

Cyclicity and non-cyclicity in Maltese:

Local ordering of phonology and morphology in OT-CC*

Matthew Wolf

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.'taf-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 be understood 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

Maltese is the national language (and, with English, the co-official language) of the Republic of Malta, a small archipelago of 417,000 inhabitants located in the center of the Mediterranean. The Maltese language is a descendant of Arabic, which was introduced to the islands during the period of Arab rule from 870 to 1091. This era concluded with the conquest of Malta by Norman Sicily, which politically and religiously separated the islands from the rest of the Arabic-speaking world. Arabic remained the vernacular language, but now came into close contact with Italian. The present-day Maltese language resulting from this history is often

described as a ‘mixed language’, due to the co-existence of a large amount of vocabulary (and certain grammatical influences) borrowed from Italian alongside that inherited from Arabic. Malta was under British rule from 1800 to 1964, which has resulted more recently in heavy borrowing from English; the Maltese population today is extensively bilingual in Maltese and English.

My concern in this paper is primarily to account for vowel ~ zero alternations in verbs in the Semitic part of the vocabulary, more specifically verbs of the first measure whose stems have the shape [CVCVC] in the 3rd person masculine singular perfective, where there are no phonologically overt affixes. Taking /CVCVC/ to in fact be the underlying form of the stem, Brame (1972, 1974) argues that vowel ~ zero alternations in verb paradigms can be accounted for if we assume that stress is assigned as in (1), and that stress assignment is followed by a rule which syncopates vowels in unstressed, non-final open syllables:²

- (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.

This can be illustrated by looking at a representative inflectional paradigm of first-measure verb in the perfective:

(2) *qatel* ‘kill’ (Sutcliffe 1936: 68)³

a. /ʔitil-t/	[ʔtilt]	‘I killed’	e. /ʔitil-na/	[ʔtil.na]	‘we killed’
b. /ʔitil-t/	[ʔtilt]	‘you.SG killed’	f. /ʔitil-tu/	[ʔtil.tu]	‘you.PL killed’
c. /ʔitil-it/	[ʔat.let]	‘she killed’	g. /ʔitil-u/	[ʔat.lu]	‘they killed’
d. /ʔitil-Ø/	[ʔa.tel]	‘he killed’			

Final stress (clause (1a)) is seen in (2a,b); penult stress (clause (1b)) is seen in (2d,e,f); and antepenult stress (clause (1c)) is seen in (2c,g). It should be acknowledged that these assumptions about the stress-syncope relationship are not universally accepted. In particular, Puech (2011) argues that ‘syncope’ in Maltese is actually a matter of vowels of the vocalic melody not being incorporated into syllable structure in the first place. For forms like [ʔat.lu] for which Brame’s (1972, 1974) analysis posits a pre-syncope antepenult stress (/ʔa.te.lu/), Puech’s analysis has the syllabification algorithm produce /ʔat.lu/, which then is assigned penult stress. One argument for Puech’s (2011) analysis is that by having ‘syncope’ apply before stress assignment rather than after, it avoids the need to posit the antepenult stress clause (1c). That is claimed to be advantageous on the grounds that loanwords with antepenult stress are often adapted with penult stress (e.g. English *Arabic* → Maltese *e.re.bic*).^{4,5} Limits of time and space unfortunately make it impossible to do justice to Puech’s alternative approach in this chapter, so from here on I will adhere to the probably more familiar approach from Brame (1972, 1974) that stress precedes (and determines the site of) syncope, entailing that the stress pattern is as in (1). In any case, the examples crucial to my argument will involve penult stress.

Given these assumptions, one argument for the cycle in Maltese comes from the fact that 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, previewed earlier in the introduction:

- (3) (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 (3a), 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 (3b), 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 syncopeated.

The evidence for the cycle comes from forms like (3c), 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 syncopeate, even though the underlying segmental composition of the word is identical to that of (3b) 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 (3c) 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 (3b), 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:

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

It is important to note that the secondary stresses, like the one which this analysis must posit for the initial syllable of words like [ħa.ˈtaf.na], are not reported in descriptions of Maltese (e.g. Aquilina 1959: 68); Brame (1974: 44) acknowledges this, suggesting that, if needs be, the secondary stress may be deleted by a late rule ordered after syncope. (We shall see later that, notwithstanding Kiparsky [2011: 5-6], the existence of some such destressing process is not in principle incompatible with the analysis to be proposed here.)

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 /ɪ/-*MW*]^{6, 7, 8} (p. 157; boldface in original):

- | | | | |
|--------------|--------------------|-----------|--------------------|
| (5) [mlɪ:ni] | ‘he filled me’ | [mlɪ:na] | ‘he filled us’ |
| [mlɪ:k] | ‘he filled you.SG’ | [mlɪ:kom] | ‘he filled you.PL’ |
| [mlɪ:h] | ‘he filled him’ | [mlɪ:hom] | ‘he filled them’ |
| [mlɪ:ha] | ‘he filled her’ | | |

Sutcliffe goes on to note that the same holds for verbs with indirect object markers⁹ (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]

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|--------------|---------------|------------|---------|
| (6) [swɪ:li] | 1sg IDO | [swɪ:lɪna] | 1pl IDO |
| [swɪ:lek] | 2sg IDO | [swɪ:lkom] | 2pl IDO |
| [swɪ:lu] | 3sg masc. IDO | [swɪ:lhom] | 3pl IDO |
| [swɪ:lha] | 3sg fem. IDO | | |

The goal of this paper is to account for this difference between consonant-final and vowel-final verb stems. Before presenting 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,¹⁰ 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:

- (7) *Gradualness*: Given a chain $\langle \dots, l_i, l_{i+1}, \dots \rangle$, l_{i+1} can differ from l_i by the performing of at most one basic operation.
- (8) *Harmonic improvement*: Given a chain $\langle \dots, l_i, l_{i+1}, \dots \rangle$, l_{i+1} must be more harmonic than l_i , given the constraint ranking of the language in question.
- (9) *Local Optimality*: Let $\langle f_1, f_2, \dots, f_n \rangle$ be a valid chain in language L , and let $\{g_1, g_2, \dots, g_m\}$ be the set of all the forms which could be produced by applying an operation of type T to f_n . Then $\langle f_1, f_2, \dots, f_n, g_i \rangle$ is not a valid chain of L unless g_i is the most harmonic member of the set $\{g_1, g_2, \dots, g_m\}$. (*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 (7) 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.

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/ \rightarrow [ka.ni]), 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/ \rightarrow kan.i \rightarrow [ka.ni]).¹¹ The building of higher-level prosodic structure will, however, occur as distinct derivational steps. Specifically, I will assume that the following operations are available:

- (10) Build one Prosodic Word node along with a single head foot. (cf. McCarthy 2008)
- (11) Build one foot. (Pruitt 2008, 2010, 2012; Kimper 2011)

Assumptions about affixation will be deferred until the next subsection, when OI and its assumptions about the interface are laid out. Finally, since we are also dealing with syncope, I will also assume that deletion of one vowel is a basic operation.

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:

- (12) **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.¹² 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, 2010].)

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:

$$(13) \quad [\sqrt{\text{CAT PLURAL}}] \rightarrow \begin{array}{c} [\sqrt{\text{CAT PLURAL}} \\ \sqrt{\text{CAT PLURAL}} \\ /kæt-z/ \end{array} \rightarrow \begin{array}{c} [\sqrt{\text{CAT PLURAL}} \\ \sqrt{\text{CAT PLURAL}} \\ [\text{kæts}] \end{array}$$

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 to these underlying forms, 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 $\text{PREC}(P, M)$, 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 which demand similarity between the morphosyntactic feature-content of morphemes, and that of the morphs with which they stand in correspondence.

With these preliminaries 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):

(14) $\text{PREC}(\text{build-PWd}, \text{Insert-obj})$

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, the pre-syncope stress pattern assumed in (1) is of the Latin type: stress the penult if heavy, else stress the antepenult. 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):

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

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

(16) *Stress on heavy penult*

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

(17) 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.

(18) 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.)¹³

The notation used in (15-16) and throughout for prosodic boundaries is as follows: ‘.’ denotes syllable boundaries; ‘(...)’ foot boundaries, and ‘|...|’ PWD boundaries. 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 sole 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:

(19) *Monosyllables get stress*

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

(20) 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.¹⁴ An additional case to consider involves

final [CV:] syllables. These are generally absent in Maltese; however, the language does have stress on final open syllables in a few native Maltese words which end in a diphthong (Vella 2009: 66-68), as in (21a). Word-final long vowels are found in loans, especially from Italian, and these are also stressed (Aquilina 1959: 121-126, 1965: 26, 28; Fenech 1978: 18-19; Vella 2003: 270-271); as seen in (21b) below, these vowels are written with a grave accent in the standard orthography.

(21) (a) *Mulej* [mʊ.ˈlɛi] ‘Lord’

(b) *università* ‘university’, *Mari* ‘Mary’, *tribù* ‘tribe’, *repò* ‘refreshments’, *kafè* ‘coffee’

If we generalize from such examples that final [CV:], when it surfaces as long, does attract stress,¹⁵ then it is only [CVC] syllables which are unexpectedly not heavy enough to get stress in word-final position. We can account for that fact by assuming that the last consonant of a word cannot project a mora, as Eure (1999: 14) proposes for Maltese; 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 [CV:], [CV:C], and [CVC^μC] 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]):

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

/CVCVCVCC/	WSP	NONFIN(Ft)
a. → CV.CV(^l CVC ^μ C)		1
b. (^l CV.CV)CVC ^μ C	1 W	L

(23) *Final CVC syllable doesn’t attract stress*

/CVCVCVC/	WSP	NONFIN(Ft)
a. CV.CV(^l CVC)		1 W
b. → (^l CV.CV)CVC		

(24) 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:

(25) *Insertion of stem is harmonically improving*

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

Form (25a) 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 (25b) 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.¹⁶ 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 (26), we have two options for continuing on from (25b): spell out the suffix, or lay down a PWd with its head foot:

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

<i>Input from (25b)</i>	ħa.taf-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. ħa.taf-1PL	1	1					
<i>insert morph</i>	b. → _L ħa.taf ^l .na		1					
<i>Build PWd</i>	c. → _L (ħa)taf -1PL	1				1	1	
	d. (ħa.taf) -1PL	1			1			
	e. ħa(ʔaf) -1PL	1			1		1	

(27) 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 (26b), 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 three logically possible ways to build a single trochaic foot: an initial monosyllabic foot as in (26c), a binary foot as in (26d), or a final monosyllabic foot as in (26e). (I assume that a constraint requiring feet to be trochaic is undominated in Maltese.) The latter two are less harmonic than (26c) 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 (26c) 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 subsequently add the suffix /-na/. If we chose a binary foot instead, this would give us |(ʰa.taʰna)| after suffixation. The trouble is that we would now need /taʰ/ to receive the primary stress. Getting from |(ʰa.taʰna)| to |(ʰa)(taʰna)| requires that we both dis-affiliate /taʰ/ from its previous foot and also build a new foot with /taʰ/ as its head. If these have to occur as separate steps, we are stuck: unfooting /taʰ/ 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:

(28) *Unfooting penult after suffixation worsens harmony*

		(ʰa.taʰna)	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a.	(ʰa.taʰna)			1		1	1	
<i>Build PWD</i>	b.	👎 (ʰa)taʰ.na			1		2	2	

We could in principle bypass this conundrum by relaxing our theory of gradualness by assuming that GEN can go from |(ʰa.taʰna)| to |(ʰa)(taʰna)| in one step. This, however, is undesirable insofar as it jeopardizes some of the empirical advantages of serial over parallel foot optimization. As Pruitt (2010: 502, fn. 15) and McCarthy & Pruitt (to appear: §4.2) note, a definition of gradualness which permitted direct mappings like |(ʰHL)L|→|(ʰH)(LL)| would make possible (at least in 3 vs. 4-syllable words) an unattested asymmetry wherein the parsing of an initial heavy syllable (in a language with left-to-right footing) as a unary vs. as part of a binary foot is determined nonlocally by the parity of the following string. Building a unary initial foot in |(ʰH)(LL)| vs. a binary initial foot in |(ʰHL)(LL)| permits exhaustive parsing into (minimally) bimoraic feet. This sort of pattern is unattested (Hyde 2007, 2008), and is excluded in HS if the grammar builds feet one at a time (Pruitt 2010: 496-503): informally, gradual foot optimization means that the grammar must commit itself to either |(ʰHL)L...| or |(ʰH)LL...| before attempting to foot the rest of the string. At least in 3-syllable words, allowing |(ʰHL)L|→|(ʰH)(LL)| as a one-step mapping would provide a way to escape this commitment, and hence should arguably not be allowed. If the grammar is indeed barred from building a new foot over part of an existing foot in one step, then |(ʰa)taʰ| must be footed as such in order for |(ʰa)(taʰna)| to be reachable.¹⁷

The subchain <SNATCH-1PL, ʰa.taʰ-1PL, |(ʰa)taʰ|-1PL> represents the course that we want to start on to achieve the an output 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. (The other path from (26), namely that which starts by spelling out the suffix as

in (26b), will be followed up on later.) 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.

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

<i>Input from (26c)</i>		(ḥa)taf -1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a.	(ḥa)taf -1PL	1				1	1	
<i>insert morph</i>	b. → _L	(ḥa)taf ^f .na			1		2	2	
<i>Delete V</i>	c. ↯	(ḥatf) -1PL	1			1			1

To preview what we ultimately say about syncope, the representation |(ḥa)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.¹⁸ 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 (29b), the coda of the syllable /taf^f/ 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.¹⁹

After suffixal /-na/ has been added, it is harmonically improving to foot the now-medial syllable /taf^f/, since doing so no longer violates NONFINALITY(ft). Below in (30), I assume that head-foot status is immediately transferred from the previously-built foot to the new foot,²⁰ though this is not essential:

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

<i>Input from (29b)</i>		MAX-V (heavy)	WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. ('ħa)taf ^h .na		1		2	2	
<i>Add foot</i>	b. → _L (ħa)(^h taf ^h)na				3	1	
	c. (ħa)(^h taf ^h .na)			1	2		
	d. ☞ (ħa)taf ^h (^h na)		1	1	2	1	
<i>Delete V</i>	e. → _L (ħa)taf ^h n		1		1	1	1
	f. ☞ (ħat ^h)fna	1			1	1	1

If we continue this derivational path by building a foot on /taf^h/, 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 a 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 (30b), yielding |(ħa)(^htaf^hn)|, would create a violation of NONFIN(ft) and therefore is not harmonically improving, as mentioned earlier.

Some discussion is in order, however, about vowel deletion as a possible step to take from |(ħa)taf^h.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 (30f), |(ħat^h)fna|, because it eliminates the unfooted (and perforce unstressed) heavy syllable /taf^h/, 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 |(ħat^h)fna| is worrisome because, again given the constraints depicted above, it is more harmonic than the attested winner |(ħa)(^htaf^h)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 |(ħat^h)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 *|(ħat^h)fna| are blocked due to the tri-

consonantal cluster which closed-syllable syncope would give 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-ú:-h] ‘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 (30): 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.²¹

If *|(ʰatʰ)fna| is barred on such grounds from being harmonically improving, this still leaves the apocope-derived |(ʰa)tafʰn| 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):

(31)

<i>Input from (30e)</i>		WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. (ʰa)tafʰn	1		1	1	
<i>Add foot</i>	b. → _L (ʰa)(ʰtafʰn)		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 |(ʰa)tafʰ.na| → |(ʰa)tafʰn| being harmonically improving, a chain ending <...|(ʰa)tafʰn|> will fare poorly compared to the attested winner |(ʰa)(ʰtafʰ)na| (when /-na/ is an object marker) or |(ʰtafʰ)na| (when /-na/ is a subject marker): |(ʰa)tafʰn| violates WSP, but the attested winners do not. As seen above, the WSP violation can be eliminated in the continuation of that chain as <...|(ʰa)tafʰn|, |(ʰa)(ʰtafʰn)|>, 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 (26c) 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 (26b): the form /ʰa.taʰ.na/, 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.ta^f.na/, the first thing that we can do is to build a PWd and head foot:

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

<i>Input from (26b)</i>	ħa.ta ^f .na	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
<i>FFC</i>	a. ħa.ta ^f .na		1					
<i>Build PWd</i>	b. → _L ħa('ta ^f)na					1	2	
	c. ('ħa.ta ^f)na			1		1	1	
	d. ħa('ta ^f .na)				1		1	
	e. ħa.ta ^f ('na)			1	1		2	
	f. ('ħa)ta ^f .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 /ta^f/. Since this is the penult and not the final syllable, it comes with one violation of ALL-FOOT-RIGHT. Three other candidates in (32) do at least as well as (32b) on AFR; however, they are less harmonic than (32b) 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:

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

<i>Input from (32b)</i>	ħa('ta ^f)na	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX-V
<i>FFC</i>	a. ħa('ta ^f)na					1	2	
<i>Delete V</i>	b. → _L ('ħta ^f)na					1	1	1
	c. ☞ ħa('ta ^f n)				1		1	1
<i>Add foot</i>	d. ☞ ('ħa)(ta ^f)na					3	1	
	e. ☞ ħa(,ta ^f)(na)				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, |('ħta^f)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 |('ħta^f)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 $|(\text{ḥa})(\text{ʔaf}^{\text{f}})\text{na}|$ to win, and in the latter case, we want the derivation terminating in $|(\text{ḥʔaf}^{\text{f}})\text{na}|$ 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 $|(\text{ḥʔaf}^{\text{f}})\text{na}|$ will indeed win (to save space, MAX-V(heavy) is omitted from the tableau, since no candidate violates it):

(34) *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, ḥa.taf-1PL >	1 W	1 W			L	L	L
c.	< SNATCH-1PL, ḥa.taf-1PL, ḥa.taf ^f .na >		1 W			L	L	L
d.	< SNATCH-1PL, ḥa.taf-1PL, ḥa.taf ^f .na, ḥa(ʔaf ^f)na >					1	2 W	L
e.	→ < SNATCH-1PL, ḥa.taf ^f -1PL, ḥa.taf ^f .na, ḥa(ʔaf ^f)na , (ḥʔaf ^f)na >					1	1	1
f.	< SNATCH-1PL, ḥa.taf-1PL, (ḥʔaf)-1PL >	1 W				1	1	L
g.	< SNATCH-1PL, ḥa.taf-1PL, (ḥʔaf)-1PL, (ḥʔaf) ^f .na >			1 W		2 W	2 W	L
h.	< SNATCH-1PL, ḥa.taf-1PL, (ḥʔaf)-1PL, (ḥʔaf) ^f .na , (ḥa)(ʔaf ^f)na >					3 W	1	L
i.	< SNATCH-1PL, ḥa.taf-1PL, (ḥʔaf)-1PL, (ḥʔaf) ^f .na , (ḥʔaf) ^f n >			1 W		1	1	1
j.	< SNATCH-1PL, ḥa.taf-1PL, (ḥʔaf)-1PL, (ḥʔaf) ^f .na , (ḥʔaf) ^f n , (ḥa)(ʔaf ^f n) >				1 W	1	L	1

Here, the 'non-cyclic' candidate (34e) bests the 'cyclic' candidate (34h), because the latter candidate has an additional non-final foot (on the initial syllable (ḥa)) and therefore has two

extra violations of ALL-FOOT-RIGHT. To get (34h) 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-marker case. As alluded to earlier, this ‘cyclic’-encouraging constraint will be a PREC constraint, specifically the following:

(35) 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 (36) illustrates how this constraint gives us the desired result. To save space, I omit all of the losing candidates from (34) which are knocked out by one of the other constraints ranked above AFR (however, numbering of candidates has been retained from (34) to facilitate comparison):

(36) *Competition of chains II: where PREC constraint is applicable, ‘cyclic’ candidate wins*

	PREC (build-PWd, ins-obj)	AFR	EXH (wd)	MAX -V
d. < SNATCH-1PL, ħa.taf-1PL, ħa.taf ^u .na, ħa(‘taf ^u)na >	2 W	1 L	2 W	
e. < SNATCH-1PL, ħa.taf ^u -1PL, ħa.taf ^u .na, ħa(‘taf ^u)na , (‘ħtaf ^u)na >	2 W	1 L	1	1 W
h. → < SNATCH-1PL, ħa.taf-1PL, (‘ħa)taf -1PL, (‘ħa)taf ^u .na , (ħa)(‘taf ^u)na >		3	1	

Candidate (36e) builds the PWd after (and not before) the object maker was inserted, thus violating both clauses of the PREC constraint. Candidate (36h) 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 (36h) beating (36e) when the /-na/ morph is serving as an object marker.

Before moving on to consider the lack of cyclicity in vowel-final stems, we should briefly examine the issue of secondary stress mentioned earlier. Because secondary stress is not mentioned in descriptions of Maltese, Brame (1972, 1974) and Kiparsky (2011: 5-6) suggest that the cyclic secondary stress in a word like |(ħa)(‘taf^u)na| can be deleted late in the derivation, after syncope has applied (to ensure that de-footing of the first syllable does not feed syncope of its vowel). Nothing in principle would prevent us from adding the same idea to the OT-CC analysis presented here. Under the ranking already assumed, a ‘cyclic’ derivation in which we ultimately delete the cyclic stress would be harmonically improving, as shown in the following harmonic-improvement tableau:^{22, 23}

(37) *Harmonic-improvement tableau for ‘cyclic’ stress followed by deletion of previous-cycle stress*

	ħa.taf -1PL	MAX-M	WDCON	WSP	AFR	EXH(wd)	MAX-V
<i>Input</i>	a. SNATCH-1PL	2					
<i>Insert root</i>	b. ħataf-1PL	1	1				
<i>Build PWd</i>	c. ('ħa)taf -1PL	1			1	1	
<i>Insert suffix</i>	d. ('ħa)taf ⁿ .na			1	2	2	
<i>Build foot</i>	e. (ħa)(taf ⁿ)na				3	1	
<i>Delete foot</i>	f. ħa(taf ⁿ)na				1	2	
<i>Delete V</i>	g. ('ħtaf ⁿ)na				1	1	1

The only thing which would be necessary to add would be to ensure that, in chain comparison, the chain which stops at (37f) beats the one which continues on to (37g)—that is, to ensure that defooting cannot be followed by syncope. If $\text{PREC}(\text{MAX-V}, \text{'MAX-FOOT'})$ outranks $\text{EXH}(\text{wd})$, we can satisfy this desideratum.²⁴ Lastly, it should also be noted that while the analysis I am proposing is *compatible* with the assumption that the secondary-stress foot is deleted, it is not committed to that assumption either—if we wanted to retain the secondary stress, it would suffice to assume that ALL-FT-RIGHT is outranked by a faithfulness constraint which prohibited the removal of a foot.

5 The lack of cyclicity in 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 $\text{PREC}(\text{build-PWd}, \text{insert-object})$ 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),²⁵ 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 (21), 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 (21) 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.²⁶

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 come to be analyzed by speakers as containing a floating mora, which docks on and lengthens a preceding stem-final vowel.²⁷ 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)mlɪ:na] ‘he filled us’. In the following tableaux illustrating the construction and comparison of derivational paths, I will ignore for the sake of brevity two processes which affect this word: (a) the prothesis of [i] before the syncope-created sonorant-initial cluster (see n. 29), and (b) the raising of stressed long /a:/ to /ɪ:/ (see n. 6). As with the consonant-final stems, the first harmonically-improving step which can be taken is to insert the stem morph:

(38) *Insertion of stem is harmonically improving*

	FILL-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. FILL-1PL	2						
<i>insert morph</i>	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 its head foot (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.⁽⁴⁾na/, where the floating mora in the suffix’s UR is not yet docked on the preceding vowel.²⁸

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

<i>Input from (38b)</i>	me.la-1PL	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. me.la-1PL	1	1					
<i>insert morph</i>	b. → _L me.la:na		1					
<i>Build PWd</i>	c. → _L ('me)la -1PL	1				1	1	
	d. me('la) -1PL	1			1		1	
	e. ('me.la) -1PL	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:

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

<i>Input from (39b)</i>	me.la:na	MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. me.la:na		1					
<i>Build PWd</i>	b. → _L me('la:na					1	2	
	c. ('me.la:na			1		1	1	
	d. me('la:na				1		1	
	e. me.la:(na			1	1		2	
	f. ('me)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 stress 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 (33)), this is ruled out by ALL-FOOT-RIGHT being ranked above EXHAUSTIVITY(word):²⁹

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

<i>Input from (40b)</i>		MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. me('la:)na					1	2	
<i>Delete V</i>	b. → _L ('mla:)na					1	1	1
	c. ☞ me('la:n)				1		1	1
<i>Add foot</i>	d. ☞ (,me)('la:)na					3	1	
	e. ☞ me(,la:)('na)				1	1	1	

Now let us go back to consider the other branch of the derivation from (39): the one with 'cyclic' stress (39c), where we construct a PwD and 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):

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

<i>Input from (39c)</i>		MAX-M	WDCON	WSP	NONFIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. ('me)la -1PL	1				1	1	
<i>insert morph</i>	b. → _L ('me)la:.na			1		2	2	
<i>Delete V</i>	c. ☞ ('mel) -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 apocope the final vowel. Deleting the stem-final vowel is ruled out by MAX-V(heavy):

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

<i>Input from (42b)</i>		MAX-V (heavy)	WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. ('me)la:na		1		2	2	
<i>Add foot</i>	b. → _L (me)('la:na				3	1	
	c. (me)('la:na)			1	2		
	d. ☞ (me)la:(na)		1	1	2	1	
<i>Delete V</i>	e. → _L ('me)la:n		1		1	1	1
	f. ☞ ('mel)na	1			1	1	1

From |(me)('la:na|, there is nothing further to do: once again, deletion of the final vowel will be blocked by NONFIN(foot). From |('me)la:n|, however, it will be harmonically improving to foot the final syllable:

(44)

<i>Input from (43e)</i>		WSP	NON FIN (Ft)	AFR	EXH (wd)	MAX -V
<i>FFC</i>	a. ('me)la:n	1		1	1	
<i>Add foot</i>	b. → _L (me)('la:n		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 (36), I omit for space reasons those candidates knocked out by markedness or faithfulness constraints ranked above ALL-FOOT-RIGHT. The candidates in (45) are numbered so as to link them with the analogous candidates in the consonant-final case seen in (34) and (36), again for ease of comparison.

(45) *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(ˈla:)na >		2	1	2 W	L
e. → <FILL-1PL, me.la-1PL, mela:na, me(ˈla:)na , (ˈmla:)na >		2	1	1	1
h. <FILL-1PL, mela-1PL, (ˈme)la -1PL, (ˈme)la:.na , (me)(ˈla:)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 (45h), since it assigns stress before spelling out the suffix (and hence before lengthening). This leaves the ‘non-cyclic stress’ candidates (45d) and (45e), with EXH(word) crucially deciding in favor of (45e), which syncopates the unfooted initial syllable, over (45d), which does not.³⁰

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:

- (46) /jV-ʔara-u/ → [jaʔ'raw] 'they read (IMPERF)'
 3.subj-read-pl.subj
 cf. /jV-ʔara/ → ['jaʔ.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('raw)]. This would leave us without an explanation of why the second but not the first of the unfooted vowels is syncope. (Indeed, under the ranking we have assumed, syncope of the second vowel would not improve harmony: doing so would result in [jaʔ('raw)], 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(ʔa.ra)u]. This is even worse, because it puts a stress on the very vowel we need to syncope. By contrast, if we apply stress before adding the suffix, the expected parse is antepenult |(ʔa.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. 18). 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).³¹ 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 /a:/, undergoes raising), but the first stem vowel is not deleted (the first three examples are from Misfud [1994: 249], [1995: 301]):

- (47) Cyclic stress with /ma ... -ʃ/
*ben*a 'he built' [ma beni:ʃ] 'he did not build'
dara 'he got used' [ma dara:ʃ] 'he did not get used' (also Misfud [1995: 119])
nesa 'he forgot' [ma nesi:ʃ] 'he did not forget' (also Misfud [1995: 119])

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.^{32, 33}

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. 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 structure of the grammar, as in Stratal OT (Kiparsky 2000). 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.

In a Stratal OT model, if C-final stems undergo stress assignment before receiving object suffixation, we would be committed to the assumption that V-final stems do as well. In order to account for the evident lack of inner-cycle stress on the first vowel of [[mela]-na], we would have to assume that V-final stems get stress on their second vowel when stress is assigned on the stem cycle. Kiparsky (2011) proposes just such an analysis, with the assignment of final stress to V-final stems following from the assumption that the 3rd radical glide remains synchronically underlying (e.g. /melaj/); since V-final stems end in an underlying diphthong, we would expect them to get final stress, in line with (21). The trouble with this analysis is that in the stem-level phonology, we cannot know if an object suffix is destined to be added at the word level or not. Therefore, the unaffixed form of a 3rd-weak-radical stem will have receive final stress at the stem level, and then undergo stress retraction as a result of final glide deletion at the word level: /melaj/ →_{Stem} me.¹laj →_{Word} me.la. Thus, the Stratal OT analysis of Maltese requires that the same underlying string—even without the addition of affixes in the course of the derivation—receive different metrical parses at successive levels. In Wolf (2012), I argue that this needed capability of Stratal OT gives rise to pernicious consequences regarding the surface distribution of stress-conditioned segmental phonology; for example, it lets us model unattested languages in which consonant-final words have aspiration on all voiceless stops in the onsets of stressed syllables, whereas vowel-final words have aspiration on stops in the onsets of *unstressed* syllables. I also show there that HS and OT-CC are immune from this problem because, unlike Stratal OT, they use only a single constraint ranking for all stages of the derivation, which tightly limits how much the metrical parses at different stages of a derivation can differ from one another.

The Maltese example does not seem to be alone in posing problems for traditional implementations of the cycle like Stratal OT. In Wolf (2009), I present an OI analysis of an ordering paradox on Tigrinya (Buckley 1994) involving the order of vowel epenthesis with respect to plural and possessive suffixation. Buckley (2012) has recently argued that facts involving vowel-length alternations in Kashaya require an OT-CC-like model in order to deal with a paradox wherein certain processes must be assigned to the stem level (based on the domain in which they apply), but where the choice of whether to perform these processes or not is sensitive to the shape of affixes added at the word level. In Bedouin Hejazi Arabic (Al-Mozainy 1981; McCarthy 2007; Wolf 2010), there is an ordering paradox involving a postlexical process of raising which counterfeeds a lexical process of syncope. These and other examples seem to point to a common conclusion that the order of phonological and morphological processes must be decided *by* the grammar, via constructing and comparing entire candidate derivations with different orders, rather than written into the procedural architecture of the grammar, as in more traditional conceptions.

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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 <gh>) represents historical /y/ or /ʕ/, and so the fact that these stems pattern with C-final stems in showing cyclic underapplication of syncope (Aquilina 1965: 165) is consistent with Brame's (1972) arguments that the /ʕ/ remains synchronically underlying.

² 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, as discussed by Johnson (1990: §5). I am grateful to Gilbert Puech for pointing out the existence of Johnson's paper to me.

³ The vowel-quality alternations in this paradigm are due to (a) lowering of /i/ to [a] adjacent to /ʔ, h/, and (b) reduction of /i/ to [e] before a single word-final consonant. See Hume (1994: 167-181) for details.

⁴ A similar point is made by Eure (1999: 16-17) in the context of a parallel OT analysis of Maltese stress. In derivational terms, after antepenult stress is assigned to /...¹σ.CV.CV(C)/, the penult vowel will syncope, giving surface [...¹H.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.

⁵ This pattern of nativization co-exists with another pattern cited by Puech (2011), in which foreign words with antepenult stress are brought to have penult stress via syncope, e.g. *A¹merica* → *a¹merka*. See also Sutcliffe (1936: 12-13), Aquilina (1959: 73), Borg (1997: 277-278), and Vella (2003: 268-269).

⁶ This process (the synchronic *imaala*) involves raising of stressed long /a:/ to a high vowel whose exact quality shows a good deal of dialectal variation. Here I follow Borg (1997) in transcribing the vowel as [ɪ]; as the passage from Sutcliffe (1936) indicates, the raised vowel is written <ie> in Maltese orthography.

⁷ 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.

⁸ 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.

⁹ 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-/).

¹⁰ 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 facts analyzed in the main text of this paper. This is advantageous for expository purposes, since thinking of candidates as sequences of derivational steps is probably more intuitive for the majority of readers. (However, see notes 23, 26 and 30 below for some places where merger may play an important role with respect to the Maltese data.)

¹¹ 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]).

¹² Local Ordering also incorporates a notion of ranking between conflicting ordering requirements (Anderson 1974: 159-164, 189, 198, 217-218).

¹³ 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.

¹⁴ According to Borg (1997: 251-252) there are cases of stressed [VC#] derived from underlying [VCC#].

¹⁵ The analyses of Maltese by Odden (1990, 1993), in a version of Lexcial Phonology, and Kiparsky (2011), in Stratal OT, rely on the assumption that final long vowels will be assigned stress.

¹⁶ Throughout, I treat the consonantal root, vocalism, and pattern as being inserted simultaneously; this is primarily for ease of exposition, and is not meant as making an empirical claim about whether or not these synchronically function as separate morphological units.

¹⁷ Kiparsky (2011: 5) objects to the unary foot assumed in this analysis on the grounds that Maltese has no monomoraic words, implying that the minimal foot of the language is bimoraic. This objection will not go through if we accept arguments (Piggott 1993, 2010; Garrett 1999; Moore-Cantwell this volume) that word-minimality restrictions are direct constraints on the size of words, rather than a side effect of constraints on the size of feet.

¹⁸ 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 [...(‘LL)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).

¹⁹ Thanks to Abdelaziz Boudlal for prompting me to be more explicit about the fate of the floating mora with C-final stems.

²⁰ See Pruitt (2012) for arguments that it is necessary to allow transfer of primary-stress status from one foot to another to occur ‘for free’, simultaneously with other operations.

²¹ For a previous proposal for positional faithfulness to heavy syllables, see Akinlabi & Urua (2000: 286).

²² This analysis requires that we allow GEN to undo an earlier operation, in this case removing a foot it had previously built. McCarthy (2007) assumes that this is not allowed, though he notes that such derivations can be harmonically improving, as this one is. That derivations of this sort should be allowed has previously been argued for by Zhang & van de Weijer (2008).

²³ While the chain which ends in (37f) does end in the same surface form as chain (34d) (and likewise the chain ending in (37g) in the same surface form as (34e)), these pairs of chains will not be merged, since the sets of operations they perform en route to that surface form are not the same: (37f) has a step of building a foot (as opposed to building a PWD and head foot), but (34d) has no such step.

²⁴ If this de-footing analysis should prove unfeasible, at least two other general responses to the secondary-stress issue are imaginable. First, we could adopt proposals to the effect that feet may exist without corresponding to an overt stress (Crowhurst 1996; Hyde 2002; Buckley 2009; Vaysman 2009; among others). Second, it might be possible to claim that the syncope of unstressed vowels in Maltese serves to partially obscure whatever phonetic cues would differentiate secondary stress from unstressedness, such that the cyclic secondary stresses are present on the surface, but are not directly recognizable as such. I am grateful to Maria Gouskova for pointing out this possibility.

²⁵ 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]).

²⁶ An anonymous reviewer objects that word-final monophthongal long vowels are limited to borrowed vocabulary, which might imply that there is still a ROTB problem with respect to the Semitic vocabulary. If this objection goes through, we would have to take into account the possibility of native stems with underlyingly final long vowels, and also to countenance the existence of final shortening. That might not be a problem, though. If having a final short vowel is the source of the failure of cyclic stress in V-final stems (as I propose), then the worst that would happen is that stems with a final long vowel would revert to having cyclic stress (i.e., not syncope the first stem vowel). Since there are idiolects in which some exceptional V-final stems do resist syncope (see n. 7 above), this is fine: the underlying contrast in final vowel length would then map onto a surface contrast in showing or not showing underapplication of syncope. In that case, the basic generalization under analysis here would be that V-final stems can differ in whether they show underapplication of syncope, whereas C-final stems cannot.

Here, in a bit more formal detail, is the argument as to why we might expect long-vowel-final stems to show the ‘cyclic’ pattern. Consider the object-marked derivatives of a stem of the

form /mela:/. Native words ending in diphthongs (like (21a)) make it reasonable to infer that a final long vowel, if left intact, would get stress. Therefore, there are two convergent derivations leading to surface [ˈmla:na], one which assigns stress before suffixation, and one which assigns stress after:

< FILL-1PL, me.la:-1PL, |me(ˈla:)|-1PL, |me(ˈla:)na|, |(ˈmla:)na| >
 < FILL-1PL, me.la:-1PL, me.la:na, |me(ˈla:)na|, |(ˈmla:)na| >

Being convergent, these chains will be merged prior to chain comparison (see note 10 above); that is, combined into one candidate which retains only those pairwise ordering relations among operations which is shared by all of the convergent chains. In this case, the merged candidate will assert no ordering relation between PWd-construction and object suffixation, since the pairwise order of these differs in the two convergent chains. The merged candidate leading to |(ˈmla:)na|—the ‘non-cyclic’ form—thus will violate PREC(build-PWd, ins-obj); it will also violate PREC(IDENT(long), build-Pwd), since it has no IDENT(long)-violating step.

Amongst the competing candidates will be this one (assuming, again, per the reviewer’s objection, that shortening of final vowels is harmonically improving):

< FILL-1PL, me.la:-1PL, me.la-1PL, |(ˈme)la|-1PL, |(ˈme)la:na|, |(ˈme)(ˈla:)na| >

This chain, which corresponds to the ‘cyclic’ outcome (i.e., the first stem vowel doesn’t syncope), also violates PREC(IDENT(long), build PWd), since the re-lengthening of the stem-final vowel occurs after stress assignment; however, it satisfies PREC(build-PWd, insert-obj), since it assigns stress prior to object suffixation. Thus, we expect the chain ending in |(ˈme)(ˈla:)na| to beat the merged candidate for surface |(ˈmla:)na|.

²⁷ Joe Pater points out that this leaves open the possibility that there could be suffixes which fail to trigger lengthening. The obvious place to look for this in Maltese would be amongst suffixes borrowed from Italian or English, as opposed to those inherited from Arabic. One such possibility is the English plural suffix /-s/, which some have suggested is being rapidly integrated into the language, and which is reportedly inert with respect to stress, at least when added to a consonant-final noun (Vella 2009: 67).

²⁸ 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 (39c-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 (40)). After reaching |me(ˈla:)na|, it is not harmonically improving to build any more feet (see (41)). 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)).

²⁹ 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, there is epenthesis to the left of the indirect-object suffix /-l-/ (see n. 9) when it occurs between two consonants. This could, if necessary, be analyzed as a choice between listed allomorphs {l, il} rather than as phonological epenthesis. Second, 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) assumes that ‘syncope’ leaves behind a floating vocalic melody which then associates to an epenthetic V-slot. The empirical argument for this comes from cases where the metathesized vowel is /i/. Maltese has a process of lowering /i/ to [a] when it is adjacent to a guttural (mentioned earlier in n. 3), but metathesized vowels do not undergo lowering in either their pre- nor post-metathesis position. Therefore, Hume argues, the ‘metathesized’ vowel melody must remain temporarily floating so as to wait out the application of lowering. It might be possible to account for this while retaining the assumption of literal metathesis by assuming the following: (a) lowering cannot apply to the output of metathesis due to an ordering requirement like PREC(IDENT(high), LINEARITY), and (b) if lowering is analyzed as some sort of autosegmental feature spreading from the guttural to the vowel, it would be impossible to lower and then metathesize, because the vowel is tethered to its original position by a [+low] feature which is shared with the guttural consonant. In any case, in light of Hume’s (1994) observations, these cases would remain enough like literal metathesis to plausibly require some sort of special treatment.

³⁰ Regarding the mechanism for the suppression of cyclic stress assumed here, there is a legitimate locality worry noted by Kiparsky (2011: 6): there could be languages like real Maltese but where the lengthening that disrupts cyclicity is quite distant from the inner ‘cyclic’ domain in the word’s morphological bracketing. However, the more extreme worry he raises about cyclic stress being suppressed if there is lengthening in another word of the same utterance is probably mistaken. Since there is little chance of lengthening in one word influencing the placement of stress in another word, the two operations would not be *crucially* ordered with respect to one another, and in OT-CC non-crucial orders are filtered out via the mechanism of chain merger (see n. 10 above).

³¹ 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).

³² 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.

³³ 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. Another source of potential cases of stress

applying before lengthening involves lengthening/vocalization induced by the abstract consonant / Ω / (Brame 1972); we may simply have to extrinsically order / Ω /-vocalization after stress (in OT-CC, via another PREC constraint), as Brame's analysis in fact assumes.

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