Cyclicity and non-cyclicity in Maltese: Local ordering of phonology and morphology in OT-CC*

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1 Introduction

Stress in Maltese furnishes one of the case studies in Brame's (1974) classic article arguing in support of the transformational cycle in phonology (Chomsky, Halle & Lukoff 1956). One argument for cyclic application of stress in Maltese is a phenomenon which the language shares with a number of Levantine Arabic dialects: syncope of vowels in unstressed open syllables underapplies in verb stems with pronominal (object-marking) suffixes. For instance, subject-marked [ˈħtaf-na] 'we snatched' contrasts with object-marked [ħa.ˈtaf-na] 'he snatched us' (Odden 1993: 139-140); in the latter form the first vowel fails to syncopate, which can be explained by assuming that it gets stress on an earlier cycle containing just the bare stem /ħataf/.

This paper addresses a complication in the Maltese facts first raised in the theoretical literature by Odden (1990, 1993): this evidence for the cycle obtains only in consonant-final stems. Vowel-final (third weak radical)[1] stems show no underapplication of syncope in object-suffixed forms. The analysis I propose here builds on Odden's idea that the difference is connected with the fact that stem-final vowels lengthen before suffixes. I will argue that the facts can best be approached as resulting from conflicting preferences about pairwise orderings between phonological and morphological processes: on the one hand there is a pressure for object marking to be preceded by stress (i.e., for stress to be applied on the inner cyclic domain), but on the other hand, there is a pressure for stress to be applied after vowel lengthening (which encourages deferring stress until after object suffixation and the lengthening it causes). This arrangement, which echoes in many ways Anderson's (1969, 1974) theory of Local Ordering, can be straightforwardly implemented in Optimality Theory with Candidate Chains (OT-CC: McCarthy 2007), and more specifically in a variant of OT-CC called Optimal Interleaving (OI: Wolf 2008) which includes morph-insertion among the operations which take place in the OT-CC phonology. Under this view, 'cyclicity' (the application of certain phonology before certain morphology) is not something that is hard-wired into the overall modular architecture of a language's grammar, but is instead simply a particular type of ordering relation between phonological and morphological processes which a language may select for some forms but not for others.

2 Stress, syncope, and the cycle in Maltese

Setting aside incompletely nativized loans, stress in Maltese is placed as follows (Brame 1972, 1974):

(1) (a) On the ultima, if it is superheavy (or the word is monosyllabic), else
(b) On the penult, if it is heavy (or the word is bisyllabic), else
(c) On the antepenult.

The Maltese stress system closely resembles those of the Levantine Arabic dialects (Brame 1974: 45; Vella 2003: 270-271). This includes not only the basic pattern in (1) and cyclic

application of stress before object suffixes, but also the lack of cyclic stress in third weak radical verbs, which is shared with some though not all Levantine dialects (Johnson 1990: §5).[2]

As mentioned, one piece of evidence for cyclic stress in C-final stems comes from the syncope of vowels in unstressed, non-final open syllables. Syncope underapplies in consonant-final verb stems which carry object suffixes (Sutcliffe 1936: 15, 155; Brame 1974: 56; Berrendonner, Le Guern & Puech 1983: 224; Odden 1993: 139; Borg 1997: 279). The pattern is illustrated by data like these, mentioned earlier in the introduction:

(2) (a)	/ħataf-$Ø_{3.masc.sg.subj}$/	[ˈħa.taf]	‘he snatched’
(b)	/ħataf-$na_{1pl.subj.}$/	[ˈħtaf.na]	‘we snatched’
(c)	/ħataf-$Ø_{3.masc.sg.subj}$ -$na_{1pl.obj}$ /	[ħa.ˈtaf.na]	‘he snatched us’

In (2a), where there is no overt affixation, stress falls on the penult as dictated by (1b). The second, unstressed vowel does not delete, since it falls in a syllable which is word-final as well as closed. Syncope is able to occur in (2b), where the appearance of the 1st person plural suffix /-na/ as a subject marker causes stress to fall on the stem-final syllable [taf], as this is now a heavy penult. The first stem-vowel then finds itself in an unstressed open syllable /ħa/, and as a result is syncopated.

The evidence for the cycle comes from forms like (2c), where /-na/ is serving as an object marker. Here, we again find stress falling on the surface penult [taf]. However, the first vowel of the stem now fails to syncopate, even though the underlying segmental composition of the word is identical to that of (2b) where there is syncope. This inconsistency can be resolved if we assume that object-marked verbs contain an inner cyclic domain which includes the stem and any subject suffixes, but not the object suffixes. Within this domain, the first stem vowel in forms like (2c) gets stress, and this stress survives as a secondary stress on subsequent cycles, protecting the vowel from syncope. By contrast, when /-na/ is a subject maker as in (2b), it is part of the same cyclic domain as the stem, and so the first stem vowel never receives stress, thereby remaining eligible for syncope:

(3)	‘we snatched’	‘he snatched us’
Input	[ħataf-na]	[[ħataf-Ø]-na]
Cycle 1		
Stress	ħa.ˈtaf.na	ˈħa.taf
Syncope	ˈħtaf.na	*no change*
Cycle 2	*n/a*	
Stress		ˌħa.ˈtaf.na
Syncope		*no change*
Output	[ˈħtaf.na]	[ħa.ˈtaf.na]

This quite straightforward analysis faces a complication first pointed out in the theoretical literature by Odden (1990, 1993): cyclic stress, as diagnosed by the underapplication of syncope in object-marked verbs, occurs only with consonant-final verb stems. Vowel-final verbs by contrast *do* permit syncope of the first stem vowel when stress shifts rightwards under object suffixation. This fact is noted for example in Sutcliffe’s (1936) grammar: “Verbs with third weak radical such as **nesa** *to forget*, **mela** *to fill*, **beda** *to begin*, are exceptional. The first vowel drops and as the vowel **a** on receiving the accent becomes **ie**” [phonologically /ɪː/-*MW*][3, 4, 5] (p. 157; boldface in original):

(4) [mlɪːni] ‘he filled me’ [mlɪːna] ‘he filled us’
[mlɪːk] ‘he filled you.SG’ [mlɪːkom] ‘he filled you.PL’
[mlɪːh] ‘he filled him’ [mlɪːhom] ‘he filled them’
[mlɪːha] ‘he filled her’

Sutcliffe goes on to note that the same holds for verbs with indirect object markers[6] (p. 160): “As with the simple suffixes [...] so also with the indirect suffixes, the verbs with third weak radical are exceptional, and lose their first vowel. Thus from **sewa** *to cost:*” [boldface in original]

(5) [swɪːli] 1sg IDO [swɪːlna] 1pl IDO
[swɪːlek] 2sg IDO [swɪːlkom] 2pl IDO
[swɪːlu] 3sg masc. IDO [swɪːlhom] 3pl IDO
[swɪːlha] 3sg fem. IDO

The goal of this paper is to account for this difference between consonant-final and vowel-final verb stems. Before seeing the analysis, however, I will first outline the theoretical premises upon which it is based.

3 Optimal Interleaving

3.1. OT with Candidate Chains

In Optimality Theory (Prince & Smolensky 2004 [1993]), the grammar determines output forms by producing a set of candidate outputs for a given input, and then evaluating them according to a hierarchy of ranked constraints. In the most common, parallel implementation of OT, each candidate is a direct mapping from input to (potential) output; there are no intermediate derivational stages, and the disparity between the input forms and candidate output forms is in principle unlimited (what McCarthy & Prince [1993a] call FREEDOM OF ANALYSIS).

OT-CC is different in that the competing candidates are (approximately) gradual, multi-step derivations,[7] or CHAINS. For example, as a candidate where apocope feeds final devoicing, in OT-CC we would have something like <taga, tag, tak> as a candidate rather than a direct mapping /taga/→ [tak] in parallel OT. There are three principles which define what is a possible candidate chain in any given language:

(6) *Gradualness*: Given a chain $<\ldots, l_i, l_{i+1}, \ldots>$, l_{i+1} can differ from l_i by the performing of at most one basic operation.

(7) *Harmonic improvement*: Given a chain $<\ldots, l_i, l_{i+1}, \ldots>$, l_{i+1} must be more harmonic than l_i, given the constraint ranking of the language in question.

(8) *Local Optimality*: Let $<f_1, f_2, \ldots f_n>$ be a valid chain in language L, and let $\{g_1, g_2, \ldots g_m\}$ be the set of all the forms which could be produced by applying an operation of type T to f_n. Then $<f_1, f_2, \ldots f_n, g_i>$ is not a valid chain of L unless g_i is the most harmonic member of the set $\{g_1, g_2, \ldots g_m\}$. (*Informally*: starting from any given point, if there is more than one way of doing some operation, the grammar may place under consideration only the initially-best way of doing that operation.)

The gradualness requirement (6) requires that candidate derivations move from input to output in manner than makes only one change at a time. Of course, this requirement must come with some theory of what counts as one change. Much research in OT-CC and in the related

theory of Harmonic Serialism (Prince & Smolensky 2004 [1993]: 19-26, 94-97) is focused on exploring the consequences of different hypotheses about what the basic operations are. In McCarthy (2007), these are assumed to be familiar operations on segmental structure: delete one segment; epenthesize one segment; change the value of one feature on one segment; metathesize two adjacent segments.

Since the Maltese facts involve both prosodic structure and affixation, we will have to assume the existence of operations dealing with these things. Regarding prosody, I will first of all assume, with McCarthy (2010), that resyllabification happens for free at each step of the derivation, along with whatever other operation was performed. The reason for this is that unfaithful phonological mappings may be harmonically improving due the less-marked syllable structure which they make possible. If, say, a language epenthesized a vowel to get rid of syllable codas (e.g. /kan/ → [ka.nɨ]), epenthesis would yield no immediate improvement in performance on NoCoda if epenthesis and resyllabification of the erstwhile coda had to occur as separate steps (/kan/ → kan.ɨ → [ka.nɨ]).[8] The building of higher-level prosodic structure will, however, occur as distinct derivational steps. Specifically, I will assume that the following operations are available:

(9) Build one Prosodic Word node and its associated foot-parse (minimally the single head foot). (McCarthy 2008)

(10) Build one foot. (Pruitt 2008, 2010; Kimper 2011)

Assumptions about affixation will be deferred until the next subsection, when OI and its assumptions about the interface are laid out.

Once the chains have been built, they compete against one another as candidates. As in parallel OT, the markedness constraints evaluate only the last form in the chain (the candidate output) and the faithfulness constraints evaluate this form's disparity from the input. The motivation for positing multi-step derivations is to account for counter-feeding and counter-bleeding opacity (Kiparsky 1973), and so it is necessary to add a new set of constraints which will refer to the intermediate stages of the derivation. These are called Precedence constraints, and have the following schema:

(11) Prec(A, B)
Assign a violation-mark for every time that:
(a) An operation of type B occurs and it is not preceded by an operation of type A.
or
(b) An operation of type B occurs and it is followed by an operation of type A.

These constraints are analogous to extrinsic ordering statements in rule-based phonology, in this case that rule A precedes rule B. These ordering statements co-exist and interact with markedness and faithfulness constraints of the familiar kind, which will generally prefer transparent interactions, as in parallel OT. Thus, ordering in OT-CC is less like the orthodox theory of rule-ordering in Chomsky & Halle (1968), where rules are extrinsically fixed in one total ordering for the language as a whole, and more like Anderson's (1969, 1974) theory of Local Ordering. In the latter theory, there is no total ordering of rules but instead only pairwise ordering statements, plus universal preferences for 'natural' orders. The main consequence of Local Ordering is that the same two rules may apply in different orders in different forms of the same language because different constraints on ordering may be applicable. (Also, two rules' functional relationship may be different in different forms, so the natural ordering

principles may prefer different orders.) OT-CC is similar: since the PREC constraints as well as the markedness and faithfulness constraints are all violable, different orderings may be chosen for different forms, because some high-ranked constraint may be decisive for some forms but indifferent for others, permitting other, lower-ranked ordering preferences to make themselves felt.[9] The analysis of Maltese will exploit this aspect of OT-CC. (For previous discussion of OT-CC's ability to produce Local Ordering-like effects, see Wilson [2006] and Wolf [2009, 2010a].)

One final point: for notational consistency with McCarthy (2007), I will assume that PREC constraints refer to phonological operations in terms of the basic faithfulness constraint which they violate, e.g. PREC(IDENT(high), MAX-C). Morph-insertion and PWd- and foot-construction will be exceptions to this.

3.2. OI: Morphological realization in the phonology

Optimal Interleaving (Wolf 2008) is an approach to the phonology-morphology interface which combines OT-CC with the assumption that morphological spell-out occurs in the same grammatical module as the phonology. On the morphological end, OI assumes a realizational view of morphology (Anderson 1992; Halle & Marantz 1993; Beard 1995), which means that words are produced by first creating an abstract morphosyntactic structure, whose component features are then given phonological instantiation. For instance, the derivation of the English word *cats* would proceed in something like the following manner:

(12)

[√CAT PLURAL] →	[√CAT PLURAL]	→	[√CAT PLURAL]
	√CAT PLURAL		*√CAT PLURAL*
	/kæt-z/		[kæts]

First, on the left, the morphosyntax joins together two abstract morphemes with the meanings 'cat' and 'plural'. Next, in the middle, these abstract morphemes are paired up with MORPHS. A morph, in OI, is formally an ordered pair like <PLURAL, /-z/>, consisting of a bundle of abstract morphosyntactic features and a bundle of phonological material (an underlying form). The morphs are essentially the same as the 'vocabulary items' of Distributed Morphology (Halle & Marantz 1993). Finally, on the right, phonology (such as assimilatory devoicing of /tz/ to [ts]) applies, giving us the surface pronunciation.

What OI claims is that both of the derivational steps depicted above take place in the same module of the grammar. That is, the input to the phonology consists only of the abstract morphosyntactic representation. OI's motivation for placing morphological spell-out alongside the phonology in specifically an OT-CC grammar is that it lets us use OT-CC's opacity-handling machinery to deal with several forms of opaque interaction between phonology and morphology (Wolf 2008: ch. 3-5). Most relevantly to this paper, 'cyclic' misapplication of a phonological process *P* within the base of application of an affix *M* can be attributed to the first clause of PREC(P, M), which demands that if *M* occurs, *P* must have occurred previously: we are required to do some phonology of type *P* on the base before *M* is added.

Inserting phonologically non-null morphs involves adding phonological structure, and thus potentially adding new phonological markedness violations. Morph insertion then would often not be harmonically-improving unless there were some constraint which specifically encouraged morph presence, and which could outrank the countervailing markedness constraints. In Wolf (2008), it is proposed that there is a Correspondence relation (McCarthy &

Prince 1995) between morphemes and the morphs which express them, meaning that morph insertion is driven by a family of MAX-M constraints, which are violated if structures at the morpheme level do not have a corresponding morph. These constraints will be part of a larger collection of faithfulness constraints on morpheme-morph correspondence which demand well-matchedness in the morphosyntactic content of morpemes and morphs.

With these preliminaries now in place, we can now proceed to the analysis of cyclic stress, and its absence, in Maltese.

4 Cyclic stress in consonant-final Maltese verb stems

With consonant-final verbs, we need stress to apply before the suffixation of object markers. Under the general OI assumptions described in the previous section, this would be attributed to the effects of the following constraint (recall our earlier assumption that building a Prosodic Word node necessarily includes the building of that node's head foot, as well as possibly additional feet):

(13) PREC(build-PWd, Insert-obj)
Assign a violation-mark for every time that:
(a) An object-marker morph is inserted, and this was not preceded by earlier construction of a PWd; or
(b) An object-marker morph is inserted, and is followed by insertion of a PWd.

Before commencing the OI analysis, we will need to lay out some background assumptions about Maltese stress. Excluding final superheavies, and looking at things in terms of where stress is placed before the application of syncope, Maltese has a Latin-type stress pattern: stress the penult if heavy, else stress the antepenult.[10] We can assume that this means that a trochaic foot is built as far to the right as possible, subject to the condition that the final syllable is unfootable. This is expressed by the following ranking (identical to that employed in Prince & Smolensky's [2004/1993: 69-70] analysis of antepenultimate stress in Latin):

(14) *Penult and ultima both light: stress on antepenult*

/LLL/	NONFINALITY(Ft)	ALL-FOOT-RIGHT
a. → |('LL)L|		1
b. |L('LL)|	1 W	L

(15) *Stress on heavy penult*

/LHL/	NONFINALITY(Ft)	ALL-FOOT-RIGHT
a. → |L('H)L|		1
b. |L('HL)|	1 W	L

(16) NONFINALITY(Ft) (Prince & Smolensky [2004/1993: 51]; Gouskova [2003: 24])
Assign one violation-mark if the head foot of a PWd is final in the PWd.

(17) ALL-FOOT-RIGHT (Prince & Smolensky [2004/1993: 46]; McCarthy & Prince [1993b])
The right edge of every foot is aligned with the right edge of the PWd.
(Violations assessed gradiently by syllables.)[11]

The notation used in (14-15) and throughout for prosodic boundaries is as follows: '.' denotes syllable boundaries; '(…)' foot boundaries, and '|…|' PWd boundaries. Also throughout, I only consider candidate foot-parses in which all feet are trochaic and in which the rightmost foot in the word is the head foot, both requirements which appear to be undominated in Maltese. These tableaux are in Prince's (2002) combination format: numerals indicate the number of violation-marks incurred by each candidate; in rows for losing candidates, W indicates that a constraint prefers the winner over that loser, and L indicates that the constraint prefers that loser over the winner.

The prohibition against footing a final syllable is overridden in two cases. First, monosyllables do get stress, on their only and therefore final syllable. With Prince & Smolensky (2004 [1993]: 51-52) we may attribute this to constraints demanding that every morphosyntactic word must be parsed into a prosodic word, together with what I will take to be an inviolable requirement that every PWd must have a head foot:

(18) *Monosyllables get stress*

/σ/	WDCON	NONFIN(Ft)
a. → |('σ)|		1
b. σ	1 W	L

(19) WDCON (cover constraint from Selkirk [1995]; cf. Prince & Smolensky's [2004/1993: 51] LEX ≈ PR)
The left and right edges of every lexical word must coincide, respectively, with the left and right edges of some prosodic word.

Second, final syllables can be footed when the final syllable is heavy enough to attract stress. Standard descriptions of stress in Maltese, summarized earlier in (1), distinguish between heavy (CVC) and superheavy (CVCC and CV:C) syllables in this regard: the latter get stress in word-final position, but the former do not.[12] An important additional case to consider involves final [CV:] syllables. These are generally absent in Maltese; however, the language does have stressed word-final long vowels in loans, especially from Italian (Aquilina 1959: 121-126, 1965: 26, 28; Fenech 1978: 18-19; Vella 2003: 270-271); as seen in (20a-e) below, these stressed final vowels are written with a grave accent in the standard orthography. Stress on final open syllables also occurs in a few native Maltese words ending in a diphthong (Vella 2009: 66-68), as in (20f):

(20) (a) *università* 'university', *karità* 'charity', *sanità* 'sanitary inspector', *età* 'age'
(b) *Marì* 'Mary'
(c) *virtù* 'virtue', *tribù* 'tribe', *Perù* 'Peru'
(d) *xabò* 'the frill of a shirt', *repò* 'refreshments', *burò* 'bureau', *però* 'however'
(e) *bidè* 'bidet', *kafè* 'coffee', *Renè* 'René', *obwè* 'oboe'
(f) *Mulej* [mʊ.ˈlɛɪ] 'Lord'

These data show that final [CVː] is able to attract stress.[13] I therefore suggest that the pertinent generalization about final position is that word-final consonants are not allowed to project a mora. Eure (1999: 14) proposes exactly this for Maltese, and comparable assumptions have been made about similar phenomena in the Levantine dialects; among others see Johnson (1990: 145) and Broselow, Chen & Huffman (1997: 57). Thus, in final position [CVC] has a non-moraic coda and therefore is treated as light, whereas [CVː], [CVːC], and [CVC$^{\mu}$C] are bimoraic in final position and are treated as heavy. (I use a superscript μ on a consonant to indicate that it is moraic, and the absence of μ to indicate non-moraicity.) The violation of NONFINALITY in these cases can then be attributed to ranking the WEIGHT-TO-STRESS PRINCIPLE (Prince 1990), which requires that heavy syllables be stressed, over NONFINALITY (on the way in which this ranking yields 'extrametricality revocation' when the final syllable is heavy, see Prince & Smolensky [2004/1993: 64]):

(21) *Heavy syllable in final position attracts stress*

/CVCVCVCC/	WSP	NONFIN(Ft)
a. → |CV.CV(ˈCVC$^{\mu}$C)|		1
b. |(ˈCV.CV)CVC$^{\mu}$C|	1 W	L

(22) *Final CVC syllable doesn't attract stress*

/CVCVCVC/	WSP	NONFIN(Ft)
a. |CV.CV(ˈCVC)|		1 W
b. → |(ˈCV.CV)CVC|		

(23) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy syllables must not be metrically weak. (Prince 1990)

The issue of the length of word-final vowels will be discussed again when we come to the analysis of vowel-final verb stems, and why they lack cyclic stress.

We may now commence the OI analysis of suffixed C-final stems, using as our example the 1st person plural subject- and object-suffixed forms of /ħataf/ 'snatch', as seen earlier. Assuming that morph-insertion necessarily moves inside out, the very first thing that must happen is for the stem morph to be inserted. The following tableau illustrates that this is harmonically improving under the ranking which we will assume:

(24) *Insertion of stem is harmonically improving*

		SNATCH-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a.	SNATCH-1PL	2						
insert morph	b. →L	ħa.taf-1PL	1	1					

Form (24a) above is the fully faithful candidate (FFC)—the form identical to the input. This is the reference point against which other candidates must be checked to see whether or not they are harmonically improving. At this point in chain construction the input is simply the two not-yet-spelled-out morphemes /SNATCH-1PL/, and so the FFC incurs two violations of MAX-M, since there are two morphemes which lack corresponding morphs. Candidate (24b) improves harmony relative to the input since it inserts the stem morph /ħataf/, thus giving a correspondent to the stem morpheme and taking away a violation of MAX-M.[14] This does however come at the expense of adding a violation of lower-ranked WDCON. With the insertion of the segments of the stem, there is now segmental (and syllabic) material which is not parsed by a PWd. If PWd construction is a separate step from morph-insertion, then insertion necessarily creates new, temporary violations of WDCON, which consequently must rank below MAX-M.

As seen in (25), we have two options for continuing on from (24b): spell out the suffix, or lay down a PWd with its head foot:

(25) *Insertion of object marker, or laying down PWd, are harmonically improving*

Input from (24b)		ħa.taf-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a.	ħa.taf-1PL	1	1					
insert morph	b. →L	ħa.taf^{u}.na		1					
Build PWd	c. →L	|(ˈħa)taf|-1PL	1				1	1	
	d.	|(ˈħa.taf)|-1PL	1			1			
	e.	|ħa(ˈtaf)|-1PL	1			1		1	
	f.	|(ˌħa)(ˈtaf)|-1PL	1			1	1		

(26) EXHAUSTIVITY(word) (Itô & Mester 2003; Selkirk 1995)
One violation-mark for every syllable which is a direct dependent of the Prosodic Word.

Inserting the affixal morph, as in (25b), is harmonically-improving by virtue of removing the remaining violation of MAX-M. Alternatively, we can also improve harmony by parsing the string into a PWd, thus removing the FFC's violation of WORDCON. Given the two syllables built so far, there are four logically possible ways to build a trochaic parse: an initial monosyllabic foot as in (25c), a binary foot as in (25d), a final monosyllabic foot as in (25e), or

two monosyllabic feet as in (25f). I will assume that the latter three are less harmonic than (25c) owing to their having feet which parse the word-final syllable. This violates the constraint NONFINALITY(ft). According to the Local Optimality requirement, only the most harmonic way of performing the 'build PWd' operation can be included in the set of chains under construction; throughout the paper, locally-optimal candidates like (25c) are indicated by the arrow with subscript L for 'local'. Double horizontal lines separate groups of candidates which result from the same operation, thus grouping the potential next steps into those groups of candidates which must compete with each other for Local Optimality.

A brief digression is in order about why we need to assume that a unary rather than binary foot parse is locally optimal at this point. This so that that the second syllable of the stem remains available to be footed after we add the suffix /-na/. If we chose a binary foot instead, this would give us |(ˈħa.tafᵘ)na| after suffixation. The trouble is that we need /tafᵘ/ to receive the primary stress. Getting from |(ˈħa.tafᵘ)na| to |(ˌħa)(ˈtafᵘ)na| requires that we both dis-affiliate /tafᵘ/ from its previous foot and also build a new foot with /tafᵘ/ as its head. If these have to occur as separate steps, we are stuck: unfooting /tafᵘ/ is not harmonically improving because it worsens performance on ALL-FOOT-RIGHT and EXHAUSTIVITY(word) without improving performance on any higher-ranked constraint. This is seen in the tableau below; here and throughout the thumbs-down symbol is used to indicate that a candidate is not harmonically improving:

(27) *Unfooting penult after suffixation worsens harmony*

	|(ˈħa.tafᵘ)na|	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. |(ˈħa.tafᵘ)na|			1		1	1	
Build PWd	b. 👎 |(ˈħa)tafᵘ.na|			1		2	2	

We could in principle bypass this conundrum by relaxing our theory of gradualness by assuming that GEN can go from |(ˈħa.tafᵘ)na| to |(ˌħa)(ˈtafᵘ)na| in one step. This, however, is probably undesirable insofar as it jeopardizes some of the empirical advantages of serial over parallel foot optimization (Pruitt 2010: 502, fn. 15). The appropriately cautious assumption, following Pruitt (2008, 2010) and Kimper (2011), seems to be that foot-parsing in HS/OT-CC respects Prince's (1985: 479) Free Element Condition, i.e. that foot-parsing can only operate on syllables that are not already footed. (See also McCarthy & Pruitt [to appear].) Accordingly, if we wish to achieve the 'cyclic' stress distribution [ˌħa.ˈtafᵘ.na] for Maltese, it is necessary that we assume that applying stress prior to suffixation yields |(ˈħa)taf|-1pl and not |(ˈħa.taf)|-1PL, which as mentioned results from the ranking NONFIN(ft) >> FTBIN.

The subchain <SNATCH-1PL, ħa.taf-1PL, |(ˈħa)taf|-1PL> represents the course that we want to start on to achieve the an ouput with 'cyclic' stress on the stem: it has placed a stress on the stem prior to any further morphology being added. Let's now investigate where further we can go from here. Unsurprisingly, it is harmonically improving to spell out the 1st person plural morpheme. As shown below, I assume that with the PWd already in place, the morph /-na/ can be incorporated into the PWd at the point of insertion.

(28) *With stem prosodified, insertion of suffix is harmonically improving*

Input from (25c)		|(ˈħa)taf|-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
FFC	a.	|(ˈħa)taf|-1PL	1				1	1	
insert morph	b. →L	|(ˈħa)tafᵘ.na|			1		2	2	
Delete V	c. ☜	|(ˈħatf)|-1PL	1			1			1

To preview what we ultimately say about syncope, the representation \|(ˈħa)taf\|-1PL contains a syllable /taf/ which is not parsed into a foot but instead linked directly to the PWd, which violates EXHAUSTIVITY(word). That constraint will serve ultimately as our driver of syncope: syncope eliminates the vowels of unfooted syllables, and thus the syllables themselves as well.[15] However, syncope does not affect the syllable /taf/, for two reasons: it is closed as opposed to open, and it is word-final. Deletion in word-final syllables will be blocked because eliminating the final syllable would result in the head foot being final, pointlessly exchanging a violation of EXH(wd) for a violation of higher-ranked NONFINALITY(foot). This explanation for the failure of deletion to affect final vowels is the same as that proposed by Gouskova (2003: 232) for the corresponding generalization in Lebanese Arabic; however, owing to the serial-optimization regime being assumed here, things get slightly more complicated in the case where we spell out the suffix before attempting syncope, as we shall see momentarily.

Another thing to note is that in candidate (28b), the coda of the syllable /tafᵘ/ has become moraic, as the addition of the suffix means that this consonant is no longer word-final. McCarthy (2007: §3.2.4.1) argues that the insertion of moras which mark the predictable weight of coda consonants occurs 'for free' at each step of an OT-CC derivation rather than being a step in its own right. This would be consistent with arguments that the insertion of such moras involves no faithfulness violation: faithfulness to the (non-)moraicity of consonants predicts the existence of contrastive moraicity and hence contrastive syllabification, which is generally held to be unattested (Bermúdez-Otero 2001; McCarthy 2003a; Campos-Astorkiza 2004; though cf. Elfner 2007). My analysis of vowel-final stems will provide another means by which the stem-final consonant would instantaneously acquire a mora upon suffixation. Specifically, I will be proposing that Maltese suffixes begin with a floating mora, to account for the lengthening of vowels before suffixes. With both V-final and C-final stems, we can assume that this floating mora docks on the stem-final segment. With V-final stems, this changes the final vowel from short to long; with C-final stems, the mora simply attaches to the previously non-moraic stem-final coda consonant, causing the stem-final CVC syllable to become heavy.[16]

After suffixal /-na/ has been added, it is harmonically improving to foot the now-medial syllable /tafᵘ/, since doing so no longer violates NONFINALITY(ft). Below in (29), I assume that head-foot status is immediately transferred from the previously-built foot to the new foot, though this is not essential:

(29) *With suffix added, putting stress on stem-final syllable is now harmonically improving*

Input from (28b)	|(ˈħa)tafᵘ.na|	MAX-V (heavy)	WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. |(ˈħa)tafᵘ.na|		1		2	2	
Add foot	b. →L |(ˌħa)(ˈtafᵘ)na|				3	1	
	c. |(ˌħa)(ˈtafᵘ.na)|			1	2		
	d. ☜ |(ˌħa)tafᵘ(ˈna)|		1	1	2	1	
Delete V	e. →L |(ˈħa)tafᵘn|		1		1	1	1
	f. ☜ |(ˈħatᵘ)fna|	1			1	1	1

If we continue this derivational path by building a foot on /tafᵘ/, we will have reached the output form corresponding to 'cyclic' stress: main stress is on the penult and secondary stress on the antepenult; the presence of that secondary stress means that the first syllable will not be syncopated. Deleting the first vowel would eliminate the violation of ALL-FOOT-RIGHT, but we may assume that this is blocked by a high-ranked positional faithfulness constraint (Beckman 1998) barring deletion of stressed vowels. The final vowel, though unfooted, will not delete either, since syncope (or, rather, apocope) is blocked word-finally: subsequently deleting the final vowel from (29b), yielding \|(ˌħa)(ˈtafᵘn)\|, would create a violation of NONFIN(ft) and therefore is not harmonically improving, as discussed earlier.

Some discussion is in order, however, about vowel deletion as a possible step to take from \|(ˈħa)tafᵘ.na\|. Because this derivational stage is obtained by first building a unary foot on the initial syllable and then adding the suffix, the sole foot that exists so far is two syllables away from the right edge. This means that deleting either of the unfooted vowels would not be locally blocked by NONFIN(ft), since one syllable will still remain to separate the foot from the right edge. Excluding the not-previously-discussed constraint MAX-V(heavy) seen above, the locally-optimal choice of which vowel to delete would be candidate (29e), \|(ˈħatᵘ)fna\|, because it eliminates the unfooted (and perforce unstressed) heavy syllable /tafᵘ/, thereby disposing of a violation of WSP. This candidate thus highlights a general concern about the analysis: since WSP is higher-ranked than MAX-V, we have to say something about why the language always copes with unstressed heavy syllables by footing them, rather than eliminating them by deleting their nuclei.

The candidate \|(ˈħatᵘ)fna\| is worrisome because, again given the constraints depicted above, it is more harmonic than the attested winner \|(ˌħa)(ˈtafᵘ)na\| by virtue of having two fewer violations of ALL-FOOT-RIGHT. Something therefore needs to rule it out, which does not come as too much of a surprise precisely because \|(ˈħatᵘ)fna\| has syncopated the vowel out of a closed syllable, contrary to all published formulations of Maltese syncope, which agree that it is something that happens only in (unstressed) open syllables. It seems that WSP must be outranked by some other constraint which discourages syncope in closed syllables. It is tempting to consider the possibility that forms like *\|(ˈħatᵘ)fna\| are blocked due to the tri-

consonantal cluster which closed-syllable syncope gives rise to. However, it is not clear that this can be the right story, because /CVCVC/ verb stems have alternants in their imperfect paradigms, in which both stem vowels have been deleted through ordinary, open-syllable syncope, such as [na-ʔsm-úːh] 'we broke him' (Sutcliffe [1936: 156]). A more promising explanation would be based on positional faithfulness (Beckman 1998) to heavy syllables, which is the option depicted in (29): deleting vowels in heavy syllables would violate a constraint MAX-V(heavy) which is ranked above WSP.

It may be independently necessary to posit such a constraint in OT-CC given a difficulty with syncope in Icelandic pointed out by Norris (to appear). Icelandic syncope does not affect vowels in heavy syllables, and Norris presents a Stratal OT account of this which requires that the constraint ranking at the time feet are built differs from the ranking at the time that syncope occurs, which is possible across levels in Stratal OT but which is not countenanced in OT-CC or HS. If there were a constraint which could directly ban syncope in heavy syllables, however, it would appear that we can bypass this problem.[17]

If *|(ˈħatᵘ)fna| is barred on such grounds from being harmonically improving, this still leaves the apocope-derived |(ˈħa)tafᵘn| as a valid next step. Where can we go from there? Deletion of the remaining unfooted vowel is ruled out by virtue of its being in a closed syllable, so the only thing further that can be done is to build a foot on the word-final CVCC syllable, which is harmonically improving given that WSP dominates NONFIN(ft):

(30)

Input from (29e)	|(ˈħa)tafᵘn|	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
FFC	a. |(ˈħa)tafᵘn|	1		1	1	
Add foot	b. →L |(ˌħa)(ˈtafᵘn)|		1	1		

As we will see shortly when we compare the completed chains, NONFINALITY(ft) will end up playing a role in blocking word-final vowel deletion after all. While it cannot stop the mapping |(ˈħa)tafᵘ.na| → |(ˈħa)tafᵘn| being harmonically improving, a chain ending <…|(ˈħa)tafᵘn|> will fare poorly compared to the attested winner |(ˌħa)(ˈtafᵘ)na| (when /-na/ is an object marker) or |(ˈħtafᵘ)na| (when /-na/ is a subject marker): |(ˈħa)tafᵘn| violates WSP, but the attested winners do not. As seen above, the WSP violation can be eliminated in the continuation of that chain as <…|(ˈħa)tafᵘn|, |(ˌħa)(ˈtafᵘn)|>, but that longer chain violates NONFIN(ft), whereas the attested winners do not. Thus does NONFIN(ft) contribute to ruling out deletion of word-final vowels, even in the case where it can't block such deletion from being harmonically improving.

We have now finished exploring the set of derivational paths which originate from the option of laying down stress (25c) before spelling out the suffix; these are, to speak loosely, the candidate derivational paths with 'cyclic stress'. Now we need to explore the potential further steps which could follow on from the other harmonically improving option in (25b): the form /ħatafna/, which spells out the object suffix rather than building a PWd. These candidate pathways are those with 'noncyclic stress', because they all begin from morphologically

building up the whole word, stem and suffix, and only afterwards assigning stress. Starting from /ħa.taf$^{\mu}$.na/, the first thing that we can do is to build a PWd and foot parse:

(31) *From unprosodified stem + suffix, stressing stem-final syllable locally optimal*

Input from (25b)	ħa.taf$^{\mu}$.na	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
FFC	a. ħa.taf$^{\mu}$.na		1					
Build PWd	b. →$_{L}$ |ħa(ˈtaf$^{\mu}$)na|					1	2	
	c. |(ˈħa.taf$^{\mu}$)na|			1		1	1	
	d |ħa(ˈtaf$^{\mu}$.na)|				1		1	
	e. |(ˌħa.taf$^{\mu}$)(ˈna)|			1	1	1		
	f. |(ˌħa)(ˈtaf$^{\mu}$.na)|				1	2		
	g. |(ˌħa)(ˈtaf$^{\mu}$)na|					3	1	
	h. |ħa(ˌtaf$^{\mu}$)(ˈna)|				1	1	1	
	i. |(ˌħa)taf$^{\mu}$(ˈna)|			1	1	2	1	
	j. |ħa.taf$^{\mu}$(ˈna)|			1	1		2	
	k. |(ˈħa)taf$^{\mu}$.na|			1		2	2	

As seen above, the locally optimal way to build a PWd and foot parse on this string is to have the single head foot on the heavy penult /taf$^{\mu}$/. Since this is the penult and not the final syllable, it comes with one violation of ALL-FOOT-RIGHT. A number of other candidates in (31) do at least as well as (31b) on AFR; however, they are less harmonic than (31b) by virtue of violating either NONFINALITY(ft) (because they foot the final syllable), WSP (because they leave the heavy penult unstressed), or both.

From here, we now find that syncopating the unfooted vowel of the first syllable will improve harmony, but parsing that syllable into a foot will not:

(32) *From form above, deleting first vowel is harmonically-improving; footing it isn't*

Input from (31b)		|ħa(ˈtafᵘ)na|	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a.	|ħa(ˈtafᵘ)na|					1	2	
Delete V	b. →L	|(ˈħtafᵘ)na|					1	1	1
	c. ☜	|ħa(ˈtafᵘn)|				1		1	1
Add foot	d. ☜	|(ˌħa)(ˈtafᵘ)na|					3	1	
	e. ☜	|(ˌħa)(ˌtafᵘ)(ˈna)|				1	3		
	f. ☜	|ħa(ˌtafᵘ)(ˈna)|				1	1	1	

Footing the initial (antepenultimate) syllable removes a violation of EXH(wd), but at the cost of adding two new violations of higher-ranked AFR. Syncopating the vowel, by contrast, swaps the EXH(wd) violation for a violation of lower-ranked MAX-V, so it is harmonically improving. With this form, \|(ˈħtafᵘ)na\|, we have now reached the output corresponding to 'non-cyclic' stress: the sole stress is on the surface penult (expected because the penult is heavy) and all vowels in nonfinal, unstressed open syllables have been syncopated. The candidate \|(ˈħtafᵘ)na\| is the locally-optimal way to delete because deletion of the only other unfooted vowel, the word-final one, is not harmonically improving, for the by now familiar reason that it would create a new violation of NONFIN(ft).

Having finished building our possible derivations, they will now compete against one another as candidates. There are actually two distinct competitions to consider: one in which the morph /-na/ is spelling out an object morpheme, and one in which /-na/ is spelling out a subject morpheme. In the former case, we want the derivation that ends in \|(ˌħa)(ˈtafᵘ)na\| to win, and in the latter case, we want the derivation terminating in \|(ˈħtafᵘ)na\| to win. If all of the chains we've built (including those which stop somewhere 'along the way') are submitted to the constraint ranking assumed so far, the chain leading to \|(ˈħtafᵘ)na\| will indeed win (to save space, MAX-V(heavy) is omitted from the tableau, since no candidate violates it):

(33) *Competition of chains I: 'Non-cyclic' candidate wins*

	SNATCH-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
a.	<SNATCH-1PL>	2 W				L	L	L
b.	<SNATCH-1PL, ħa.taf-1PL>	1 W	1 W			L	L	L
c.	<SNATCH-1PL, ħa.taf-1PL, ħa.taf^{u}.na>		1 W			L	L	L
d.	<SNATCH-1PL, ħa.taf-1PL, ħa.taf^{u}.na, |ħa('taf^{u})na|>					1	2 W	L
e. →	<SNATCH-1PL, ħa.taf^{u}-1PL, ħa.taf^{u}.na, |ħa('taf^{u})na|, |('ħtaf^{u})na|>					1	1	1
f.	<SNATCH-1PL, ħa.taf-1PL, |('ħa)taf|-1PL>	1 W				1	1	L
g.	<SNATCH -1PL, ħa.taf-1PL, |('ħa)taf|-1PL, |('ħa)taf^{u}.na|>			1 W		2 W	2 W	L
h.	<SNATCH -1PL, ħa.taf-1PL, |('ħa)taf|-1PL, |('ħa)taf^{u}.na|, |(ˌħa)('taf^{u})na|>					3 W	1	L
i.	<SNATCH -1PL, ħa.taf-1PL, |('ħa)taf|-1PL, |('ħa)taf^{u}.na|, |('ħa)taf^{u}n|>			1 W		1	1	1
j.	<SNATCH -1PL, ħa.taf-1PL, |('ħa)taf|-1PL, |('ħa)taf^{u}.na|, |('ħa)taf^{u}n|, |(ˌħa)('taf^{u}n)|>				1 W	1	L	1

Here, the 'non-cyclic' candidate (33e) bests the 'cyclic' candidate (33h), because the latter candidate has an additional non-final foot (on the initial syllable (ˌħa)) and therefore has two extra violations of ALL-FOOT-RIGHT. To get (33h) to win instead when the morpheme notated as '1PL' is an object rather than a subject marker, it must therefore be favored by some constraint which outranks AFR and which is relevant only in the object-mkarker case. As alluded to earlier, this 'cyclicity'-encouraging constraint will be a PREC constraint, specifically the following:

(34) PREC(build-PWd, insert-object)
Assign a violation mark for each time that:
(a) An object marker morph is inserted, and this is not preceded by the building of a PWd; or
(b) An object marker morph is inserted, and this is followed by the building of a PWd.

Tableau (35) illustrates how this constraint gives us the desired result. To save space, I omit all of the losing candidates from (33) which are knocked out by one of the other constraints ranked above AFR (however, numbering of candidates has been retained from (33) to facilitate comparison):

(35) *Competition of chains II: where PREC constraint is applicable, 'cyclic' candidate wins*

	SNATCH-1PL	PREC (build-Pwd, ins-obj)	AFR	EXH (wd)	MAX -V
d.	< SNATCH-1PL, ħa.taf-1PL, ħa.taf$^{\mu}$.na, |ħa('taf$^{\mu}$)na| >	2 W	1 L	2 W	
e.	< SNATCH-1PL, ħa.taf$^{\mu}$-1PL, ħa.taf$^{\mu}$.na, |ħa('taf$^{\mu}$)na|, |('ħtaf$^{\mu}$)na| >	2 W	1 L	1	1 W
h. →	< SNATCH -1PL, ħa.taf-1PL, |('ħa)taf|-1PL, |('ħa)taf$^{\mu}$.na|, |(ˌħa)('taf$^{\mu}$)na| >		3	1	

Candidate (35e) builds the PWd after (and not before) the object maker was inserted, thus violating both clauses of the PREC constraint. Candidate (35h) by contrast has PWd-construction occurring before (and not occurring after) the insertion of the object marker, so it violates neither clause. Ranking the PREC constraint above ALL-FOOT-RIGHT thus results in (35h) beating (35e) when the /-na/ morph is serving as an object marker.

5 The lack of cyclicity in vowel-final stems

We now move on to deal with vowel-final stems. The analysis just given for consonant-final stems will, if left as is, lead us to expect that vowel-final stems will also show cyclic stress in object-marked forms, since that is what PREC(build-PWd, insert-object) will prefer. Since vowel-final stems do not have cyclic stress with object suffixes, that constraint's demands will have to be overridden by a factor connected with something that happens only in vowel final stems. Building on the insights in Odden (1990, 1993),[18] the analysis I will give below will assume that this something is the lengthening of stem-final vowels before suffixes.

Outside of the mainly borrowed words with final (stressed) long vowels mentioned earlier in (20), Maltese patterns with many Arabic dialects in that morph-final vowel length is predictable: these vowels are short word-finally but long before consonant-initial suffixes. (The feminine ending /-a/ in Maltese is an exception [Borg 1997: 267]; it is consistently short, even before a following suffix.) As with any property which varies allophonically, there is potential

indeterminacy regarding the *underlying* length of such vowels. Are they underlyingly long, shortening when word-final, or are they underlyingly short, lengthening before suffixes? Both assumptions have widely been made in the literature on the phonology of Arabic dialects; see McCarthy (2005), who favors the shortening analysis, for extensive references. Maltese is no exception: Borg (1997: 266-267) assumes shortening, and Odden (1990, 1993) assumes lengthening.

Here, I will be taking the latter option and assuming that the stem-final vowels of Maltese third-weak-radical verbs are short in the underlying representation. In an OT context, this immediately poses a worry about Richness of the Base: we cannot assume any systematic language-specific restrictions on underlying forms, so we must ensure that inputs with underlying final long vowels are mapped onto some licit surface form of the language. I will suggest that words like those in (20) already furnish the evidence we need about what happens to underlyingly long word-final vowels in Maltese: they surface faithfully as long, and receive stress.

If stem-final vowels in 3rd weak radical verbs are underlyingly short, then they must systematically lengthen before suffixes. What mechanism is responsible for this? As mentioned earlier, I will assume that all verbal suffixes have been analyzed by speakers as containing a floating mora, which docks on and lengthens a preceding stem-final vowel. The account of the absence of cyclic effects will then run like this: ranked above PREC(build-PWd, insert-object) is another PREC constraint which demands that stress be preceded by lengthening. With consonant-final stems, there is no opportunity for lengthening and so the constraint will be equally violated by all candidates (except those where no stress is assigned at all, which will be knocked out by higher-ranked WDCON and/or MAX-M). With vowel-final verbs, on the other hand, we can satisfy the new PREC constraint by applying stress only after lengthening. Since lengthening is caused by suffixation, doing stress after lengthening entails deferring stress until after suffixation—that is, not having cyclic stress.

I will illustrate the analysis by showing the derivation of [(i)mlɪːna] 'he filled us'. In the following tableaux illustrating the construction and comparison of derivational paths, I will ignore for the sake of illustration two processes which affect this word: (a) the prothesis of [i] before the syncope-created sonorant-initial cluster (see n. 20), and (b) the raising of stressed long /aː/ to /ɪː/ (see n. 6). As with the consonant-final stems, the first thing that it is harmonically-improving to do is to insert the stem morph:

(36) *Insertion of stem is harmonically improving*

	FILL-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. FILL-1PL	2						
insert morph	b. →L me.la-1PL	1	1					

After the stem is inserted, the derivation splits (again as before): it is harmonically improving to lay down a PWd and associated foot parse (with the initial syllable being the locally optimal location for stress), and it is also harmonically improving to insert the suffix morph. For ease of presentation, I will assume that the insertion of the segments of the pronominal suffix and the associated lengthening mutation of the stem-final vowel occur simultaneously, in one step. This is not crucial to the argument, though: the same results will

obtain if we assume that insertion of the object morph results in an intermediate stage /me.la.$^{(\mu)}$na/, where the floating mora in the suffix's UR is not yet docked on the preceding vowel.[19]

(37) *Insertion of object marker, or laying down PWd, are harmonically improving*

Input from (36b)	me.la-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. me.la-1PL	1	1					
insert morph	b. →$_{L}$ me.la:.na		1					
Build PWd	c. →$_{L}$ |(ˈme)la|-1PL	1				1	1	
	d. |me(ˈla)|-1PL	1			1		1	
	e. |(ˈme.la)|-1PL	1			1			
	f. |(ˌme)(ˈla)|-1PL	1			1	1		

On the derivational branch initiated by inserting the suffix morph (with concomitant morpho-phonological lengthening of the stem-final vowel), the one thing that it is harmonically improving to do next is to build a PWd whose head coincides with the stem-final syllable:

(38) *From unprosodified stem + suffix, stressing stem-final syllable locally optimal*

Input from (37b)	me.la:.na	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. me.la:.na		1					
Build PWd	b. →$_{L}$ |me(ˈla:)na|					1	2	
	c. |(ˈme.la:)na|			1		1	1	
	d |me(ˈla:.na)|				1		1	
	e. |(ˌme.la:)(ˈna)|			1	1	1		
	f. |(ˌme)(ˈla:.na)|				1	2		
	g. |(ˌme)(ˈla:)na|					3	1	
	h. |me(ˌla:)(ˈna)|				1	1	1	
	i. |(ˌme)la:(ˈna)|			1	1	2	1	
	j. |me.la:(ˈna)|			1	1		2	
	k. |(ˈme)la:.na|			1		2	2	

This is closely analogous to what we saw earlier with CVC-final stems. Adding a suffix puts the stem-final syllable in penult position and also makes it heavy, either by allowing its coda to become moraic (with C-final stems) or by inducing lengthening of the stem-final vowel (with V-final stems). In either case, the resultant /σHL/ sequence will subsequently be assigned penult main stress.

After this foot parse has been assigned, it is harmonically improving to syncopate the first vowel so as to eliminate a violation of EXHAUSTIVITY(word). As before, this is locally-optimal relative to the alternative option of syncopating the word-final vowel, which is harmonically disimproving because it would create a new violation of higher-ranked NONFIN(foot). Also as before, it is not harmonically improving to eliminate the EXHAUSTIVITY(word) violation of the initial syllable by footing it; just as with consonant-final stems (see (32)), this is ruled out by ALL-FOOT-RIGHT being ranked above EXHAUSTIVITY(word):[20]

(39) *From form above, deleting first vowel is harmonically-improving; footing it isn't*

Input from (38b)	|me(ˈlaː)na|	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. |me(ˈlaː)na|					1	2	
Delete V	b. →L |(ˈmlaː)na|					1	1	1
	c. ☜ | me(ˈlaːn)|				1		1	1
Add foot	d. ☜ |(ˌme)(ˈlaː)na|					3	1	
	e. ☜ |me(ˌlaː)(ˈna)|				1	1	1	

Now let us go back to consider the other branch of the derivation from (37): the one with 'cyclic' stress (37c), where we construct a foot parse without having yet inserted the suffix morph. If we first assign a PWd and foot parse to the stem (with initial stress), it is then harmonically-improving to spell out the suffix (which again per our assumptions comes with simultaneous lengthening of the stem-final vowel). Deleting the unfooted second syllable will not improve harmony at this point, again due to the blocking effect of NONFIN(ft):

(40) *With stem prosodified, insertion of suffix is harmonically improving*

Input from (37c)	|(ˈme)la|-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a. |(ˈme)la|-1PL	1				1	1	
insert morph	b. →L |(ˈme)laː.na|			1		2	2	
Delete V	c. ☜ |(ˈmel)|-1PL	1			1			1

After this, it will be harmonically improving to foot the (now long and penultimate) stem-final syllable, as well as to apocopate the final vowel. Deleting the stem-final vowel is ruled out by MAX-V(heavy):

(41) *From above, putting stress on stem-final syllable is harmonically improving*

Input from (40b)		|(ˈme)laː.na|	MAX-V (heavy)	WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a.	|(ˈme)laː.na|		1		2	2	
Add foot	b. →L	|(ˌme)(ˈlaː)na|				3	1	
	c.	|(ˌme)(ˈlaː.na)|			1	2		
	d. ☜	|(ˌme)laː(ˈna)|		1	1	2	1	
Delete V	e. →L	|(ˈme)laːn|		1		1	1	1
	f. ☜	|(ˈmel)na|	1			1	1	1

From \|(ˌme)(ˈlaː)na\|, there is nothing further to do: once again, deletion of the final vowel will be blocked by NONFIN(foot). From \|(ˈme)laːn\|, however, it will be harmonically improving to foot the final syllable:

(42)

Input from (41e)		|(ˈme)laːn|	WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
FFC	a.	|(ˈme)laːn|	1		1	1	
Add foot	b. →L	|(ˌme)(ˈlaːn)|		1	1		

With our chains now completed they compete as candidates. In the tableau below, marks from PREC(build-PWd, insert-obj) are shown under the assumption that /-na/ is serving as an object marker, since this is the situation where cyclic stress would have been (incorrectly) expected if we left the analysis from section 4 unmodified. Also, as in (35), I omit for space reasons those candidates knocked out by markedness or faithfulness constraints ranked above ALL-FOOT-RIGHT. The candidates in (43) are numbered so as to link them with the analogous candidates in the consonant-final case seen in (33) and (35), again for ease of comparision.

(43) *Competition of derivational paths: candidate without 'cyclic' stress wins*

FILL-1PL		PREC (IDENT(long), build-PWd)	PREC (build-PWd, ins-obj)	AFR	EXH (wd)	MAX -V
d.	<FILL-1PL, me.la-1PL, mela:na, |me('la:)na|>		2	1	2 W	L
e. →	<FILL-1PL, me.la-1PL, mela:na, |me('la:)na|, |('mla:)na|>		2	1	1	1
h.	<FILL-1PL, mela-1PL, |('me)la|-1PL, |('me)la:.na|, |(ˌme)('la:)na|>	2 W	L	3 W	1	L

Because the vowel-final status of the stem results in lengthening occurring at the point that we insert the direct object marker, PREC(IDENT(long), build-PWd) serves to knock out the 'cyclic stress' candidate (43h), since it assigns stress before spelling out the suffix (and hence before lengthening). This leaves the 'non-cyclic stress' candidates (43d) and (43e), with EXH(word) crucially deciding in favor of (43e), which syncopates the unfooted initial syllable, over (43d), which does not.

While PREC(IDENT(long), build-PWd) serves to discourage 'cyclic' stress in vowel-final stems, it will have no such effect with consonant-final stems. With C-final stems, there is no lengthening, so every candidate which actually does build a prosodic word will equally violate PREC(IDENT(long), build-PWd): there simply is no lengthening for PWd-construction to be preceded by. This violation could be avoided by not building a PWd at all, but those candidates will be knocked out by their violations of MAX-M and/or WDCON. All other candidates tie on PREC(IDENT(long), build-PWd), which allows lower-ranked PREC(build-PWd, ins-obj) and its preference for 'cyclic' stress to emerge as decisive.

There are also several places in Maltese where PREC(IDENT(long), build-PWd) proves to be violable with vowel-final stems. The most trivial case is when there are no suffixes at all, as in the 3rd person masculine singular perfective without object suffixes. Bare stems like /mela/ do indeed receive stress, despite having no opportunity to undergo lengthening owing to the lack of suffixes. This is because WDCON, which demands the presence of a PWd and hence of stress, outranks PREC(IDENT(long), build-PWd).

Less trivially, there are two morphological environments in which vowel-final stems do show evidence of undergoing cyclic stress. One occurs in the imperfect conjugation. In imperfects, the stem is preceded by a /CV-/ prefix which marks the person of the subject, and is followed by a suffix /-u/ if the subject is plural; any object markers occur to the right of this plural suffix. This plural suffix is argued by Brame (1972, 1974) to be cyclic: stress applies in the /CV + *stem*/ constituent it attaches to before the /-u/ is added. The argument for the cyclic status of /-u/ applies even when it attaches to a V-final stem. In forms like the one below (Sutcliffe 1936: 118), we can diagnose the presence of cyclic stress from the fact that the first stem vowel, but not the prefix vowel, is syncopated:

(44) /jV-ʔara-u/ → [jaʔˈraw] ‘they read (IMPERF)’
3.subj-read-pl.subj
cf. /jV-ʔara/ → [ˈjaʔ.ra] ‘he reads’

As we can see, when /-u/ is attached to a V-final stem, it devocalizes to become an off-glide of the stem-final vowel. The resulting diphthong is bimoraic and so it attracts stress. If we waited to assign stress until after diphthong-formation, the expected parse would be |jaʔa(ˈraw)|. This would leave us without an explanation of why the second but not the first of the unfooted vowels is syncopated. (Indeed, under the ranking we have assumed, syncope of the second vowel would not improve harmony: doing so would result in |jaʔ(ˈraw)|, with a new unfooted heavy syllable. Since WSP outranks EXH(wd), the motivator of syncope, this would be harmonically dis-improving). Likewise, if we assigned stress after suffixation but before diphthong-formation, we would expect antepenult stress: |ja(ˈʔa.ra)u|. This is even worse, because it puts a stress on the very vowel we need to syncopate. By contrast, if we apply stress before adding the suffix, the expected parse is antepenult |(ˈja.ʔa)ra|, which we subsequently expect to undergo syncope of the second vowel as it falls in the weak position of a foot (see n. 15). This is just what we see above in the unsuffixed form of the word. What this suggests is that there is another constraint PREC(build-PWd, insert-imperf-pl) which outranks PREC(IDENT(long), build-PWd). That is, assigning a ‘cycle’ of stress before adding /-u/ is more important than deferring stress-assignment until after lengthening.

The other place where V-final stems show cyclic behavior is when they are negated. Negation is marked by circumfixation of /ma … -ʃ/, though this arguably is really two separate morphs, since there are specific morphological conditions under which each part will appear without the other (Borg & Azzopardi-Alexander 1997: 88-91).[21] What is important for our purposes is that /-ʃ/, like other suffixes, causes lengthening of a preceding vowel. When /-ʃ/ is attached to a vowel-final stem, the final vowel lengthens and gets stress (and, if /aː/, undergoes raising), but the first stem vowel is not deleted (the first three examples are from Misfud [1994: 249], [1995: 301]):

(45) Cyclic stress with /ma … -ʃ/

bena ‘he built’	[ma beniːʃ]	‘he did not build’	
dara ‘he got used’	[ma daraːʃ]	‘he did not get used’	(also Misfud [1995: 119])
nesa ‘he forgot’	[ma nesiːʃ]	‘he did not forget’	(also Misfud [1995: 119])
beda ‘he began’	[ma bædiːʃ]	‘he did not begin’	(Schabert 1976: 117)[22]

This suggests that the first stem vowel is protected by virtue of having been assigned stress ‘cyclically’, prior to the suffixation of /-ʃ/. That means assigning stress before lengthening, so as with /-u/, we can infer that PREC(IDENT(long), build-PWd) is dominated by a constraint which requires us to build a PWd before adding the negative suffix.[23, 24]

6 Conclusion

The distribution of syncope in Maltese shows that neither cyclic stress nor its absence is an immutable property of the language. Normally there is cyclic stress before object markers, but this fails to obtain with vowel-final stems. As we just saw, though, vowel-final stems can and do undergo cyclic stress before other types of suffixes. In this paper I have shown that such facts obtain easily in a theory like OT-CC (and specifically the OI variant of it) where the ordering of processes takes the form of violable pairwise ordering statements. The pressure to assign stress before object suffixation is overridden by a pressure to defer stress until after (pre-

suffixal) lengthening, which in turn is overridden by pressures to assign stress before the addition of imperfective plural subject /-u/ or negative /-ʃ/. OI is able to model such patterns because the ordering used for any given form is chosen by the constraint hierarchy itself, rather than being hard-wired into the overall modular stucture of the grammar, as in Stratal OT (Kiparsky 2000).[25,26] OT-CC thus echoes Local Ordering (Anderson 1969, 1974) in that orderings are decided on a form-by-form basis, rather than being pre-established and fixed for the language as a whole. The existence of such effects in phonology-morphology interaction suggests that situating this interaction within an OT-CC system, as OI does, is empirically desirable.

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[1] Third weak radical stems are those which historically had a glide as the third root consonant. There is a second class of verbs in Maltese whose stem is vowel-final in the absence of a following suffix, but which do show cyclic stress and underapplication of syncope. This is the class of verbs with orthographic <’> as the third radical and [a] as the preceding rightmost vowel. The character <’> (in other environments written <għ>) represents historical /ɣ/ or /ʕ/, and so the fact that these stems pattern with C-final stems in showing cyclic stress (Aquilina 1965: 165) is consistent with Brame’s (1972) arguments that the /ʕ/ remains synchronically underlying.

[2] I am grateful to Gilbert Puech for pointing out the existence of this paper to me.

[3] This process (the synchronic *imaala*) involves raising of stressed long /aː/ to a high vowel whose exact quality shows a good deal of dialectal variation. Here I follow Borg (1997) in transcribing the vowel as [ɪː]; as the passage from Sutcliffe (1936) indicates, the raised vowel is written <ie> in Maltese orthography.

[4] For at least some present-day speakers, there are some lexical exceptions to this pattern. Michael Spagnol (p.c.) reports that object-marked forms of *nesa* and *mela* (among other verbs) resist syncope in his idiolect.

[5] Because syncope for this particular verb creates an initial cluster beginning with a sonorant, these forms will be pronounced with a prothetic initial [i], unless they are immediately preceded by a vowel-final word within the same phonological phrase.

[6] Indirect objects are generally marked by /-l-/ followed by the same suffix as would be used for a direct object of the same person/number/gender. One source of difference is that the 3rd.masc.sg. object suffix has a post-vocalic allomorph /-h/ (which will appear after the final vowel of a weak-final stem) and a post-consonantal allomorph /-u/ (which will appear following the indirect-object /-l-/).

[7] The ‘approximately’ is the result of the mechanism of CHAIN MERGER. Technically, candidates in OT-CC are not sequences of representations but rather surface forms plus a partially-ordered set of the derivational operations which were applied to reach the surface form. Merger makes these sets partially ordered by combining together candidates which reach the same output via different orders of application of the same operations, keeping only those ordering relations among the operations which are shared by all of the merged chains. While

essential to the analysis of many kinds of opacity effects in OT-CC, it is possible to abstract away from merger with regards to all of the facts being discussed here. This is advantageous for expositiory purposes, since thinking of candidates as sequences of derivational steps is probably more intuitive for the majority of readers.

[8] However, cf. Prince & Smolensky (2004 [1993]: ch. 2), Elfner (2009) and Pater (to appear) on syllabification as a step in its own right (and in turn cf. Elfner [2010]).

[9] Local Ordering also incorporates a notion of ranking between conflicting ordering requirements (Anderson 1974: 159-164, 189, 198, 217-218).

[10] As Eure (1999: 16-17) points out, the characterization of /σLL/ words as getting antepenult stress is necessarily opaque. In derivational terms, after antepenult stress is assigned to /…ˈσ.CV.CV(C)/, the penult vowel will syncopate, giving surface […ˈH.CVC]. In parallel OT, the antepenult case can therefore be understood as actually reflecting a surface-oriented preference for penult stress with heavy stressed syllables across the board, consistent with descriptions of Maltese stress as being generally penultimate (e.g. Borg & Azzopardi-Alexander [1997: 320-321]); see also Sutcliffe [1936: 12-13], Aquilina [1959: 73], Borg [1997: 277-278], and Vella [2003: 268-269] on this aspect of the stress-syncope relationship. Because this paper adopts a serial-OT orientation, with stress necessarily assigned before syncope, I will follow Brame (1972, 1973, 1974) in assuming antepenult stress. (Surface antepenult stress does occur in loans, though in all such cases the antepenult is heavy; see e.g. Borg & Azzopardi-Alexander [1997: 321] and Vella [2003: 270; 2009: 67].)

[11] McCarthy (2003b), among others, is critical of the use of gradient constraints and in particular gradient alignment constraints in parallel OT. Pruitt (2008: §4.2) argues that the alternative of categorical alignment is incompatible with serial optimization, and that at least some of the pathologies associated with gradient foot alignment under parallel optimization disappear with serial optimization.

[12] According to Borg (1997: 251-252) there are cases of stressed [VC#] derived from underlying [VCC#].

[13] Odden (1990, 1993) also assumes that final long vowels attract stress, albeit for analysis-internal reasons.

[14] Throughout, I treat the consonantal root, vocalism, and pattern as a single morph (contra e.g. McCarthy [1979]). This is chiefly to simplify the exposition, but it may also be empirically motivated by psycholinguistic research finding that primes with shared roots, but not shared patterns, faciliate lexical access in Maltese (Twist 2006; Ussishkin & Twist 2007; Ussishkin *et al.* 2011).

[15] EXHAUSTIVITY(word) will be the driver of syncope in all of the examples discussed in this paper. In /…LLL/ forms which initially get an antepenult parse |…(ˈLL)L|, syncope of the penult vowel will instead be a response to *VPL-WEAK, which forbids vowel place features in the dependent position of a foot, as in the analysis of metrically-conditioned syncope in McCarthy (2008).

[16] Thanks to Abdelaziz Boudlal for prompting me to be more explicit about the fate of the floating mora with C-final stems.

[17] For a previous proposal for positional faithfulness to heavy syllables, see Akinlabi & Urua (2000: 286).

[18] Odden's (1990, 1993) analysis posits that all morphology precedes all phonology, but that phonology does operate cyclically on morphological constituents. He proposes that pre-suffixal

lengthening applies pre-cyclically, so on the stem cycle, the final vowel is already long if there is a suffix on the next cycle. This results in the stem-final vowel getting stress on the first cycle. The problem for this approach is that it predicts that phonologically-conditioned allomorphy of an affix cannot be sensitive to derived phonological properties of the affix's base; despite the counter-arguments given in Odden (1990, 1993) against certain proposed examples, this seems to be well-attested (see e.g. Kiparsky [1996: 24-25], Wolf [2009]).

[19] The reasoning is as follows. For a stem like /mela/, it will never be locally optimal to place stress on the second syllable until after lengthening (and therefore, after suffixation) has occurred. If we tried assigning stress before suffixation, the locally optimal parse would be |(ˈme)la| (see (37c-e).) If we assigned a foot parse to the string /me.la.na/ (after suffixation but before docking the floating mora), the locally optimal parse would be |(ˈme.la)na|, with antepenult stress. By contrast, after lengthening, the locally-optimal choice is to stress the heavy penult (see (38)). After reaching |me(ˈlaː)na|, it is not harmonically improving to build any more feet (see (39)). Ergo, to get a stress anywhere other than on the second syllable, we would have to assign stress before lengthening, and thus violate PREC(ID(long), build-PWd)).

[20] Since syncope at this step can create a sonorant-initial onset cluster /ml/, EXHAUSTIVITY(word) must outrank the constraint against such clusters. Maltese adds a prothetic /i/ before such word-initial clusters, unless the preceding word ends in a vowel and is in the same phonological phrase (Sutcliffe 1936: 16; Brame 1972: 33-34; Borg 1997: 273-274). For prothesis to improve harmony, it must not create a new violation of EXHAUSTIVITY(word), i.e. the syllable headed by the prothetic vowel must fall outside of the PWd. Along the lines of de Lacy (2004) and Flack (2009: 292-294), we may assume that the PWd left- and right-edge alignment constraints abbreviated as WDCON require only syllables whose nuclei belong to the morphological word to be parsed into the PWd. Since epenthetic vowels lack a morphological affiliation, the prothetic vowel can then be extraprosodic, and thus not incur a violation of EXHAUSTIVITY(word). This solution obviously would not work for vowel epenthesis into word-medial CRC clusters; however, claimed cases of this seem amenable to re-analysis. First, Hume (1994: ch. 6) argues that CRVCV → CVRCV metathesis is really syncope followed by epenthesis (see also Kiparsky [2003]). However, in order to predict the quality of the vowel inserted before the sonorant, the analysis in Hume (1994) needs to assume that 'syncope' leaves behind a floating vocalic melody which then associates to an epenthetic V-slot, so it is effectively a notational variant of assuming literal metathesis. Second, there is epenthesis to the left of the indirect-object suffix /-l-/ (see n. 6) when it occurs between two consonants. However, this may be partly morphologized, since there is no epenthesis when the consonant preceding /-l-/ belongs to the 3rd person plural direct object marker /-hom/ (Aquilina 1965: 213).

[21] Specifically, negated imperatives take only /-ʃ/ (p. 88), while /ma/ by itself is used when the verb occurs with certain negative pronouns like *ħadd* 'nobody', *xejn* 'nothing', *imkien* 'nowhere', or with the negative adverb *qatt* 'never' (pp. 90-91).

[22] Schabert's (1976) data come from the dialects of St. Julian's and Marsaxlokk.

[23] For reasons too involved to go into here, the constraint in question cannot be a PREC constraint, but instead an alignment constraint (McCarthy & Prince 1993b) requiring /-ʃ/ to appear at the right edge of a PWd. If ranked above MAX-M, this constraint will prevent it from being harmonically-improving to insert /-ʃ/ unless a PWd is already in place.

[24] For reasons of space I have not dealt at all here with another potential source of violations of PREC(IDENT(long), build-PWd), namely when the vowel of a V-final suffix lengthens before another suffix, but we would need to apply a 'cycle' of stress to a constituent inside of the suffix which induces the lengthening. This is a concern but not a very big one, since the range of suffix combinations possible in the language produces relatively few such situations where cyclic stress is actually required. (For details, see Wolf [2011], which is a brief appendical note to the present paper.) Another source of potential cases of stress applying before lengthening involves lengthening/vocalization induced by the abstract consonant /ʕ/ (Brame 1972); we may simply have to extrinsically order /ʕ/-vocalization after stress (in OT-CC, via another PREC constraint), as Brame's analysis in fact assumes.

[25] For a similar argument from Tigrinya, see Wolf (2009).

[26] There is a way to model the Maltese facts in Stratal OT, but which requires a type of Duke of York derivation (Pullum 1976) which leads to implausible typological predictions about stress-conditioned phonology (Wolf in prep.).

References

Akinlabi, A., and Urua, E. (2000). Tone in Ibibio verbal reduplication. In H.E. Wolff and O.D. Gensler (eds), *Proceedings of the Second World Conference of African Linguistics, Leipzig 1997* 279--291 Köln: Rüdiger Köppe Verlag.

Anderson, S.R. (1969). *West Scandinavian Vowel Systems and the Ordering of Phonological Rules*. Ph.D. dissertation, MIT, Cambridge, MA.

Anderson, S.R. (1974). *The Organization of Phonology*. San Diego: Academic Press.

Anderson, S.R. (1992). *A-Morphous Morphology*. Cambridge: Cambridge University Press.

Aquilina, J. (1959). *The Structure of Maltese: A Study in Mixed Grammar and Vocabulary*. Valletta: Royal University of Malta.

Aquilina, J. (1965). *Teach Yourself Maltese*. London: English Universities Press.

Berrendonner, A., Le Guern, M., and Puech, G. (1983). *Principes de grammaire polylectale*. Lyon: Presses Universitaires de Lyon.

Beard, R. (1995). *Lexeme-Morpheme Base Morphology*. Albany: SUNY Press.

Beckman, J.N. (1998). *Positional Faithfulness*. Ph.D. dissertation, University of Massachusetts, Amherst.

Bermúdez-Otero, R. (2001). Underlyingly nonmoraic consonants, faithfulness, and sympathy. Ms., University of Manchester. [Available online at http://bermudez-otero.com/DEP-mora.pdf]

Borg, A.J., and Azzopardi-Alexander, M. (1997). *Maltese*. London: Routledge.

Borg, A. (1997). Maltese phonology. In A.S. Kaye (ed.), *Phonologies of Asia and Africa*, vol. 1 245--285. Winona Lake, IN: Eisenbrauns.

Brame, M.K. (1972). On the abstractness of phonology: Maltese ʕ. In M.K. Brame (ed.), *Contributions to Generative Phonology* 22--61. Austin: University of Texas Press.

Brame, M.K. (1974). The cycle in phonology: Stress in Palestinian, Maltese, and Spanish. *Linguistic Inquiry* **5**: 39--60.

Broselow, E., Chen, S.-I. and Huffman, M. (1997). Syllable weight: Convergence of phonology and phonetics. *Phonology* **14**: 47--82.

Campos-Astorkiza, R. (2004). Faith in moras: A revised approach to prosodic faithfulness. In K. Moulton and M. Wolf (eds.), *Proceedings of the 34th Annual Meeting of the North East Linguistic Society*, vol. 1 163--174 Amherst: GLSA.

Chomsky, N., and Halle, M. (1968). *The Sound Pattern of English*. New York: Harper and Row.

Chomsky, N., Halle, M., and Lukoff, F. (1956). On accent and juncture in English. In M. Halle, H. Lunt, H. McLean and C. van Schooneveld (eds), *For Roman Jakobson: Essays on the Occasion of his Sixtieth Birthday* 65--80. The Hague: Mouton.

de Lacy, P. (2004). Maximal words and the Māori passive. In J.J. McCarthy (ed.), *Optimality Theory in Phonology: A Reader* 295--512. Oxford: Blackwell.

Elfner, E. (2007). Moraic faithfulness: Evidence from Blackfoot and English. Talk presented at 15th Manchester Phonology Meeting, University of Manchester, UK. [Handout available

online at http://www.people.umass.edu/eelfner/morafaith.pdf]

Elfner, E. (2009). Syllabification and stress-epenthesis interactions in Harmonic Serialism. Ms., University of Massachusetts Amherst. [ROA-1047]

Elfner, E. (2010). Stress-epenthesis interactions in Harmonic Serialism. Ms., University of Massachusetts Amherst. [Available online at http://www.people.umass.edu/eelfner/elfner_2010_Stress-epenthesisHS.pdf]

Eure, J. (1999). *Maltese Arabic Syllabic Phenomena in Optimality Theory*. Senior essay in Linguistics, Yale College, New Haven, CT.

Fenech, E. (1978). *Contemporary Journalistic Maltese: An Analytical and Comparative Study*. Leiden: E.J. Brill.

Flack, K. (2009). Constraints on onsets and codas of words and phrases. *Phonology* **26**: 269--302.

Gouskova, M. (2003). *Deriving Economy: Syncope in Optimality Theory*. Ph.D. dissertation, University of Massachusetts Amherst.

Hume, E.V. (1994). *Front Vowels, Coronal Consonants, and their Interaction in Nonlinear Phonology*. New York: Garland.

Itô, J., and Mester, A. (2003). Weak layering and word binarity. In T. Honma, M. Okazaki, T. Tabata, and S.-I. Tanaka (eds.), A *New Century of Phonology and Phonological Theory: A Festschrift for Professor Shosuke Haraguchi on the Occasion of his Sixtieth Birthday* 26--65. Tokyo: Kaitakusha.

Johnson, C.D. (1990). Levantine cyclogenesis. In M. Eid and J.J. McCarthy (eds.), *Perspectives on Arabic Linguistics II* 143--166. Amsterdam: John Benjamins.

Kimper, W. (2011). Locality and globality in phonological variation. *Natural Language and Linguistic Theory* **29**: 423--465.

Kiparsky, P. (1973). Phonological representations. In O. Fujimura (ed.). *Three Dimensions of Linguistic Theory* 1--135. Tokyo: TEC.

Kiparsky, P. (1996). Allomorphy or morphophonology? In R. Singh (ed.), *Trubetzkoy's Orphan* 13-31. Amsterdam: John Benjamins.

Kiparsky, P. (2000). Opacity and cyclicity. *The Linguistic Review* **17**: 351--367.

Kiparsky, P. (2003). Syllables and moras in Arabic. In C. Féry and R. van de Vijver (eds.), *The Syllable in Optimality Theory* 161--182. Cambridge: Cambridge University Press.

McCarthy, J.J. (1979). *Formal Problems in Semitic Phonology and Morphology*. Ph.D. dissertation, MIT, Cambridge, MA.

McCarthy, J.J. (2003a). Sympathy, cumulativity, and the Duke-of-York gambit. In C. Féry and R. van de Vijver (eds.), *The Syllable in Optimality Theory* 23--76. Cambridge: Cambridge University Press.

McCarthy, J.J. (2003b). OT constraints are categorical. *Phonology* **20**: 75--138.

McCarthy, J.J. (2005). The length of stem-final vowels in colloquial Arabic. In M.T. Alhawary and E. Benmamoun (eds.), *Perspectives on Arabic Linguistics XVII-XVIII* 1--26. Amsterdam: John Benjamins.

McCarthy, J.J. (2007). *Hidden Generalizations: Phonological Opacity in Optimality Theory*.

London: Equinox.

McCarthy, J.J. (2008). The serial interaction of stress and syncope. *Natural Language and Linguistic Theory* **26**: 499--546.

McCarthy, J.J. (2010). Studying GEN. *Journal of the Phonetic Society of Japan* **13**.2: 3--12. [ROA-1049]

McCarthy, J.J., and Prince, A. (1993a). *Prosodic Morphology I: Constraint Interaction and Satisfaction*. Technical Report 3, Rutgers University Center for Cognitive Science, New Brunswick, NJ. [ROA 482]

McCarthy, J.J., and Prince, A. (1993b). Generalized Alignment. *Yearbook of Morphology 1993*: 79--153. [ROA-7]

McCarthy, J.J., and Prince, A. (1995). Faithfulness and reduplicative identity. In J.N. Beckman, S. Urbanczyk, and L. Walsh Dickey (eds.), *University of Massachusetts Occasional Papers in Linguistics 18*: *Papers in Optimality Theory* 249--384. Amherst: GLSA. [ROA-60]

McCarthy, J.J., and Pruitt, K. (to appear). Sources of phonological structure. In H. Broekhuis and R. Vogel (eds), *Linguistic Derivations and Filtering: Minimalism and Optimality Theory*. London: Equinox.

Misfud, M. (1994). The weak-final conjugation in the Semitic component of Maltese. In J.M. Brincat (ed.), *Languages of the Mediterranean: Substrata - The Islands - Malta: Proceedings of the Conference Held in Malta: 26-29 September 1991* 244--265. Msida: Institute of Linguistics, The University of Malta.

Misfud, M. (1995). *Loan Verbs in Maltese: A Descriptive and Comparative Study*. Leiden: E.J. Brill.

Norris, M. (to appear). The architecture of derivational OT: Evidence from Icelandic syncope. In L. Fainlieb, N. LaCara, and Y. Park (eds), *Proceedings of the 41st Annual Meeting of the North East Linguistic Society*. Amherst: GLSA.

Odden, D. (1990). Phonology and its interaction with syntax and morphology. *Studies in the Linguistic Sciences* **20**.2: 69--108.

Odden, D. (1993). Interaction between modules in Lexical Phonology. In S. Hargus and E.M. Kaisse (eds.), *Phonetics and Phonology 4: Studies in Lexical Phonology* 111--144. San Diego: Academic Press.

Pater, J. (to appear). Serial Harmonic Grammar and Berber syllabification. In T. Borowsky, S. Kawahara, T. Shinya, and M. Sugahara (eds), *Prosody Matters: Essays in Honour of Elisabeth O. Selkirk*. London: Equinox. [ROA-1085]

Prince, A. (1985). Improving tree theory. In M. Niepokuj, M. Van Clay, V. Nikiforidou, and D. Jeder (eds.), (eds.), *Proceedings of the 11th Annual Meeting of the Berkeley Linguistics Society* 471--490. Berkeley: BLS.

Prince, A. (1990). Quantitative consequences of rhythmic organization. In M. Ziolkowski, M. Noske, and K. Deaton (eds), *Proceedings of the 26th Regional Meeting of the Chicago Linguistic Society: Volume 2: Parasession on the Syllable in Phonetics and Phonology* 355--398. Chicago: CLS.

Prince, A. (2003). Arguing Optimality. In A.C. Carpenter, P. de Lacy, and A.W. Coetzee (eds.),

University of Massachusetts Occasional Papers in Linguistics 26: Papers in Optimality Theory II 269--304. Amherst: GLSA. [ROA-562]

Prince, A., and Smolensky, P. (2004 [1993]). *Optimality Theory: Constraint Interaction in Generative Grammar*. Oxford: Blackwell. [ROA-537]

Pruitt, K. (2008). Iterative foot optimization and locality in stress systems. Ms., University of Massachusetts Amherst. [ROA-999]

Pruitt, K. (2010). Serialism and locality in constraint-based metrical parsing. *Phonology* **27**: 481--526.

Pullum, G.K. (1976). The Duke of York gambit. *Journal of Linguistics* **12**: 83--102.

Schabert, P. (1976). *Laut- und Formenlehre des Maltesischen anhand zweier Mundarten*. Erlangen: Palm und Enke.

Selkirk, E.O. (1995). The prosodic structure of function words. In J.N. Beckman, S. Urbanczyk, and L. Walsh Dickey (eds), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory* 439--470. Amherst: GLSA.

Sutcliffe, E.F. (1936). *A Grammar of the Maltese Language: With Chrestomathy and Vocabulary*. London: Humphrey Milford/Oxford University Press.

Twist, A. (2006). *A Psycholinguistic Investigation of the Verbal Morphology of Maltese*. Ph.D. dissertation, University of Arizona, Tucson.

Ussishkin, A., and Twist, A. (2007). Auditory and visual lexical decision in Maltese. In B. Comrie, R. Fabri, E. Hume, M. Misfud, T. Stolz, and M. Vanhove (eds.), *Introducing Maltese Linguistics* 233--249. Amsterdam: John Benjamins.

Ussishkin, A., Wedel, A., Schluter, K., and Dawson, C. (2011). Supraliminal and subliminal root and binyan priming in Maltese. Talk presented at GĦILM 3rd Conference on Maltese Linguistics, University of Malta, Valletta. [Slides available online at http://www.um.edu.mt/__data/assets/pdf_file/0015/124008/ussishkin.shluter.pdf]

Vella, A. (2003). Language contact and Maltese intonation: Some parallels with other language varieties. In K. Braunmüller and G. Ferraresi (eds.), *Aspects of Multilingualism in European Language History* 261-283. Amsterdam: John Benjamins.

Vella, A. (2009). Maltese intonation and focus structure. In R. Fabri (ed.), *Maltese Linguistics: A Snapshot: In Memory of Joseph A. Cremona (1922-2003)* 63-92. Bochum: Brockmeyer.

Wilson, C. (2006). Counterfeeding from the past. Ms., University of California, Los Angeles. [Available online at http://quote.ucsd.edu/blogs/sadphig/files/2009/01/counterfeedingfromthepast.pdf]

Wolf, M. (2008). *Optimal Interleaving: Serial Phonology-Morphology Interaction in a Constraint-Based Model*. Ph.D. dissertation, University of Massachusetts Amherst. [ROA-996]

Wolf, M. (2009). Local ordering in phonology/morphology interleaving: Evidence for OT-CC. 83rd Linguistic Society of America Annual Meeting, San Francisco, CA. [Handout available online at http://wolf.phonologist.org/LSA%202009%20handout.pdf]

Wolf, M. (2010). On the existence of counter-feeding from the past. 84th Linguistic Society of America Annual Meeting, Baltimore, MD. [Handout available online at http://wolf.phonologist.org/OnTheExistenceOfCFFTP-corrected.pdf]

Wolf, M. (2011). A note on cyclic stress and suffix-vowel lengthening in Maltese. Ms., Yale University, New Haven, CT.

Wolf, M. (in prep.) Inversion of stress-conditioned phonology in Stratal OT. Ms., Yale University, New Haven, CT.