)

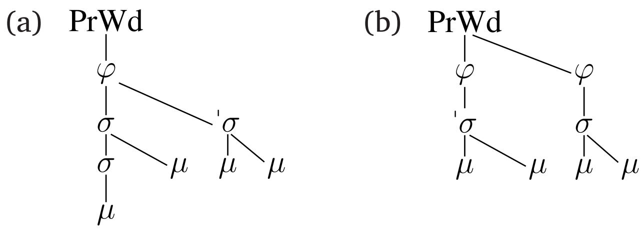
d. Post-peninitial stress
  - i. LLH → (ˌLL)(ˈH)

In such a system, both minimal and maximal feet are moraic. However, WSP, the constraint penalizing heavy syllables that receive no stress, dominates foot form constraints, and therefore H syllables attract stress. Regarding foot directionality, feet are rightwards (left-to-right parsing), and this is what explains why unparsed syllables appear at the right word edge, as in ((ˈLL)L)L. Most importantly, to explain why main stress is leftmost in ((ˈLL)L)(ˌH) but rightmost in (ˌLL)(ˈH) it is enough to establish that main stress falls on the rightmost non-minimal foot, like in ((ˌH)L)((ˈH)L) (cf. ((ˈLL)L)(ˌH), in which the rightmost non-minimal foot is the first one), and in the absence of non-minimal feet, stress also falls on the rightmost foot, like in (H)(ˈH). Like in our analysis, the first foot in (H)(ˈH) does not receive secondary stress to avoid a stress clash. In (H)(ˈH)(H), the rightmost foot does not receive primary stress in order to avoid a stress lapse. However, why *(ˌH)(H)(ˈH), with initial secondary stress and final main stress, is not attested seems more difficult to explain under an analysis with internally layered feet. Nonetheless, aside from that issue, internally layered feet seem to offer a very attractive analysis of the MI stress data. A deeper investigation of internally layered feet applied to these data is left for future research.

4.2 Weight-sacrificing recursion

Iosad (2013) has developed an OT account of MI stress that rests upon two basic ideas: first, the distinction between metrical heads and stress, according to which stress is a property that does not necessarily match the position of metrical heads, and second, the possibility of generating recursive prosodic structures at the moraic and syllabic levels that has consequences for the computation of weight. To illustrate these fundamental aspects of his analysis, consider the representation of a [H.ˈH] form, illustrated in (29a), a form that exemplifies what Iosad (2013) calls a case of *forward stress*.

(29) H.ˈH vs. *ˈH.H representations according to Iosad (2013)



The representation in (a) makes use of recursion at the level of the syllable; the first H syllable is rendered monomoraic at the level of the foot's (immediate) daughter because the higher-level syllable directly dominates only one mora, and this level is the relevant level for stress assignment. This is an instance of what Iosad terms "weight-sacrificing" recursion. The head of the foot is the leftmost, as signaled by the straight line that links the foot with the syllable, although stress, understood as a feature that can knock onto any syllable, falls under the second, dependent syllable of the foot. Candidate (b) has instead two feet, each of which dominates a bimoraic syllable, and the leftmost foot is the head of the prosodic word. The second foot receives no stress. The preference for a candidate with only one foot in /HH/ forms is driven by the branchingness constraint BRANCHING COMPLEXITY/WORD, which demands that if a word branches, then the head constituent has more branches than the dependent; candidate (b) violates this constraint, but candidate (a) satisfies it because there is no word dependent. Recursion at the level of the syllable in candidate (a) is motivated by another constraint, EMBEDDING COMPLEXITY/FT, which demands that heads must have more embedded constituents than their dependents. This can be achieved through recursion. Because recursion renders the first syllable monomoraic for purposes of stress assignment, WEIGHT-TO-STRESS can only be satisfied if stress is assigned to the foot dependent, which contains a bimoraic syllable.

Iosad's (2013) approximation to the MI facts crucially relies on a representational distinction between the notions of prosodic *heads* and *stress*, and also needs to rely on recursive structures at the moraic, syllabic and foot levels. On the other hand, our proposal, in which two phonetic syllables can be conflated into one phonological syllable at level 1 of the metrical grid, has the advantage of maintaining the isomorphy between prosodic categories and stress, and does not require any kind of recursive structure. An analysis based on internally layered feet also seems more intuitive; although ternary constituents are achieved by means of minimal recursion of feet through syllable adjunction, recursive moras or syllables are excluded, and, like in our proposal, metrical heads transparently map onto the metrical grid.

5 Conclusion

In this paper we have presented a solution to the problem of stress in MI that makes use of a constituentized metrical grid subject to branchingness constraints on heads and dependents, and the possibility of parsing a sequence of two open phonetic syllables into one phonological syllable. In other words, as noted above, we claim that any analysis of MI stress must account for the fact that a sequence of two L syllables and one H syllable can behave identically, and that feet are large enough to accommodate up to three moras. This can be done by means of many-to-one relations between phonetic and phonological syllables, expressed in terms of identical structures for both LL and H syllables at the first level of the metrical dimension as a response to branchingness constraints.

An alternative analysis in terms of internally layered feet (see Martínez-Paricio & Kager 2015) that does not allow for such mismatches between phonetic and phonological syllables does also account for most of the Munster Irish data. The analysis provided in Iosad (2013), on the other hand, makes use of recursive prosodic categories at different levels of the prosodic hierarchy (moras, syllables and feet), and crucially relies on a distinction between metrical heads and stress, which can be associated with any syllable. Our proposal, however, does not disconnect stress from prosodic headedness and not only avoids recursivity but dispenses with the syllable, an approach that we think should be preferred based on simplicity arguments.

Abbreviations

GEN = genitive, PL = plural

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Competing Interests

The authors have no competing interests to declare.

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