

On the proper treatment of (non-)cyclicity in Maltese*

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•Stress in Maltese verbs applies cyclically, as revealed by interactions with syncope (Brame 1974). But vowel-final stems fail to undergo cyclic stress (Odden 1993). Why?

•A straightforward account of this difference can be given in Optimal Interleaving (Wolf 2008), a theory of phonology/morphology ordering effects using the derivational machinery of OT with Candidate Chains (McCarthy 2007), specifically by exploiting OT-CC's ability to model certain kinds of local ordering effects (Anderson 1969, 1974).

•A solution in Stratal OT (Kiparsky 2000) is available if we let final (long) vowels get stress at Level 1. This analysis will produce the right outputs for Maltese, but is typologically problematic: it leads us to expect that languages can have opaque and non-local differences between C-final and V-final stems, mediated by different stress placement at Level 1 which is subsequently neutralized.

1. Cyclic stress in Maltese

•Stress in Maltese is placed as follows (Brame 1972, 1973, 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.¹

•Vowels in open, non-final, unstressed syllables are syncopeated.

•Stress, syncope, and the cycle illustrated in the following:

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

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¹ As Eure (1999: 16-17) points out, the characterization of certain words as getting antepenult stress is necessarily opaque. This will only arise in words of the form /...σ.CV.CV(C)/, and in such cases the penult vowel will syncope, 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 Borg [1997: 277-278] on this aspect of the stress-syncope relationship). Because this talk adopts a serial-OT orientation, with stress necessarily assigned before syncope, I will follow Brame (1972, 1974) in assuming antepenult stress.

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

•Problem: vowel-final stems (with third weak radical) show no sign of cyclic stress (Odden 1990, 1993).

•Sutcliffe (1938: 157) “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** as explained above, the forms assumed by this class of verb are as follows” [boldface in original]

(4) [mlieni]	‘he filled me’	[mliena]	‘he filled us’
[mliek]	‘he filled you.sg’	[mliekom]	‘he filled you.PL’
[mlieh]	‘he filled him’	[mliehom]	‘he filled them’
[mlieha]	‘he filled her’		

•(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) [swieli]	1sg indirect object	[swielna]	1pl indirect object
[swielek]	2sg indirect object	[swielkom]	2pl indirect object
[swielu]	3sg masc. indirect object	[swielhom]	3pl indirect object
[swielha]	3sg fem. indirect object		

•Analysis to be proposed in a moment, like the one in Odden (1990, 1993), ties different behavior of vowel-final stems to (mostly) predictable stem-final vowel-length: stem-final vowels are short word-finally, but long if followed by any suffixes.

2. Optimal Interleaving

2.1 OT-CC

•Optimal Interleaving (OI: Wolf 2008) is an approach to derivational interactions between phonology and morphology which uses the serial apparatus of Optimality Theory with Candidate Chains (OT-CC: McCarthy 2007).

•In classic OT (Prince & Smolensky 2004 [1993]), candidates are fell-swoop mappings from the input to a (potential) surface form. Inputs and candidate outputs can differ in more than one way. Indeed, input/output disparity is in principle unlimited ('Freedom of Analysis': McCarthy & Prince [1993a]).

•In OT-CC, candidates are (approximately) gradual, multi-step mappings from the input to the (potential) surface form.²

So as a candidate where apocope feeds final devoicing, in OT-CC we have something like <taga, tag, tak> as a candidate rather than direct mapping /taga/ → [tak] in classic OT.

•Two key requirements on defining what is a well-formed candidate chain:

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

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

•With regard to the gradualness requirement, the abstract OT-CC architecture can be coupled with any number of different hypotheses about what are the 'basic operations' available to the candidate-generating function GEN.

•Operations in McCarthy (2007): epenthesize one segment; delete one segment; change one feature-value of one segment; metathesize two adjacent segments.

OI adds morphological spell-out to this list, as we'll see.

² OT-CC is a more elaborate kin of Harmonic Serialism (Prince & Smolensky 2004 [1993]: §5.2.3.3). In HS, a single harmonically-improving derivational path is built; in OT-CC many possible derivations are built, which then compete with each other. There is a growing literature arguing that HS, by virtue of admitting only gradual, harmonically-improving derivations, gives us the means to exclude many types of unattested non-local interactions; these results will in general carry over in OT-CC since that theory imposes similar requirements on possible derivations. A bibliography of work in HS and OT-CC can be found via the site of the McCarthy/Pater NSF grant: <http://web.linguist.umass.edu/~mccarthy-pater-nsf/>.

- To be able to model opaque interactions, OT-CC adds to the markedness and faithfulness constraints a set of PRECEDENCE constraints which regulate the relative order in which operations occur in the chains:

(8) $PREC(A,B)$

Assign a violation-mark for every time that:

- (i) Operation B occurs, and is not preceded by an instance of operation A
- (ii) Operation B occurs, and is followed by an instance of operation A

- This is analogous to an extrinsic rule-ordering statement in rule-based phonology: rule A precedes rule B.

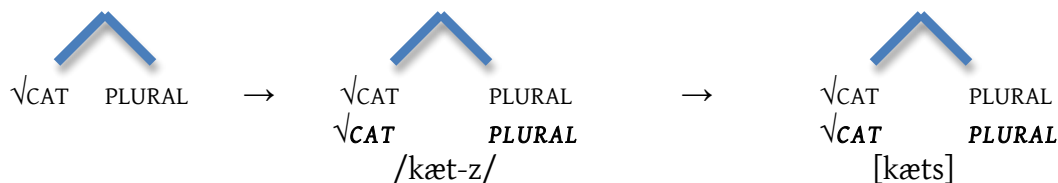
Difference from standard theory of rule ordering (Chomsky & Halle 1968): instead of an extrinsic total ordering of all rules of a language, OT-CC has a collection of (violable, potentially conflicting) *pairwise* ordering statements, plus the markedness and faithfulness constraints, which as in parallel OT will tend to exert a preference for transparent orderings.

This closely resembles Anderson’s (1969, 1974) theory of LOCAL ORDERING, which has pairwise extrinsic ordering statements plus universal ‘natural’ ordering preferences. Consequence: same rules may apply in different orders in different representations. OT-CC can replicate at least some kinds of Local Ordering effects (Wilson 2006; Wolf 2009, 2010), and the analysis of Maltese will rely on this aspect of the theory.

2.2 Optimal Interleaving: Vocabulary insertion in the OT-CC phonology

- Core assumption #1: OI adopts a REALIZATIONAL view of morphology, following frameworks like Distributed Morphology (Halle & Marantz 1993): first the abstract morphosyntactic structure of a word is built; then the elements of this structure are phonologically realized by morphs drawn from the lexicon:

(9)



(•Notation in above: morphosyntactic features in PLAIN small caps belong to MORPHEMES—the terminal nodes of the morphosyntactic tree. Features in **BOLD ITALIC** small caps belong to MORPHS.)

- Morphs are the storehouses of arbitrary sound-meaning pairs, analogous to the VOCABULARY ITEMS of DM. Formally, a morph is an ordered pair consisting of a bundle of

morphosyntactic features and a bundle of phonological material, e.g. <PLURAL, /-z/> in English.

•Core assumption #2: morph-insertion and phonology take place in the same module of grammar (and this module has an OT-CC architecture). Motivations:

☞ Phonological constraints can arguably override purely morphological conditions on morph choice, e.g. French *beau* ~ *bel(le)* suppletion, Spanish ‘feminine *el*’, etc.

☞ Lets us use PREC constraints to regulate ordering relations between morph-insertions and phonological operations, including those traditionally dealt with under the rubric of the cycle (Chomsky, Halle & Lukoff 1956).

2.3 ‘Cyclicity’ in *OI*

•Basic idea: ‘cyclic’ effects are induced by constraints of the general schema $PREC(P,M)$: these demand that phonological process *P* be done before inserting morph of type *M*.

•Result is that *P* applies within and with reference to a morphologically incomplete sub-part of the eventual word, specifically one excluding the material introduced by *M*.

•For Maltese:

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

Assign a violation-mark for every time that:

(i) An object-marker morph is inserted, and this was not preceded by earlier construction of a prosodic word.

(ii) An object-marker morph is inserted, and is followed by construction of a prosodic word.

•Substantive assumptions about operation set:

☞ Insertion of prosodic word node along with associated foot parse is a basic operation, following McCarthy (2008). Insertion of foot structure (minimally a head foot) simultaneous with construction of PWd is taken to be an inviolable condition on GEN: PWd constituent with no head is universally excluded.

☞ Insertion of a single foot can also occur as a single step (see Pruitt [2010] on foot-parsing in Harmonic Serialism).

☞ (Re-)syllabification happens for free at each step (McCarthy 2010; cf. Pater to appear)

3. Cyclic stress in consonant-final verb stems

3.1 Basic assumptions about Maltese stress

•Excluding cases where stress is final, there is a straightforward Latin-type stress pattern: stress the penult if it's heavy, otherwise stress the antepenult. Suggests that main stress is a trochaic foot ('σσ) or ('H) built as far to the right as possible, but with footing of the final syllable prohibited³:

(11) *Stress assigned to light antepenult, heavy penult*

/LLL/	NONFIN	ALL-FOOT-RIGHT	/LHL/	NONFIN	ALL-FOOT-RIGHT
a. [('LL)L]		1	a. [L('H)L]		1
b. [L('LL)]	W1	L	b. [L('HL)]	W1	L

Notation: '.' For syllable boundaries, '(...)' for foot boundaries, '|...|' for PwD boundaries.

(12) NONFINALITY: The rightmost syllable in a PwD must not be footed. (Prince & Smolensky 2004 [1993])

(13) ALL-FOOT-RIGHT: The right edge of every foot coincides with the right edge of the PwD; violations assigned gradiently by syllables. (McCarthy & Prince 1993b)

•NONFINALITY violable in two cases:⁴ first, stressability of monosyllabic words shows that requirement for morphosyntactic words to be parsed into prosodic words (which by assumption must be headed) overrides ban on footing final syllable:

(14) *Final foot tolerated in order to prosodify monosyllabic words*

/σ/	WORDCONDITION	NONFINALITY
a. [('σ)]		1
b. σ	W1	L

(15) WORDCONDITION
One violation-mark for every morphosyntactic word which is not parsed by a prosodic word. (Selkirk 1995)

•Second, stress can be final when final syllable is [CVCC] or [CV:C], but not when it's [CVC]⁵. I will assume, with Eure (1999: 14) (see also Broselow, Chen & Huffman [1997:

³ Tableaux in this handout generally are in the comparative format of Prince (2002, 2003). Numerals indicate counts of violation-marks. In rows for losing candidates, 'W' indicates that a constraint prefers the winner over that loser; an 'L' indicates that the constraint prefers that loser over the winner.

⁴ A third possible morphologically-induced exception involves 3rd.fem.sg. perfects, in which even vowel-initial object markers permit stress to move forward onto a (light) penult, e.g. /qatəl-it-u/ → [qat.'li.tu], 'she killed him', as observed by Kang (1989: 108). I'm not sure yet what the explanation for this should be.

⁵ According to Borg (1997: 251-252) there are cases of stressed [VC#] derived from underlying [VCC#].

57]) that this is due to an undominated constraint forbidding word-final syllables to head a mora.

So word-finally [CVCC] and [CV:C] are bimoraic but [CVC] is monomoraic.

Final [CV:], were it to surface intact, will also be bimoraic and would be expected to attract stress—more on this later.

•Contextually bimoraic word-final syllables will attract stress if NONFINALITY is outranked by a constraint requiring heavy syllables to be stressed:⁶

(16) *Contextually heavy final syllables attract stress*

/CVCVCVCC/	WSP	NONFIN	/CVCVCVC/	WSP	NONFIN
a. [CV.CV('CVC^H C)]		1	a. [CV.CV('CVC)]		W1
b. [('CV.CV)CVC^H C]	W1	L	b. [('CV.CV)CVC]		

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

3.2 Cyclic stress with consonant-final verb stems

•We now have the tools in hand to work through the OT-CC analysis. I'll start with a form [ħa.'taf.na] 'he snatched us' which we do want to undergo cyclic stress.

•To keep things simple, I will treat the stem /ħataf/ as a single morph that's inserted as one step, rather than separating out the root, pattern and vocalism (whether those are distinct morphs or not is orthogonal to what I'm dealing with). Likewise, I will not depict the insertion of the phonologically null 3.masc.sg subject marker.

•So, we can approximate the morphosyntactic input for this word as /SNATCH-1PL/. Assuming that morph-insertion necessarily occurs 'inside-out', insertion of the stem morph will be the first thing to occur:

(18) *Insertion of stem is harmonically improving*

	/SNATCH-1PL/	MAX-M	WD CON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC ⁷	a. SNATCH-1PL	2						
insert morph	b. ħa.taf-1PL	1	1					

(19) **MAX-M:** Every morpheme must have a corresponding morph. (Wolf 2008)

⁶ Ranking WSP over NONFIN implies by transitivity that WSP dominates AFR, meaning that heavy syllables should be able to attract stress any distance away from the right edge. Borg & Azzopardi-Alexander (1997: 321) indicate that in loans, long vowels earlier than the penult can attract stress, e.g. *Adrijatiku* 'Adriatic', with antepenult stress. I don't know yet of such examples with stress further to the left.

⁷ 'FFC' stands for 'fully faithful candidate'—a form identical to the input.

(20) *Insertion of object marker, or laying down PwD, are harmonically improving*

Input from (18b)	/ ĥa.taf-1PL/	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. ĥa.taf-1PL	1	1					
insert morph	b. ĥa.taf ^t .na		1					
PwD+ft parse	c. ☞_L (ĥa)taf -1PL	1				1	1	
	d. (ĥa.taf) -1PL	1			1			
	e. ĥa('taf) -1PL	1			1		1	

Notation: ' ☞_L ' indicates LOCALLY OPTIMAL way of doing any given type of operation. (Only locally optimal option can be explored in chain construction: see McCarthy [2007]; Wolf [2008: §3.4, under review] for motivations and consequences)

(21) EXHAUSTIVITY(word)

One violation-mark for every syllable linked directly to a Prosodic Word node. (Itô & Mester 2003 [1992]; Selkirk 1995)

(22) *With stem prosodified, insertion of object marker is harmonically improving*

Input from (20c)	('ĥa)taf -1PL	MAX-M	WD CON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. ('ĥa)taf -1PL	1				1	1	
insert morph	b. ('ĥa)taf ^t .na			1		2	2	

(23) *With object marker added, putting stress on stem-final syllable is now harmonically improving*

Input from (22b)	('ĥa)taf ^t .na	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. ('ĥa)taf ^t .na			1		2	2	
Add foot	b. ☞_L (,ĥa)(^t taf ^t)na					3	1	
	c. (,ĥa)(^t taf ^t .na)				1	2		
	d. (,ĥa)taf ^t (^t na)			1	1	2	1	

(The closed syllable (taf^t) is now no longer final, so its coda is now moraic, and leaving the now-heavy syllable unstressed therefore violates the WSP.)

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

Input from (20b)	ħa.ta ^f .na	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. ħa.ta ^f .na		1					
Add foot	b. $\text{[ħa}^{\text{f}}\text{.na]}$					1	2	
	c. $\text{[}^{\text{f}}\text{ħa.ta}^{\text{f}}\text{.na]}$			1		1	1	
	d. $\text{[ħa}^{\text{f}}\text{.na]}$				1		1	
	e. $\text{[}^{\text{f}}\text{ħa.ta}^{\text{f}}\text{.(na)}]$			1	1	1		
	f. $\text{[(ħa)}^{\text{f}}\text{.na]}$				1	2		
	g. $\text{[(ħa)}^{\text{f}}\text{.na]}$					3	1	

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

Input from (24b)	$\text{[ħa}^{\text{f}}\text{.na]}$	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	$\text{[ħa}^{\text{f}}\text{.na]}$					1	2	
Del.-V	$\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$					1	1	1
Add foot	$\text{[(ħa)}^{\text{f}}\text{.na]}$					3	1	

(26) MAX-V: Every vowel in the input must have an output correspondent.
(McCarthy & Prince 1995)

(27) *Competition of derivational paths: candidate with 'cyclic' stress wins*

	MAX-M	WD CON	WSP	PREC (build-PWd, ins-obj)	AFR	EXH(wd)	MAX-V
a. <SNATCH-1PL>	W2				L	L	
b. <SNATCH-1PL, ħa.ta ^f -1PL>	W1	W1			L	L	
c. <SNATCH-1PL, ħa.ta ^f -1PL, ħa.ta ^f .na>		W1		1	L	L	
d. <SNATCH-1PL, ħata ^f -1PL, ħa.ta ^f .na, $\text{[ħa}^{\text{f}}\text{.na]}$ >				W2	L1	W2	
e. <SNATCH-1PL, ħa.ta ^f -1PL, ħa.ta ^f .na, $\text{[ħa}^{\text{f}}\text{.na]}$, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$ >				W2	L1	1	W1
f. <FILL-1PL, ħata ^f -1PL, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$ >	W1				L1	1	
g. <FILL-1PL, ħa.ta ^f -1PL, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$ >			W1		L2	W2	
h. $\text{[(ħa)}^{\text{f}}\text{.na]}$ <FILL-1PL, ħa.ta ^f -1PL, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$, $\text{[}^{\text{f}}\text{ħa}^{\text{f}}\text{.na]}$ >					3	1	

•Notice that if we took out PREC(build-PWd, ins-obj), candidate (27e) would win—and this is exactly what we want to happen if /-na/ were instead a subject marker, and the PREC constraint were consequently irrelevant.

4. Vowel-final verbs

•Longstanding debate on phonology of Arabic dialects: stem-final vowels short word-finally, long before suffixes. Two options⁸:

Underlying short vowels, with process of presuffixal lengthening (*Cairene*: Abdel-Massih *et al.* [1979: 323], Broselow [1976: 106-118], Watson [2002: 201-203]; *Damascene*: Bohas [1978: 98]; *Lebanese & Palestinian*: Abdul-Karim [1980], Brame [1971: 584], Haddad [1984]; *Sudanese*: Hamid [1984]; *Maltese*: Odden [1990, 1993]; *generally*: Yip [2009])

Underlying long vowels, with process of word-final shortening (*Lebanese & Palestinian*: Abdo [1969], Abu-Salim [1982]; *Meccan*: Abu-Mansour [1987: 134]; *Omani*: Glover [1988]; *Maltese*: Borg [1997: 266-267]; *generally*: McCarthy [2005])

(Also see Angoujard [1978: 16] on Tunisian, who reports finding no basis to prefer one alternative over the other)

•The following analysis assumes that the verb-stem-final vowels of interest in Maltese are underlyingly *short*;⁹ lengthening before suffixes is due to suffixes being pre-lengthening, with an underlying floating mora (basically equivalent to analyses with rule of presuffixal lengthening).

This would be in keeping with arguments in Becker (2009) that learners prefer to lexicalize surface form of unaffixed roots/stems as the UR.

•Immediate worry (McCarthy 2005): OT allows no language-particular constraints on inputs, ('Richness of the Base': Prince & Smolensky 2004 [1993]), so URs with final long vowel have to be dealt with. These have to be handled by mapping them onto some licit surface form of the language.

•What I'll suggest: stems with final underlying long vowels get final stress, as revealed in (mainly) borrowings from Italian (Aquilina 1959: 121-126, 1965: 26, 28; Fenech 1978: 18-19):

- (28) a. *università* 'university', *karità* 'charity', *sanità* 'sanitary inspector',
 età 'age'
 b. *Mari* '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'

⁸ Most of these references are drawn from McCarthy (2005).

⁹ The feminine marker /-a/ in Maltese does not lengthen before suffixes (Borg 1997: 266-267), so on this analysis we will have to treat this affix as a lexical exception to lengthening.

(•If there are no verbs illustrating this, I presume it must be due to the way that borrowed verbs are systematically put into the weak-final conjugation via addition of -a/-ja: Drewes [1994], Misfud [1995, 1996], Hoberman & Aronoff [2003].)

•Given our assumption about underlying vowel length, we can now proceed with the OT-CC analysis of vowel-final verb stems.

(29) *Insertion of stem is harmonically improving*

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

(30) *Insertion of object marker, or laying down PWD, are harmonically improving*

Input from (29b)	me.la-1PL	MAX-M	WD CON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. me.la-1PL	1	1					
insert morph	b. me.la:na		1					
Add PWD and foot	c. $\text{me}_L ('me)la -1PL$	1				1	1	
	d. $ me('la) -1PL$	1			1		1	
	e. $ ('me.la) -1PL$	1			1			

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

Input from (30b)	me.la:na	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. me.la:na		1					
Add PWD and Foot	b. $\text{me}_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	
	g. $ (.me)('la:.na) $				1	2		
	h. $ ('me.la:)(,na) $			1	1	1		

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

Input from (31b)	$ me('la:)na $	MAX-M	WDCON	WSP	NONFIN	AFR	EXH(wd)	MAX-V
FFC	a. $ me('la:)na $					1	2	
Add foot	b. $ (.me)('la:)na $					3	1	
Del.-V	c. $ ('mla:)na $					1	1	1

(33) *With stem prosodified, insertion of object marker is harmonically improving*

Input from (32c)	('me)la -1PL	MAX-M	WD CON	WSP	NON FIN	AFR	EXH (wd)	MAX-V
FFC	a. ('me)la -1PL	1				1	1	
insert morph	b. ('me)la:.na			1		2	2	

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

Input from (33b)	('me)la:.na	MAX-M	WD CON	WSP	NON FIN	AFR	EXH (wd)	MAX-V
FFC	a. ('me)la:.na			1		2	2	
Add foot	b. σ_L ('me)('la:)na					3	1	
	c. (,me)('la:.na)				1	2		
	d. (,me)la:(na)			1	1	2	1	

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

	MAX-M	WD CON	WSP	PREC (ID(long), build-PWD)	PREC (build-PWD, ins-obj)	AFR	EXH (wd)	MAX-V
a. <FILL-1PL>	W2					L	L	L
b. <FILL-1PL, me.la-1PL>	W1					L	L	L
c. <FILL-1PL, me.la-1PL, mela:na>		W1	W1		L1	L	L	L
d. <FILL-1PL, me.la-1PL, mela:na, me('la:)na >					2	1	W2	L
e. σ_L <FILL-1PL, me.la-1PL, mela:na, me('la:)na , ('mla:)na >					2	1	1	1
f. <FILL-1PL, me.la-1PL, ('me)la -1PL>	W1			W1		1	1	L
g. <FILL-1PL, me.la-1PL, ('me)la -1PL, ('me)la:.na >			W1	W2		W2	W2	L
h. <FILL-1PL, mela-1PL, ('me)la -1PL, ('me)la:.na , (,me)('la:)na >				W2		W3	1	L

•We now see the local ordering aspect of the analysis: we want to do stress before object suffixation, but we also want to do stress after lengthening, which would mean doing stress after object suffixation. The ranking of the two PREC constraints means that the latter ordering preference wins out.

- In the Level 1 phonology, we need for /ħataf/ to emerge as [ˈħa.taf], but we somehow need /mela(:)/ *not* to emerge as [ˈme.la(:)], lest the stress on the first vowel protect it against syncope.

- So what instead *should* be the Level 1 output for /mela/?

- Option 1: [me.la(:)] with no stress or metrical structure.

Seems like a non-starter; if this is possible, then we expect to find languages which behave transparently on the surface like the hypothesized Level 1 phonology of Maltese: C-final words have stress (somewhere), but V-final words have no stress anywhere. As far as I know such a language isn't reported.

- Option 2: [meˈla(:)] with final stress. This seems doable, assuming stem-final vowels are underlyingly long, and/or systematically lengthened at level 1:

(37)

/ħataf/	WSP	*C ^μ #	NONFINALITY	WEIGHT-BY-POSITION
a. \mathbb{S} [(ˈħa).taf]				1
b. [(ˈħa).taf ^μ]	W1	W1		L
c. [ħa.(ˈtaf)]			W1	1
d. [ħa.(taf ^μ)]		W1	W1	L

(38)

/mela:/	WSP	MAX(μ)	NONFINALITY
a. \mathbb{S} [me(ˈla:)]			1
b. [(ˈme)la:]	W1		L
c. [(ˈme.la:)]	W1		1
d. [(ˈme.la)]		W1	1

- WSP compels heavy syllables to be stressed, even when this violates NONFINALITY; however, word-finally [CVC] doesn't count as heavy because *C^μ# ('word-final consonants can't project a mora') outranks WEIGHT-BY-POSITION ('coda consonants are moraic', Hayes [1989]).

- But long vowels are bimoraic by definition, so they do count as heavy finally, and get stress at Level 1.

- Hypothesized Level 1 output [me(ˈla:)] will eventually have to be changed to [(ˈme).la] in some later stratum, if no suffixes are added.

- Could happen in one of two ways.

- Option 1: Final shortening kicks in. MAX(μ) ≧ *V:# protects final vowel length at Level 1; ranking reversed at Level 2, resulting in final shortening and retraction of stress.

(39)

/me('la:)/	WSP	NONFINALITY	*V:#	MAX(μ)
a. [('me).la]				1
b. [('me).la:]	W1			
c. [me('la:)]		W1	W1	L
d. [me('la)]		W1		1

Option 2: NONFINALITY is promoted above WSP at Level 2, so even if the final vowel stays long and hence the final syllable stays heavy, the desire to stress that heavy syllable is now overridden by the desire to avoid a final foot:

(40)

/me('la:)/	NONFINALITY	WSP
a. [('me).la:]		1
b. [me('la:)]	W1	L

- The Stratal OT solution involves assuming that a form like [('me).la] ends up with expected penult stress on the surface, it necessarily passes through an intermediate stage [me('la:)] .

- It's hard to see that we can falsify this analysis of the Maltese data, since the final Level 1 stress on V-final stems leaves no trace of itself; it 'manifests' only as the **absence** of a cyclic stress on the first vowel of the stem, i.e. syncope of that vowel in object-suffixed forms.

This analysis thus involves making the Duke-of-York gambit (Pullum 1976; Hogg 1978; Idsardi 2000; Rubach 2003; Bermúdez-Otero 2006, Odden 2008; cf. McCarthy 2003): final vowel unstressed underlyingly, gets stress at Level 1, reverts to unstressed at Level 2.

- However, we can easily imagine languages which work like this analysis assumes Maltese to, where the different stress patterns assigned to C-final vs. V-final stems at Level 1 condition other changes at that level.

- When the stress patterns of C-final vs. V-final stems is neutralized at Level 2, the effects of those stress-conditioned changes will remain, resulting in opaque and highly non-local differences between C-final and V-final stems.

- Example: Imagine a language (almost) just like Maltese under the hypothetical Stratal OT analysis given:

- No extrametricality
- Word-final C is non-moraic (as assumed for Maltese)
- Word-final long V retains length at Level 1, so it gets stressed despite being final

•Suppose further that while main stress in Maltese' is quantity sensitive, secondary stress is quantity-insensitive: every second syllable before the main stress gets secondary stress.

This situation occurs in Huaripano (Panoan, Peru: Parker 1994, 1998; McGarrity 2003: §5.2.3)

•Level 1 stress in Maltese':

(41)	<i>V:-final</i> $\sigma.^1CV:$ $,\sigma\sigma.^1CV:$ $\sigma,\sigma\sigma.^1CV:$ $,\sigma\sigma,\sigma\sigma.^1CV:$ $\sigma,\sigma\sigma,\sigma\sigma.^1CV:$ $,\sigma\sigma,\sigma\sigma,\sigma\sigma.^1CV:$	<i>C-final</i> $^1\sigma.CVC$ $\sigma^1\sigma.CVC$ $,\sigma\sigma^1\sigma.CVC$ $\sigma,\sigma\sigma^1\sigma.CVC$ $,\sigma\sigma,\sigma\sigma^1\sigma.CVC$ $\sigma,\sigma\sigma,\sigma\sigma^1\sigma.CVC$
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•Then at Level 2, just as required for real Maltese, the final syllable of V:-final stems in Maltese' loses its stressability (e.g. via final shortening), and the V-final stems get re-assigned the same stress pattern as the C-final stems.

•That means, that in V:-final stems, every syllable has (primary or secondary) stress at some point in the derivation: odd-numbered syllables (counting from the end) all have stress at Level 1; even-numbered syllables (counting from the end) all have stress at Level 2.

•So—suppose we then pick any arbitrary phonological process conditioned by stress (so long as it's not incompatible with our assumption that secondary stress is QI), and let us suppose that in Maltese' this process applies at both Level 1 and Level 2. In that case:

V-final words undergo the process in every syllable (since every syllable is stressed in one or the other level)

C-final words undergo it only in syllables stressed on the surface (since they get the same stress in Levels 1 and 2).

•Things that might happen¹⁰:

Lowering of vowels in stressed syllables (so, e.g., V-final words cannot contain high vowels *anywhere*, no matter how long the word is)

Epenthesis of Cs to provide stressed syllable with onset (so, e.g. V-final words cannot contain onsetless syllables *anywhere*, again regardless of length)

¹⁰ See Smith (2002: §3.2), González (2003), and Blumenfeld (2006: §1.1.2) for reported example of these and related stress-conditioned processes in numerous languages.

Strengthening of onsets (so, e.g., in V-final words, all onset voiceless stops must be aspirated)

- Such patterns are not reported as far as I know, and it would be surprising if they were, given the rather perversely non-local nature of the relationship between cause and effect: V-final status seemingly induces some markedness requirement over the whole word.

- Brief concluding remark: Odden (1990, 1993) proposes to reconcile the Maltese facts with Lexical Phonology via the assumption that all morphological material is inserted before phonology begins. He notes that this has the potential weakness that allomorphy or morphological subcategorization of ‘outer’ affixes cannot be sensitive to derived phonological properties of their base of affixation (e.g. stress).

- Odden discusses a number of possible examples, arguing them to be unconvincing; however, there are quite a lot of others besides those he deals with. A sampling:

Finnish (Kiparsky 1993: 280-282): selection of /-se:n/ vs. /-h(V)n/ allomorphs of illative singular and /-nsa/ vs. (optional) /-Vn/ allomorphs of possessive are sensitive to results of applying /t/-deletion and optional vowel coalescence within base of affixation.

(some varieties of) English (Skousen 1975; McCarthy 2002: 155): *a/an* allomorphy of indefinite article sensitive to deletion of initial /h/ in unstressed position: *a history* versus *an (h)istorical event*.

Tigrinya (Buckley 1994; Wolf 2009): /-at/ ~ /-tat/ allomorphy of plural suffix (variably?) decided after a vowel has been epenthesized following a stem-final consonant cluster.

4. Output-output faithfulness

- The other most commonly-held view about how to deal with cyclic effects in OT is OUTPUT-OUTPUT FAITHFULNESS (Burzio 1994; Benua 1997): alongside the faithfulness constraints which pressure outputs to resemble underlying forms, there are a second set of constraints which pressure the surface forms of derived words to resemble the surface forms of their morphological bases.

See Kager (1999) for an OO-faith analysis of cyclic stress-syncope interactions in Palestinian Arabic (Brame 1974), which are very similar to those in Maltese.

- It’s hard to see how OO-faithfulness could enforce faithfulness to presence of a vowel if the base were C-final but not if it were V-final.

- (42) OO-MAX-V: A vowel in the base of OO-correspondence must have a correspondent in the derived form.

We would need a violation to be assigned to [ˈħa.taf] ~ *[ˈħtaf.na] ‘he snatched (us)’ but not to [ˈme.la] ~ [ˈmlie.na] ‘he filled (us)’. Hard to see how to reformulate OO-MAX-V to do this in a way that doesn’t merely restate the generalization.

•Moreover, even if there was a way to do this, there’s a further problem: with respect to whether syncope happens in object-marked forms, <għ>-final stems pattern with C-final stems, even though the unaffixed form of the stem (the base of OO-correspondence) is V-final as a result of <għ>-deletion (see e.g. Brame 1972).

- | | | | | |
|------|-----------------------------------|-----------------|------------|------------------------|
| (43) | [tefaʼ] | ‘he threw’ | [tefa] | ‘he extinguished’ |
| | [te.ʼfaħ.ħa] | ‘he threw her’ | [ˈtʃiə.a] | ‘he extinguished her’ |
| | [te.ʼfaħ.hom] | ‘he threw them’ | [ˈtʃiə.om] | ‘he extinguished them’ |
| | (above from Aquilina [1965: 165]) | | | |

•Additionally, in an underlyingly /CVCVgħ/ stem, it would be difficult to say that it’s the presence of the underlying <għ> which blocks syncope of the first vowel, since that vowel does syncope when it’s unstressed due to *subject-agreement* suffixation. Sutcliffe (1936: 102) gives the following perfect paradigm for **qata** ‘to cut’:

- | | | | | |
|------|---------|--------------|--------|--------------|
| (44) | qtajt | ‘I cut’ | qtajna | ‘we cut’ |
| | qtajt | ‘you.SG cut’ | qtajtu | ‘you.PL cut’ |
| | qtajt | ‘he cut’ | qatgħu | ‘they cut’ |
| | qatgħet | ‘she cut’ | | |

5. Conclusion

•The difference between C-final verb stems in Maltese (cyclic stress) and V-final stems (no cycle) can be treated in OI as ‘local ordering’ of stress and object suffixation, with order determined by whether suffixation causes lengthening (as it can only with V-final stems).

•Stratal OT can get the Maltese facts to come out on the surface, but only by resorting to a Duke-of-York derivation of a sort which we probably want to exclude due to its overgenerating effects.

•OO-faithfulness offers no plausible basis for the difference, and is arguably in principle unable to correctly sort C-final and V-final stems apart due to the way that the distinction is rendered opaque by <għ>-deletion.

•The Maltese facts thus suggest that OI is the preferable account of cyclic effects in OT.

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