RHYTHM AND ALIGNMENT IN MACEDONIAN ENLARGED STRESS DOMAINS

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This paper proposes that optionality of stress in so-called enlarged stress domains in Macedonian is best handled by Optimality Theory My analysis primarily harnesses the constraints proposed in Hung 1995 to account for languages other than Macedonian More specifically, in order for this sort of free variation to be attested, the Optimality-theoretic constraints must be defined as generally as possible, I therefore reject certain refinements in Hung's constraint definitions In addition, I show that even though Macedonian is a trochaic language, a universal constraint requiring iambic foot form nonetheless plays a role—known in the literature as Emergence of the Unmarked—in selecting the two best-formed candidates Finally, I propose a tie in the ranking of two constraints in the hierarchy [1]

This paper's organization is as follows I begin in section 1 with some background on metrical-grid theory, using so-called stress clash in English as an example Section 2 then summarizes the portions of Hung 1995 relevant to this paper Next, section 3 introduces the Macedonian data and reviews the relevant literature Finally, I present my own analysis of this phenomenon in section 4

1 Metrical grids

The examples in (1a-b) show two typical disyllabic English words, (1a) usually bears stress on the second syllable, while (1b) is end-stressed The bottom row stands for the segmental representation [2]

```
(1) a          x      Level 1          b  x           Level 1
          x    x      Level Ø             x    x      Level Ø
          four teen                       wo   men              [Hung 1995 9]
```

A grid is then erected over the segmental representation in successively higher levels (Liberman 1975) Each syllable is represented by an *x* on level Ø, while a level-1 *x* is drawn over each stressed syllable

One use of metrical grids is in formalizing so-called stress clash Observe that while *fourteen* has final stress when it stands alone in (1a), when a word with initial stress immediately follows, the stress on *fourteen*, represented by the first *x* on level 1, shifts to its initial syllable, as in (2a-b)

```
(2) a          x    x               b  x         x           Level 1
          x    x    x   x      -->     x    x    x   x       Level Ø
          four teen wo  men            four teen wo  men
```

The intuition behind stress clash is that stress peaks should not be bunched together too closely

Another facet of metrical grids is the nuclear stress rule, which allows a single syllable to be the most prominent one in a larger constituent For example, the phrase in (2b) has two equally prominent peaks, English requires the rightmost such peak to have phrasal prominence This is accomplished by adding another level to the grid and drawing a mark over the rightmost level-1 grid mark as in (3)

[1] Versions of this work were presented at LingCircle and the Institute of Cognitive Science, both at the University of Colorado, Boulder I am grateful to audiences at both of these venues, as well as at MALC 1999, especially Beth Heywood and Fiona McLaughlin, for useful comments and discussion However, any mistakes that remain in this paper are my own responsibility Thanks also to the University of Colorado Linguistics Department for a travel grant to present the MALC talk

[2] For simplicity, throughout the paper I use the orthographic representation to represent the segments, in none of the data is this a crucial factor I also insert spaces between the syllables in order to align the vowels under their respective columns of grid marks Level Ø is better defined universally as ' stressable units" some languages, such as Indonesian, routinely ignore syllables with schwa-like vowels for the purposes of assigning level-Ø grid marks (Kenstowicz 1994 554, citing Cohn 1989) Contrary to Hung (1995), I've also added levels and numbers to each grid example, numbering the levels beginning with Ø

```
(3)                x                Level 2
       x           x                Level 1
       x     x     x     x          Level Ø
      four  teen  wo    men
```

[Hung 1995 9]

For the purposes of assigning a level-2 grid mark in (3), only those syllables with level-1 grid marks are considered That is, it is impossible to have a grid mark without a full column of marks underneath it

One final property of metrical grids is the notion of strict adjacency The grid in (2a) is ill-formed because of the two adjacent grid marks on level 1 However, strict adjacency does not require the grid marks to be in adjacent syllables, as the more complicated grids in (4a-b) and (5) show

```
(4) a            x               Level 2      b
       x         x               Level 1          x             Level 1
       x    x    x    x          Level Ø          x    x        Level Ø
       Mi   ssi  ssi  ppi                         ri   ver
```

As in (1a-b), the grids in (4a-b) show the grids for *Mississippi* and *river* as separate utterances (Nuclear stress requires (4a) to have three levels, while (4b) requires only two) Joined together as a phrase, and given that English requires the latter word to take phrasal prosodic prominence, the result is as in (5b)

```
(5) a                    x             b                     x        Level 3
                 x       x                  x                x        Level 2
       x         x       x       -->        x        x       x        Level 1
       x    x    x   x   x   x              x   x    x   x   x   x    Level Ø
       Mi  ssi  ssi ppi  Ri  ver            Mi  ssi ssi ppi  Ri  ver
```

[Kenstowicz 1994 555]

The relevant point of strict adjacency is not the added level-3 grid mark, but the first level-2 mark on *Mississippi*, which shifts from the third syllable in (4a) and (5a) to the initial syllable in (5b) That is to say, whereas the two grid positions on level 2 are not adjacent with respect to level Ø, they are adjacent with regard to level 1 The first and third syllables are consecutive strictly with regard to level 1

To summarize this section, metrical grids are used not only to depict prominence of stress, but also to formalize stress clash Clash is part of a larger phenomenon known as the rhythm rule, which also requires stresses not to be too far part, see Kenstowicz 1994 555 for further discussion The following section expands on the concepts outlined so far, introducing how metrical grids have been harnessed, using Optimality Theory, to account for languages which exhibit antepenultimate stress

2 Hung 1995 on the rhythm rule and antepenultimate stress in Latin

A recent study, Hung 1995, looks at the prosodic properties of edges of words Hung observes that in numerous languages the rightmost constituent does not receive the usual stress and argues that stressing a syllable too close to the end of a word is akin to having two stress peaks too close together, as in (2a) and (5a) above Prior to Hung 1995, stress clash and the rhythm rule were considered to be a distinct phenomenon from nonfinality of stress, the latter was subsumed under extrametricality, which formalizes how edgemost (usually final) constituents are exceptional to some prosodic properties Hung (1995 10) cites the principle in (6a) as inspiration for subsuming final extrametricality under rhythm

(6) The Principle of Rhythmic Alternation (Selkirk 1984 52)

a Every strong position on a metrical level *n* should be followed by at least one weak position on that level

b Any weak position on a metrical level *n* may be preceded by at most one weak position on that level

These two sub-principles continue to be influential, albeit in slightly modified theoretical form They are recast below as Optimality-theoretic constraints **Rhythm** in (7) and **Lapse** in (28b), respectively

Hung 1995 employs Optimality Theory (Prince and Smolensky 1993) as a means of formalizing the interaction of the rhythmic phenomena Hung redefines (6a) as the **Rhythm** constraint in (7)

(7) **Rhythm** Every x of height n (where $n \geq Ø$) must be followed by a column of height $n - 1$ such that there is no intervening column of height greater than $n - 1$

x		Level n
x	x	Level $n - 1$

[≈ Hung 1995 10]

The vast majority of the languages discussed by Hung (1995) assign a level-Ø grid mark to each syllable and a level-1 mark to the head of each metrical foot, which usually bear stress of some sort[3] For example, the level-1 marks in the English examples above in (1) through (5) represent foot heads

Hung doesn't consider Macedonian, but does discuss Latin as an antepenultimate-stress language In order to account for Latin, Hung (1995 136) modifies her model considerably by introducing an intermediate grid level to represent each *footed* syllable Thus, in (8) level Ø shows each syllable, as above in the English examples, level 1, each footed syllable, and level 2, each *head* of a foot

(8)

x			Level 2	(= stressed syllable)
x*	x		Level 1	(= footed syllable)
x	x	x	Level Ø	(= syllable)
(Σ	σ)	σ		

[Legend Σ = stressed syllable, σ = unstressed syllable, ( ) = foot edges]

The intuition behind the grid in (8) is the same descending-staircase pattern as in (7), but with more levels This configuration achieves the desired stress location, but with *two* final unstressed syllables

Notice, however, that by Hung's definition in (7), the grid in (8) entails one violation of the **Rhythm** constraint The level-1 mark in the first column of the grid—shown with an asterisk—is followed by a column of equal height, (7) calls for the following column to be level Ø in height Other grids, in (9a-c), with various configurations reflecting three different footings, illustrate this point

(9)

a				b				c			
		x*			x*				x			Level 2
		x			x				x		x*	Level 1
	x	x	x		x	x	x		x	x	x	Level Ø

Each of the grids in (9) has one non-rhythmic grid mark, shown with an asterisk The level-2 mark in each of (9a-b) is not followed by any column of height 1, thus incurring one violation of **Rhythm** In (9c), on the other hand, the level-2 grid mark satisfies **Rhythm** because it is followed by a column of height 1, the offending mark in (9c) is the final level-1 mark because no column of height Ø follows it

Faced with unwanted ties of the sort exemplified by (9a-c), Hung fine-tunes her definition of the **Rhythm** constraint above in (7) Comparing specifically the patterns in (8) and (9c), while also discussing grids like (9a-b), Hung (1995 142-143) writes the following (with Hung's original italics)

(10) "Intuitively, we can see that only in [(8)] is nonfinality truly met, reflecting the observation given by Mester (1994 17) that '(in final position) avoid foot-head and avoid footing ' [ ] It seems then that Latin calls for a refinement of the definition of **Rhythm**, not only should we look at the bad grid marks, but we should also look at the good grid marks More specifically, we prefer the good grid marks to be in *different* columns "

I object to this refinement on both conceptual and empirical grounds Firstly, Optimality-theoretic constraints should be maximally simple, ties should be broken by other constraints Indeed, as I argue below in section 4 using Macedonian data, this refinement is unnecessary because other constraints can

[3] In fact, Hung (1995) usually begins numbering her grid levels with 1 As I mention above in a footnote, I've translated her notation non-crucially throughout this paper to begin with Ø (in keeping with Kenstowicz 1994 554-55 and other works)

be used to rule out the grids in (9a-c) Moreover, the refinement in (10) causes the grammar to undergenerate attested forms in Macedonian, the grid in (9a) is attested, as exemplified below in (18a)

Before turning to the Macedonian data, it's also worth pointing out that other, less rhythmic grids exist The various grids in (11) show successively more violations of **Rhythm** than in (8) or (9a-c)

(11) a		x		b			x*	c	x		x*	Level 2
		x*	x*			x*	x*		x*	x*	x*	Level 1
	x	x	x		x	x	x		x	x	x	Level Ø

These grid configurations are clearly not a challenge to the definition of **Rhythm** above in (7)

To summarize this section, I've shown how Hung's **Rhythm** constraint, along with her proposed intermediate grid level pertaining to footed syllables, accounts for one antepenultimate-stress language In section 4 below I apply this constraint and others to the Macedonian data introduced in section 3

3 Macedonian enlarged stress domains

I now turn in the remainder of this paper to Macedonian, a Balkan Slavic language In this section I begin by presenting the data on simplex words, then proceed to discuss enlarged stress domains

Macedonian is relatively exotic cross-linguistically in exhibiting a so-called final trisyllabic stress window Most words have stress on the antepenultimate syllable, as exemplified in (12a-c)

(12) a	bra tu čed	'cousin'	
b	bra tu če di	'cousin*s*'	
c	bra tu če di *te*	'***the*** cousins'	[Koneski 1983 118]

(Stress is indicated with an underlined vowel) Adding various suffixes to the word changes the number of syllables Adding the vowel *i* in (12b) entails the addition of one syllable, which shifts the stress rightward from *bra* to *tu* Likewise, adding *te* in (12c) shifts the stress rightward by yet another syllable

In words of one or two syllables the stress is regularly on the first syllable It is also possible for trisyllabic or longer words to exceptionally take penultimate or final stress Thus, stress can fall anywhere in the last three syllables of the word This is the so-called final trisyllabic stress window

Of particular interest is a length distinction in vowels between antepenultimate stress (in words of three or more syllables) and penultimate/final stress in smaller words (or in longer words lexically marked for penultimate of final stress) According to Koneski 1983 66-67, penultimate or final stress involves lengthening (and on-glide diphthongization particularly in some western dialects) of the stressed syllable's vowel For example, (13a) shows a disyllabic word with penultimate stress, lengthening of the stressed syllable's vowel, and a *w* on-glide As soon as this word gains a third syllable, as in (13b), the stressed syllable loses vowel length and loses on-glide diphthongization as well

(13) a p^wo lno 'full$_{neut\ sg}$, fully' b polno*to* '***the*** full (one)$_{neut\ sg}$'

(Vowel length is indicated here with a colon) For similar details, see also Koneski 1952/1967 140-41

Koneski (1983 68) briefly mentions a specific western dialect, spoken in Žernonica (Reka), in which a similar distinction between the two kinds of stressed syllables is attested (here *â* = schwa)

(14) a Final stress	b Penultimate stress	c Antepenultimate stress	d Unstressed
pot 'road'	potot the road'	pâtišta 'roads'	na pât on the road

In this dialect final- and penultimate-stressed syllables show augmentation—if not outright vowel length—from *â* to *o*, in (14a-b) Antepenultimate-stressed vowels pattern with unstressed ones, (14c-d)

The distinctions in (13) and (14) suggest to me that final- and penultimate-stressed syllables are bimoraic, while antepenultimate-stressed and unstressed syllables are monomoraic Whereas

Macedonian is not usually considered a weight-sensitive language, Koneski (1983 75-77) argues for a bimoraic interpretation in numerous environments where two syllables have collapsed into one Also, in Macedonian I see no reason to suspect that consonant codas affect syllabic weight Indeed, all quantity-sensitive languages in Slavic (e g , Czech) exclude consonant codas from consideration of moraicity

Assuming, as in other quantity-sensitive trochaic languages, that feet are constructed from either a single heavy syllable or two light syllables, the forms in (14a-c) can be assigned the grids in (15a-c)

(15)	a	x*	b	x*		c	x			Level 2
		x*		x			x*	x		Level 1
		x		x	x		x	x	x	Level Ø
		(pot)		(po)	tot		(pâ	ti)	šta	

(I've added asterisks to the **Rhythm**-violating grid marks, to be discussed further in section 4 below)

Moving to the heart of the paper's data, Macedonian also allows certain combinations of more than one lexical word (LxWd) to be stressed as one prosodic word (PrWd), resulting in a single stress, most often on the antepenultimate syllable This phenomenon is variously referred to as "accentual units" (translating the Macedonian term *akcentski celosti*), "collocational stress" (Elson 1993), and "enlarged stress domains" (Franks 1987), I adopt the last of these, hereafter abbreviated as ESD

The *syntactic* environments which allow ESD include (but aren't limited to) the following the negative element *ne* plus the following verb, as in (16a), a *wh*-question word plus the verb, in (16b), an adjective plus the noun it modifies, in (16c), and a numeral plus the noun it quantifies, shown in (16d)

(16) a	ne nosat	'(they) don't carry'	$1\sigma + 2\sigma$
b	koga dojde	'when (did you/he/she) come'	$2\sigma + 2\sigma$
c	kiselo mleko	'yogurt' (etymologically 'sour' + 'milk')	$3\sigma + 2\sigma$
d	sedom godina	'seven years'	$2\sigma + 3\sigma$

Note also that (16a-d) represent a variety of *prosodic* shapes, indicated in the right-hand column (16a) is a monosyllable plus a disyllable, (16b) is two disyllables, (16c) is a trisyllabic form plus a disyllabic one, and (16d) is two syllables plus three syllables in shape In each of (16a-d) the stress is regular, on the antepenultimate syllable, just as in any of the preceding examples of at least three syllables in size

Whereas it is possible to stress the two words in each of (16a-d) independently, in some contexts the two words combine to be pronounced as a single word, with a single stress In some examples, the ESD gains a new meaning For example, *kiselo mleko*, when stressed as two words, means 'sour milk', but when stressed as one word, *kiselo mleko*, as in (16c), the ESD has come to mean 'yoghurt' I won't discuss the semantics or syntax of these forms any further here, however ESDs are dealt with at length in Rudin, Kramer, Billings, and Baerman 1999 as well as the other references listed in this section

There is an exception to the orderly stress pattern in (16), however If the second LxWd of the ESD is monosyllabic, then the stress on the ESD is not on the third-to-last syllable, but rather on the penultimate syllable, with concomitant lengthening of the stressed syllable's vowel, as shown in (17)

(17) okol^{w}u rid 'around (the) hill' (cf *okolu rid) $3\sigma + 1\sigma$

The exception in (17), which Franks (1989) dubs the monosyllabic-head effect, has its own exception ESDs consisting exactly of a disyllabic followed by a monosyllabic LxWd allow stress to appear either on the penult (with the expected lengthening and diphthongization) or on the antepenult, as in (18a-b)

(18) a prek^{w}u rid *in free variation with* b preku rid 'over (the) hill' $2\sigma + 1\sigma$

Thus, (18b) has regular antepenultimate stress, with no vowel length, while (18a) and (17) exhibit seemingly exceptional penultimate stress Notice, however, that (18a) and (17) are regular to the extent that the stressed, penultimate syllable's vowel is lengthened and diphthongized, as in *p^{w}o lno* 'full' above in (13a) This pattern of regularity within apparent irregularity is summarized in the following table, rows (19) through (21) show stress in simplex (non-ESD) words, in which a single LxWd corresponds to a single PrWd, while various ESD environments are arrayed in (22) through (26)

	Underlying representation	a Penultimate/final stress with long vowel	b Antepenultimate stress with short vowel		
(19)	σ	[(Σ)]		*Legend*	
(20)	σ σ	[(Σ·) σ]		σ	Syllable
(21)	σ σ σ		[. (Σ σ) σ]	Σ	Stressed σ
(22)	σ + σ	[(Σ.) + σ]			Vowel length
(23)	σ σ + σ	[σ (Σ) + σ]	[(Σ σ) + σ]	+	LxWd boundary
(24)	σ σ σ + σ	[σ σ (Σ:) + σ]		[ ]	PrWd edges
(25)	. σ + σ σ		[... (Σ + σ) σ]	..	Additional σ(s)
(26)	σ + ... σ σ σ		[σ + . (Σ σ) σ]	( )	Foot edges

A gap in the table indicates that this form is not attested for this underlying representation For example, a trisyllabic or larger simplex word—shown in row (21) of the table and exemplified above in (12a-c), (13b), (14c), and (15c)—has only the antepenultimate-stress, short-vowel option, listed in (21b)

Grids corresponding to each of the simplex patterns in (19a), (20a), and (21b) are shown in (27a-c) [~ (15a-c)], respectively As with simplex words of less than three syllables in size, the disyllabic domain in (22) results in penultimate stress (with vowel-lengthening and -diphthongization), the grid for this word is shown in (27b) Trisyllabic or longer ESDs, just like simplex words, generally take antepenultimate stress, as illustrated in (23b), (25b), and (26b), these have the same grid as (27c)

```
(27) a   x*        b   x*          c   x                    Level 2
         x*            x               x*   x               Level 1
         x             x     x         x    x    x          Level Ø
         (Σ )          (Σ )  σ         (Σ   σ)   σ
```

Exceptional-stress simplex words take the grids in (27a-b) The grid in (27a) occurs only with simplex words, there is no ESD counterpart of the grid in (27a) because ESDs require at least two syllables

In summary, among ESDs of three syllables or more in total size, the primary exception is when the ESD's second LxWd is monosyllabic, as in (23a) and (24a), exemplified above by *prek*^{w}*u rid* (18a) and *okol*^{w}*u rid* (17), respectively The riddle is how to account for the required antepenultimate stress in (21b), (25b) and (26b), while requiring only penultimate stress—and vocalic length—in (19a), (20a), (22a), and (24a), yet allowing ESDs with 2σ + 1σ shape to take either option, as in (23a-b)

4 Optimality-theoretic analysis

I propose a solution similar to Hung's (1995 140-51) treatment of Latin, summarized above in section 2 My model involves the constraints in (28) All but the **Lapse** constraint are either proposed, adopted, or adapted by Hung [4] Crucially, I rely on Hung's *first* definition of **Rhythm** in (7), not her refinement of it

[4] Aside from **Rhythm**, already defined above in (7), **Weight-to-Stress**, **Fill**, and **Ft-Form** are defined in Hung 1995 30, 5, and 30 (respectively) Instead of **Rtmost-Ft**, Hung (1995 145) uses **Edgemost**, and unfortunately fails to define this constraint The definition of **Rtmost-Ft** in (28b) is my interpretation of Hung's intended definition, see Billings 1997 for discussion **Rtmost-Ft** is not identical to the **Edgemost (pk, L/R, Word)** defined by Prince and Smolensky (1993 39) and used in their (1993 43-66) analysis of Latin The former requires feet to be PrWd-final, while the latter requires the stress peak to be final Because high-ranked **Rhythm** essentially entails that only one foot be present, this distinction is not crucial **Ft=μμ**, although not actually defined in Hung 1995 147, refers to Prince and Smolensky's (1993 59) **Rhythmic Harmony** Finally, **Al-Lx-Str** is my modification of the rather malleable **Align** constraint family, cf , for example, Hung 1995 79, 104

(28) a { **Weight-to-Stress** (a heavy σ is stressed) › **Ft=μμ** (a foot is exactly two moras in weight) }

b >> **Rhythm** [as defined in (7) above, *not* as redefined in (10)]
>> **Rtmost-Ft** (feet are as far to the right as possible)
>> **Al-Lx-Str** (align each end of a LxWd with a stressed syllable)
>> **Lapse** (prohibits consecutive, unfooted syllables)[5] [Green and Kenstowicz 1995]

c { **Fill** (prohibits epenthesis) = **Ft-Form** (if the foot has a head, it is on the right) }

The two constraints in (28a), **Weight-to-Stress** and **Ft=μμ**, are undominated The consequence of this is that every heavy syllable in Macedonian is stressed, and every foot is bimoraic—either two light syllables or one heavy syllable In addition, other undominated constraint(s) of some sort must be present to generate the intermediate grid level shown in (8) above [6] Yet another undominated constraint, which may be part of *Gen*, requires each PrWd to have a main stress Since none of **Weight-to-Stress**, **Ft=μμ**, or these other undominated constraints is violated, they cannot be ranked relative to each other

The undominated constraints then each dominate the rest of the hierarchy Furthermore, **Rhythm** » **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** Finally, the two constraints in (28c) are crucially tied, see below regarding this tie's exact properties The ranking of the constraints in (28c) relative to **Rtmost-Ft**, **Al-Lx-Str**, or **Lapse** cannot be determined precisely, however, **Fill** and **Ft-Form** must be dominated by **Rhythm** [7] For simplicity of presentation, I've listed **Fill** and **Ft-Form** below **Lapse** in the tableaux

Some constraints are violated categorically, while others are gradient For example, **Weight-to-Stress** and **Ft=μμ** are either violated or satisfied, these are categorical constraints An example of a gradient constraint is **Rhythm**, where the violating marks are simply counted from the grid For instance, (27b-c) each have one **Rhythm**-violating grid mark, while (27a) has two such violations [8]

The following tableaux corroborate the rankings in (28) I do not list any undominated constraints in the tableaux because of width limitations (and because they do not interact in any interesting way with any other constraints) Additionally, because each candidate in the tableaux satisfies the undominated constraints, each foot in the various candidates consists of either a single heavy syllable or two light syllables The constraints in (28b-c) are arrayed across the top of each tableau in their precise ranking, I point out each part of this ranking as it is proven by a particular tableau (Attested forms are indicated with a pointing finger [☞] in the left-hand column of each tableau Fatal violations of any unattested candidate are indicated with an exclamation point [!] The shading reflects the overall ranking of the tableaux taken as a group, not the ranking proven by any single tableau)

I begin in tableau (29) with a simplex two-syllable word, cf (13a) and (14b) above for data In each tableau I show the input (= underlying representation) between curly braces—e g , { σ σ } in (29) The only outputs which satisfy the dominant constraints in (28a) are these four candidates, arrayed as rows of the tableau (29a) shows a disyllabic trochee, (29b) shows a disyllabic iamb, (29c) shows a final heavy syllable's own foot, and (29d) shows the same heavy-syllable foot built over the initial syllable

[5] A pre-Optimality formulation of **Lapse** is shown in (6b) above Green and Kenstowicz (1995 1) actually define **Lapse** as follows "adjacent unstressed [ ] syllables must be separated by a foot boundary " That is it is also possible for adjacent unstressed syllables to be *inside* a foot This distinction is irrelevant to this study, because of the superordinate **Ft=μμ** constraint in (28a), such unbounded feet wouldn't survive the competition until the relatively lower-ranked **Lapse** constraint

[6] Hung (1995 136) does not define such a constraint Nor do I attempt do so here Among other things, this yet undefined constraint—in conjunction with the relatively dominant **Rhythm** constraint, both ranked above (iambic) **Ft-Form**—would induce trochaic feet Hung adds that introducing the intermediate layer in (8) "would not have the same rhythmic advantage in an iambic system Since the iambic foot-head is on the right, it will never be followed by a non-head" (1995 136, fn 2)

[7] If **Fill** were ranked above **Rhythm**, then structures like [(Σ) σ], shown with a grid above in (15b), would not be attested Instead, the less rhythmic *[(Σ σ)] would result (without vocalic length), this form's grid would have one level-2 mark (over the first syllable), two level-1 marks, and two level-Ø marks This would result in two violations of **Rhythm** one for each level-1 grid mark (By transitivity, if **Rhythm** » **Fill**, and **Fill** is tied with **Ft-Form**, then **Rhythm** » **Ft-Form**)

[8] The violations of **Rhythm** in (27a-c) are forced by the undominated constraints, it's impossible to satisfy **Weight-to-Stress**, **Ft=μμ**, and the constraint(s) requiring the intermediate grid level without having at least the one **Rhythm**-violating grid mark in each of (27b-c) Furthermore, because of minimal-word considerations, it's impossible to satisfy all the undominated constraints in a monosyllabic word, (27a), without two **Rhythm** violations (since no down-stepping is possible word-finally)

(29) { σ σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** , {**Fill** = **Ft-Form**} }

		Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
a	x x* x* x x [(Σ σ)]	* *!		*			*
b	x* x* x* x x [(Σ σ)]	* *! *		*			
c	x* x* x x [σ (Σ.)]	* *!		*		*	
☞ d	x* x x x [(Σ) σ]	*	*	*		*	

Comparing (29c-d) proves that **Rhythm** » **Rtmost-Ft** These two candidates fare equally with regard to every other constraint (one asterisk under each of **Al-Lx-Str** and **Fill**, and no asterisks under **Lapse** or **Ft-Form**) At this point the ranking is only { **Weight-to-Stress** , **Ft=μμ** } » **Rhythm** » **Rtmost-Ft**

An explanation of the remaining constraints' violations in (29) is in order (29d) violates **Rtmost-Ft** once because the foot is separated from the right edge of the word by one syllable Next, in (29a-c) the feet are at the right edge, satisfying **Rtmost-Ft** All four candidates violate **Al-Lx-Str**, either one edge or the other of the LxWd does not coincide with a stressed syllable In (29a, d) the right edge has no stress, while in (29b-c) the left edge is stressless There are no **Lapse** violations by virtue of there being no sequences of unstressed syllables The epenthetic vowel length in (29c-d) violates **Fill**, while (29a-b) show no epenthesis Lastly, (29a) violates **Ft-Form** because there's a head-initial trochee

Next, consider monosyllabic grids, as in (15a) and (27a) above The pseudo-tableau in (30) shows how two violations of **Rhythm** are necessary to ensure satisfaction of the constraints in (28a)

(30) { σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** , {**Fill** = **Ft-Form** }}

	Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
☞ x* x* x [(Σ)]	* *				*	

I call this a pseudo-tableau because there is no actual constraint interaction Accordingly, because the best-formedness determination has already taken place above **Rhythm**, all the cells shown are shaded

To summarize up to this point, in PrWds of less than three syllables a single foot formed from a single heavy syllable is chosen as optimal In monosyllabic PrWds there is no other option, of course In disyllabic forms it is possible to produce a foot from two light syllables, as in (29a) However, because such a foot at the very right edge of the word violates **Rhythm** twice, the more rhythmic candidate in (29d) is selected This explains why penultimate and final stress entails vocalic length

With trisyllabic simplex words, tableau (31) formalizes how antepenultimate stress without vowel length is optimal, see (12a), (13b), or (14c) above for examples Furthermore, there now being a sufficient number of syllables in the PrWd, tableau (31) additionally shows how the **Al-Lx-Str** constraint is instrumental in selecting a candidate with stress on a syllable at one edge of the LxWd

(31) { σ σ σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** › {**Fill** = **Ft-Form** }}

		Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse		Fill	Ft-Form
a	x x* x* x x x [σ (Σ σ)]	* *!		* *				*
☞ b	x x* x x x x [(Σ σ) σ]	*	*	*				*
c	x* x* x* x x x [σ (σ Σ)]	* *! *		*				
d	x* x* x x x x [(σ Σ) σ]	* *!	*	* *				
e	x* x* x x x [σ σ (Σ)]	* *!		*	*		*	
f	x* x x x x [σ (Σ) σ]	*	*	* *!			*	
g	x* x x x x [(Σ) σ σ]	*	* *!	*	*		*	

As tableau (31) shows, although each of the candidates has at least one violation of **Rhythm**, any foot that is exactly at the right edge of the PrWd will incur at least two **Rhythm** violations, as in (31a, c, e)

Additionally, the candidates with disyllabic iambic feet, in (31c-d), show that at least two **Rhythm** violations occur, as in (31d), no matter how far the foot is from the PrWd's right edge If the iambic foot is at the right edge, in (31c), then a third violation is incurred Candidates (31b, d) each have a two-syllable foot in the very same position, the foot in (31b) is a trochee, while in (31d) it is an iamb The fact that an iambic foot is consistently less rhythmic—given the additional intermediate level introduced above in (8)—than a trochee, there is no need for a trochaic foot-form constraint to mirror the inherently iambic **Ft-Form** constraint in (28c), the effect of which will be seen in tableau (39) below

The candidates that survive the **Rhythm** constraint—namely, (31b, f, g)—move on to the next constraint **Rtmost-Ft** Because of **Rhythm**'s inherent aversion to the right edge of the PrWd, each of (31b, f, g) incurs at least one violation of **Rtmost-Ft** However, (31g) incurs comparatively more violations of **Rtmost-Ft** and is eliminated by that constraint This leaves only (31b, f), **Al-Lx-Str** decides between these two candidates by virtue of (31f) having stress at *neither* end of the LxWd Thus, (31b) survives as the attested candidate I should emphasize that the tableaux so far have not proven any rankings below **Rtmost-Ft** (namely, the rankings of **Rtmost-Ft** » **Al-Lx-Str** » **Lapse**, as well as the tie between **Fill** and **Ft-Form**) These additional rankings are established in the tableaux yet to come

Tableau (32) shows a simplex four-syllable word, for data, see example (12b) above (Due to space limitations, I discontinue showing metrical grids in the remaining tableaux Nor do I continue to list disyllabic iambs, as in (29b) and (31c-d), such feet are always less rhythmic than other candidates)

(32) { σ σ σ σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** , {**Fill** = **Ft-Form** }}

		{ σ σ σ σ }	Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
	a	[σ σ (Σ σ)]	* *!		* *	*		*
☞	b	[σ (Σ σ) σ]	*	*	* *			*
	c	[(Σ σ) σ σ]	*	* *!	*	*		*
	d	[σ σ σ (Σ·)]	* *!		*	* *	*	
	e	[σ σ (Σ) σ]	*	*	* *	*!	*	
	f	[σ (Σ·) σ σ]	*	* *!	* *	*	*	
	g	[(Σ.) σ σ σ]	*	* *! *	*	* *	*	

Unlike the trisyllabic environment in (31), in which **Al-Lx-Str** makes the final determination, in (32) the only candidates which survive **Rtmost-Ft** violate **Al-Lx-Str** equally That is, neither of (32b, e) is stressed at an edge of the LxWd Therefore, the algorithm moves on to **Lapse**, (32e), with two consecutive unfooted syllables, violates this constraint, making antepenultimate (32b) the attested form

Additionally, the relatively high ranking of **Rhythm** in the hierarchy—along with the intermediate grid level for footed syllables—has the effect of ruling out more than one foot per PrWd

(33)

	a				b				
	x						x*		Level 3
	x		x		x		x		Level 2
	x*	x*	x*	x*	x*	x*	x*	x*	Level 1
	x	x	x	x	x	x	x	x	Level Ø
	(Σ	σ)	(Σ	σ)	(Σ	σ)	(Σ	σ)	

The grids in (33a) show how a four-syllable word might be prosodized with two feet, causing at least four **Rhythm** violations Due to nuclear stress, if the *latter* foot bears main stress, then a fifth violation is entailed Even in a five-syllable PrWd (not shown), with a gap between feet, there would be three violations Thus, one and only one foot is generated under such a combination of dominant constraints

Additional syllables—cf (12c)—do not change the result in any significant way, as (34) shows

(34) { σ σ σ σ σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** , {**Fill** = **Ft-Form** }}

		{ σ σ σ σ σ }	Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
	a	[σ σ σ (Σ σ)]	* *!		* *	* *		*
☞	b	[σ σ (Σ σ) σ]	*	*	* *	*		*
	c	[σ (Σ σ) σ σ]	*	* *!	* *	*		*
	d	[(Σ σ) σ σ σ]	*	* *! *	*	* *		*
	e	[σ σ σ σ (Σ:)]	* *!		*	* * *	*	
	f	[σ σ σ (Σ:) σ]	*	*	* *	* *!	*	
	g	[σ σ (Σ:) σ σ]	*	* *!	* *	* *	*	
	h	[σ (Σ.) σ σ σ]	*	* *! *	* *	* *	*	
	i	[(Σ.) σ σ σ σ]	*	* *! * *	*	* * *	*	

As feet move successively further from the right edge of the PrWd, more and more violations of **Rtmost-Ft** are incurred Additionally, with only one foot per candidate, more and more **Lapse** violations result Nonetheless, the antepenultimate-stress, disyllabic-foot candidate (34b) is selected by **Lapse**

I turn now to ESDs The remaining tableaux of this paper formalize this phenomenon's unique properties Tableau (35) shows an ESD the second LxWd of which is trisyllabic, as in (26b) above

(35)

		{ σ } + { σ σ σ }	**Rhythm** »	{ **Rtmost-Ft** »	**Al-Lx-Str** »	**Lapse** ›	{**Fill** =	**Ft-Form** }}
	a	[σ + σ (Σ σ)]	* *!		* * * *	*		*
☞	b	[σ + (Σ σ) σ]	*	*	* * *			*
	c	[(Σ + σ) σ σ]	*	* *!	* *	*		*
	d	[σ + σ σ (Σ·)]	* *!		* * *	* *	*	
	e	[σ + σ (Σ·) σ]	*	*	* * * *!	*	*	
	f	[σ + (Σ:) σ σ]	*	* *!	* * *	*	*	
	g	[(Σ·) + σ σ σ]	*	* *! *	* *	* *	*	

As above in tableaux (31), (32), and (34), the leading candidates in this tableau, (35b, e), incur only one violation each of **Rhythm** and **Rtmost-Ft**, pushing the optimality determination to **Al-Lx-Str** However, unlike the simplex (i e , non-ESD) forms in the preceding tableaux, ESDs have *four* LxWd edges And (35b) is preferable because its stressed syllable coincides with the left edge of the second LxWd

Essentially the same result is achieved with ESDs ending in a disyllabic LxWd, cf (25b) above

(36)

		{ σ } + { σ σ }	**Rhythm** »	{ **Rtmost-Ft** »	**Al-Lx-Str** »	**Lapse** ›	{**Fill** =	**Ft-Form** }}
	a	[σ + (Σ σ)]	* *!		* * *			*
☞	b	[(Σ + σ) σ]	*	*	* *			*
	c	[σ + σ (Σ.)]	* *!		* * *	*	*	
	d	[σ + (Σ·) σ]	*	*	* * *!		*	
	e	[(Σ·) + σ σ]	*	* *!	* *	*	*	

Candidate (36b) wins because its main stress corresponds to two of the four LxWd edges of the input (i e , both edges of the first LxWd) In (36d) the stressed syllable coincides with only one LxWd edge (the left edge of the second LxWd) So far, however, the ESDs in tableaux (35) and (36) have results identical to non-ESD forms with the same number of syllables in tableaux (32) and (31), respectively

Nor does an ESD composed of two monosyllables—cf (22a)—fare any differently than a simplex disyllable, in tableau (29) above This is because **Rhythm** makes the optimality determination

(37)

		{ σ } + { σ }	**Rhythm** »	{ **Rtmost-Ft** »	**Al-Lx-Str** »	**Lapse** ›	{**Fill** =	**Ft-Form** }}
	a	[(Σ + σ)]	* *!		* *			*
	b	[σ + (Σ:)]	* *!		* *		*	
☞	c	[(Σ.) + σ]	*	*	* *		*	

However, the unique circumstances of two LxWds for every PrWd in an ESD bring about a different stress pattern when the second LxWd in the ESD consists of exactly one syllable, as (38) and (39) show

Franks's (1987, 1989) monosyllabic-head effect—cf (24a) above—is formalized in tableau (38)

(38) { σ σ σ } + { σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** › {**Fill** = **Ft-Form** }}

	{ σ σ σ } + { σ }	Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
a	[σ σ (Σ + σ)]	* *!		* * *	*		*
b	[σ (Σ σ) + σ]	*	*	* * * *!			*
c	[(Σ σ) σ + σ]	*	* *!	* * *	*		*
d	[σ σ σ + (Σ)]	* *!		* *	* *	*	
☞ e	[σ σ (Σ.) + σ]	*	*	* * *	*	*	
f	[σ (Σ:) σ + σ]	*	* *!	* * * *	*	*	
g	[(Σ.) σ σ + σ]	*	* *! *	* * *	* *	*	

Because the stressed syllable in (38b) fails to coincide with any of the LxWd edges, the candidate in (38e) is selected The ESD-penultimate stressed syllable coincides with the first LxWd's right edge

Finally, the heart of the ESD phenomenon is formalized in tableau (39), corresponding to (23a-b) above Unlike the other tableaux of this paper, not one but two candidates are attested in free variation

(39) { σ σ } + { σ } **Rhythm** » { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** › {**Fill** = **Ft-Form** }}

	{ σ σ } + { σ }	Rhythm	Rtmost-Ft	Al-Lx-Str	Lapse	Fill	Ft-Form
a	[σ (Σ + σ)]	* *!		* * *			*
☞ b	[(Σ σ) + σ]	*	*	* * *			*
c	[σ σ + (Σ)]	* *!		* *	*	*	
☞ d	[σ (Σ) + σ]	*	*	* * *		*	
e	[(Σ) σ + σ]	*	* *!	* * *	*	*	

As with most of the preceding tableaux, two candidates fare equally with regard to **Rhythm** and **Rtmost-Ft** Unlike the preceding ESD tableaux, however, two candidates fare equally with regard to **Al-Lx-Str**, with three violations each (39b) stresses the initial syllable, which coincides with the first LxWd's left edge, the second-syllable stress in (39d) coincides with a different edge—this time the same LxWd's *right* edge The algorithm then moves on to **Lapse**, which is not violated by either candidate

For the first and only time in this analysis, the two tied constraints—**Fill** and **Ft-Form**, defined in (28c) above—affect the outcome **Fill** prohibits epenthetic material from appearing in the output, while **Ft-Form** requires a disyllabic foot to have the second syllable as its head These constraints are ranked as a conjunctive local tie, where "two constraints are merged into a single constraint [ ] A candidate violates a tie if it violates a constraint that is part of this tie" (Muller 1999 6) In other words, a violation of **Fill** is just as adverse as a **Ft-Form** violation Thus, the two candidates in (39b, e) are both attested because they fare equally with regard to every member in the constraint hierarchy

The tie between (39b, e) is especially instructive because it illustrates two different kinds of optionality In addition to the tied constraints discussed in the preceding paragraph, the two candidates fare equally—albeit in very different ways—with regard to the **Rhythm** and **Rtmost-Ft** constraints, I discuss **Rtmost-Ft** first The stressed syllables in (39b, e) do not coincide with the same LxWd edge, in (39b) the alignment is with the first LxWd's *left* edge, while in (39e) it is with the same LxWd's *right* edge A similar situation leads to the tie in the **Rhythm** column as well Grids corresponding to (39b, e) are shown in (27c, b), respectively The **Rhythm**-violating grid mark in (39b) is on level 1, while in (39e) it caused by a level-2 grid mark This sort of tie—where two distinct stress configurations or grid patterns fare equally—is possible only with maximally simple constraint definitions Hung's refinement of **Rhythm**, quoted in (10) above, would incorrectly predict only one of the attested forms i e , (39b)

Using the tie between **Fill** and **Ft-Form** established in tableau (39), it is now possible to fill in the remaining rankings in the hierarchy Given that **Fill = Ft-Form**, comparing candidates (38b, e) proves that **Al-Lx-Str » Lapse**, these two candidates fare equally on every other constraint in the hierarchy (again, bearing in mind that **Fill** and **Ft-Form** essentially function as a single constraint) Furthermore, given the ranking of **Rhythm » Rtmost-Ft** from (29c-d) and of **Al-Lx-Str » Lapse** determined from (38b, e), it is finally possible to rank **Rtmost-Ft » Al-Lx-Str** Only the ranking of **Rtmost-Ft » Al-Lx-Str** will result in the attested form in (32b) Thus, the ranking in (40) is established

(40) Dominant constraints » **Rhythm** » { { **Rtmost-Ft** » **Al-Lx-Str** » **Lapse** } , { **Fill** = **Ft-Form** } }

"Dominant constraints" here refer to those listed in (28a) and the others discussed right after (28a-c)

To summarize the paper so far, then, I have shown that many of the constraints and mechanisms proposed by Hung (1995) for another penultimate-stress language, Latin, are directly applicable to Macedonian Moreover, the free variation in stress in tableau (39) corroborates Hung's **Rhythm** constraint (in its simplest formulation) Next, **Al-Lx-Str**, the constraint which requires LxWd edges to coincide with the stressed syllable, is crucial in generating the monosyllabic head effect In addition, **Rhythm**, in conjunction with the undominated **Weight-to-Stress** and **Ft=μμ** constraints, insures that a *trochaic* foot-form constraint is not needed in addition to the inherently *iambic* **Ft-Form** constraint used here Indeed, the latter is necessary even in this overwhelmingly trochaic language to counterbalance the effects of **Fill** I've also shown that Optimality Theory can capture the seeming irregularities in stress location associated with the monosyllabic-head effect in Macedonian enlarged stress domains Crucially, maximally simple constraints are required, two candidates tied with regard to one constraint nearly always are resolved by non-ties on other constraints lower in the hierarchy Remarkably, every single constraint used here is also proposed elsewhere in the literature, proving the universality of this theory

5 Remaining unresolved phenomena and directions for future research

This is not to say that the entire problem of Macedonian ESD stress is explained I have intentionally set aside ESDs in which verbal clitics intervene between the two LxWds The syntactic environments in (16a-b) also allow intervening verbal clitics A few examples are listed in (41) through (43)

(41) Final LxWd is longer than one syllable

a	ne bi rekol not would said	'He would not have said '	1σ + 1 clitic + 2σ
b	koj bi go kazal who would it told	'Who would tell it?'	1σ + 2 clitics + 2σ
c	koga bi vlegol whom would entered	'When would he enter?'	2σ + 1 clitic + 2σ
d	ne sme mu go prikažuvale not 2 PL him it told	'We didn't tell it to him '	1σ + 2 clitics + 5σ

(42) Final LxWd is exactly one syllable (ESD is four syllables or larger)

a	što bi mu· zel whom would him taken	'What should he take to him?'	1σ + 2 clitics + 1σ
b	ne bi mu go dal not would him it given	'He should not have given it to him '	1σ + 3 clitics + 1σ

(43) Final LxWd is exactly one syllable (ESD is exactly three syllables)

a	ne bi dal ~ ne bi dal not would given	'He should not have given '	1σ + 1 clitic + 1σ
b	koj go· zel ~ koj go zel who it taken	'Who took it?'	1σ + 1 clitic + 1σ

Franks (1987, 1989) and Elson (1993) discusses such data in greater detail Forms with a polysyllabic final LxWd, in (41), result in the predictable antepenultimate stress with no lengthening of the stressed vowel In (42), not surprisingly, the monosyllabic-head effect surfaces, with penultimate stress and vocalic length Finally, in (43) the same alternation in stress as in tableau (39) is attested The problem is that the forms in (42) and the penultimate-stress options in (43), under the analysis presented above, rely on the existence of a right-hand LxWd edge coinciding with the stressed penultimate syllable

To date, the syntax of ESDs has not been adequately explained For example, Elson (1993 158, n 4) and Rudin *et al* (1999 561) point out that the environment in (16b)—*wh* word (+ clitics) + verb—does not correspond to any syntactic constituent, both papers also show several prosodic tests which suggest certain syntactic configurations Lacking any definitive syntactic account of Macedonian ESDs, however, I leave the issue open Possibly, these phonological facts will inform future syntactic analyses

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