

# Theoretical Consequences of Metathesis in Maltese

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## 0. Introduction

Consonant/vowel metathesis describes the process whereby the linear ordering of segments in a string switches. Traditionally, metathesis has been described through the use of transformational notation, as exemplified below.

(1) V C C V C V → 1 2 4 3 5 6  
1 2 3 4 5 6

Although major advancements have been made to eliminate the use of this type of notation in processes such as assimilation and dissimilation, the formal mechanisms used to represent metathesis in nonlinear phonology have changed little. Many current analyses continue to make use of a linear transformational notation and hence, treat metathesis as a one-step operation.

In this paper, I present evidence from Maltese Arabic showing the inadequacy of this representation of metathesis. Rather, I argue that metathesis must be viewed as the product of several independent operations, each of which constitutes an elementary operation in nonlinear phonology. The implications of this study extend beyond the representation of metathesis as they also bear directly on the representation of total vowel movement across an intervening consonant. As a means of introduction, I begin by briefly outlining the problem being addressed in this paper.

In Maltese Arabic, the plural imperfective stem of first measure trilateral verbs is typically comprised of three adjacent consonants, preceded by a prefix of the form CV- and followed by the invariable plural suffix [-u], e.g. *ji+bdl+u* 'they change'. However, there is a large class of plural imperfectives which contain a stem vowel to the left of the medial consonant, e.g. *jifirdu* 'they separate'. The vowel's quality is typically identical to the underlying vocalic melody of the stem, i.e. /i/, /a/, /o/ or /e/, and the vowel only occurs when the medial stem consonant is sonorant, which includes [m, n, l, r].

In earlier works, it has been claimed that the presence of the plural stem vowel is the result of consonant/vowel metathesis (e.g. Brame 1972, Puech 1979, Berrendonner et al. 1983): underlyingly, the stem vowel occurs to the right of the medial stem consonant but by metathesis, the consonant and vowel switch positions. To anticipate the discussion in section 4, I will briefly outline the motivation for this approach.

There is an independently motivated assimilation rule in Maltese which is of particular relevance. This rule, Guttural Assimilation, changes an underlying /i/ to [a] when adjacent to a guttural consonant, i.e. [ħ ʔ]. This rule applies bi-

directionally changing, for example, /i/ in perfective verbs such as /lihiʔ/ to [laħaʔ] 'he reached'. Guttural Assimilation also applies across morpheme boundaries affecting the imperfective prefix vowel.

The relevance of Guttural Assimilation to consonant/vowel metathesis relates to plural imperfectives of this last category. Consider, for example, the verb [jaħilbu] 'they milk', derived from underlying /jV+hilib+u/. It will be noticed that although the prefix vowel undergoes Guttural Assimilation and surfaces as [a], the plural stem vowel does not, and is consequently realized as [i]. An adequate analysis must be able to account for the failure of Guttural Assimilation to apply in such cases.

As noted above, in previous analyses it has been claimed that the plural stem vowel occurs in its surface position as the result of consonant/vowel metathesis. Moreover, metathesis is crucially ordered before Guttural Assimilation. Thus, at the point in the derivation in which Guttural Assimilation applies, the plural stem vowel occurs to the right of the medial sonorant consonant and is not affected by the rule. Following the application of Guttural Assimilation, the second stem vowel (still /i/) switches positions with the medial sonorant consonant and surfaces as [i], as desired.

While this analysis is well-motivated for verbs such as [jaħilbu], it is unable to account for the full range of plural imperfectives. There are verbs for which the ordering of Guttural Assimilation before metathesis yields the wrong results. Consider, for example, [jifilħu] 'they are strong', derived from /jV+filih+u/. In this instance, applying Guttural Assimilation prior to metathesis would yield \*[jifalħu], since the final stem vowel would first change from /i/ to [a], and then by metathesis, surface incorrectly as [a] to the left of the medial sonorant consonant.

Although some form of consonant/vowel metathesis is well-motivated, it will be shown that the traditional view of metathesis is unable to account for the full range of imperfective plurals in Maltese. The problem is associated with the view of metathesis as a one-step operation, frequently expressed by means of linear transformational notation, as in (1) above. I argue that metathesis in Maltese is more appropriately viewed as the product of three elementary operations: delete, insert and associate. The first two characterize independently motivated rules of Maltese: Syncope and Epenthesis, respectively. The third operation, associate, takes the form of a universal association convention which maps a floating melody onto an unspecified slot of the prosodic template. When these three operations are sequenced within a single derivation, the product is metathesis. As will be seen, this analysis also provides a simple account of the realization of the imperfective prefix vowel.

This analysis is similar in some ways to that proposed by Kenstowicz (1981) for Palestinian Arabic. Although the data in the two languages differ in many respects, the

## Maltese Metathesis

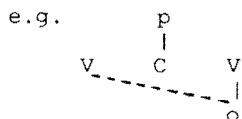
traditional view of metathesis is shown to be descriptively inadequate in both cases. Kenstowicz rejects the metathesis approach since, as he states, "metathesis merely duplicates the work of syncope and epenthesis" (p.460). Although he incorporates syncope and epenthesis into his analysis, Kenstowicz nonetheless assumes that metathesis continues to exist in phonology as an independent one-step operation. I would suggest, however, that the reason for this duplication stems from the fact that consonant/vowel metathesis is in fact the product of more than one operation. By analyzing metathesis in this manner, it is unnecessary to maintain the traditional one-step approach as well.

The analysis presented in this paper also bears directly on the representation of total vowel movement and the organization of consonant and vowel place features. Processes of vowel movement across an intervening consonant serve as a good testing-ground for nonlinear models of feature organization. Within the well-motivated view of assimilation as spreading, the features of consonants and vowels must be sufficiently disjunctive to allow for the spreading of vowel features across those of a consonant without violating the No Crossing Constraint (Goldsmith 1976), which I state in (2).

- (2) No Crossing Constraint  
Association lines linking features on the same tier may not cross.

McCarthy (1989b) has convincingly shown the inadequacy of current models of feature geometry to account for cases of consonant/vowel metathesis, a process which he treats as spreading a vowel's features across those of a consonant. To remedy this problem, he attributes metathesis to planar V/C segregation and further suggests that metathesis *implies* planar segregation. With the melodies of consonants and vowels arrayed on separate planes, vowel features are able to spread freely across a consonant without crossing association lines, as illustrated in (3).

- (3) Vowel spreading with planar segregation (based on McCarthy 1989b)



Evidence from Maltese suggests, however, that not all cases of C/V metathesis can be attributed to planar segregation. Like other Arabic dialects, Maltese's verbal morphology is templatic, comprised of a prosodic template, a consonantal root and a vocalic melody, with each serving a specific semantic function in varying degrees. Following

McCarthy's arguments, this then would seem to be a case in which we might expect planar segregation to be applicable. I argue, however, that this account is not available since at the point in the derivation in which metathesis, or more specifically, total vowel movement, occurs, the planes of consonants and vowels must be conflated.

With an enriched model of feature geometry there is an alternative means of representing vowel movement which does not require complete planar V/C segregation. In this model, emanating from the work of Clements (1989, 1991), Herzallah (1990), and Hume (1991, 1992), vowel place and height features form a unit dominated by a Vocalic node, which is able to spread freely across intervening consonants, which do not bear such a node. The spreading of the vowel features in Maltese presents strong evidence for the Vocalic node as an independent constituent in feature organization and, furthermore, shows that total vowel movement across intervening consonants need not imply complete consonant/vowel segregation.

The organization of this paper is as follows. After the preliminaries of section 1, I focus in section 2 on the typical formation of the imperfective, first measure, thus providing essential background information for subsequent discussions. Following this, I elaborate on the problem associated with accounting for the class of imperfective plurals which have traditionally been analyzed as involving consonant/vowel metathesis. I show that although some account of metathesis must be maintained, the traditional view of metathesis as a one-step operation is inadequate. In section 4, I present an alternative account and I show how this analysis accounts not only for the realization of the metathesized vowel but, in addition, for that of the imperfective prefix vowel. Finally, I discuss implications of this study for the representation of total vowel movement and the organization of place features.

## 1. Preliminaries

The dialect under investigation is standard Maltese Arabic, spoken on the mediterranean island of Malta, situated approximately 60 miles south of Sicily and 180 miles east of the Tunisian coast. My data are drawn from a wide range of sources which include Aquilina (1959), Berrondonner et al. (1983), Borg (1973), Brame (1972, 1973), Bugeja (1984), Busuttill (1981), Butcher (1938), Puech (1978, 1979) and Sutcliffe (1936). These data are consistent with the variety of Maltese spoken by my consultants<sup>1</sup>.

In (4) and (5) below, I give the phonemic inventory of standard Maltese Arabic for reference.

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<sup>1</sup>Several people associated with the Permanent Mission of Malta to the United Nations graciously served as consultants. I am particularly grateful to Mr. Michael Bartolo, Mr. Tony Borg and Mr. George Vella and, in particular, Mr. Anton Mifsud-Bonnici.

## Maltese Metathesis

(4) Vowels<sup>2</sup>:

i	u
e	o
a	

(5) Consonants:

	Labial	Labio-dental	Dental	Palato-alveolar	Velar	Pharyngeal	Laryngeal
stops	p b		t d		k g		ʔ
fricatives		f v	s z	ʃ [ʒ]*		ħ	
affricates			tʃ dz*	tʃ dʒ			
nasals	m		n				
liquids			l r				

\*  $\widehat{dz}$  occurs only in a few Italian/Sicilian loanwords

\* [ʒ] occurs only before voiced obstruents

## 2. First Measure Triliteral Verb<sup>3</sup>

### 2.1 Typical Formation of the Imperfective

Of particular interest to the present paper are imperfective verbs of the triliteral verb, first measure. The imperfective of the verb 'to break' is illustrated in (6) below. As can be seen, both singular and plural forms bear a prefix of the form CV-. The invariable suffix [-u] is added to plurals.

(6) Imperfective, e.g. 'to break'

3rd masc. sing.	já+ʔsam	3rd plural	já+ʔsm+u
3rd fem. sing.	tá+ʔsam		
2nd singular	tá+ʔsam	2nd plural	tá+ʔsm+u
1st singular	ná+ʔsam	1st plural	ná+ʔsm+u

I follow Aquilina (1959) and Puech (1979), among others, in positing that the imperfective is derived from the canonical form -CVCVC-, a bisyllabic template which corresponds in form to the third person masculine singular of the perfective verb, e.g. [ʔasam] 'he broke'. It will be

<sup>2</sup>In addition to the vowels in (1), Maltese also includes the diphthong [iə] (orthographically ie) in its vowel inventory (see e.g. Aquilina 1959).

<sup>3</sup>There are certain verbs in which one of the root consonants is orthographically 'h' or 'gh'. I have not included this class of verbs in the discussion in this paper since although they pattern in a manner similar to triliteral strong verbs, there are certain significant differences. In particular, the orthographic consonant is generally not realized phonetically. Providing a full analysis of these verbs is beyond the scope of this work. However, I refer the reader to the insightful discussions in, most notably, Brame (1972) and Puech (1979).

noticed, however, that in the stem of the singular imperfective there is only one vowel, and in the plural, there are no vowels. Thus, in claiming that these forms are derived from a bisyllabic stem, some account must be given of the absence of vowels in the imperfective. Brame (1973) convincingly argues that the lack of vowels is due to a more general rule of vowel deletion which is described in its preliminary formulation in (7).

- (7) Syncope (preliminary formulation):  
 $\check{V} \rightarrow \emptyset / C\_ \_ C V$   
 A short unstressed vowel in a non-final open syllable deletes.  
 Domain of application: first measure

Note that stress assignment in Maltese is similar to that of most Arabic dialects in that stress generally falls on a final superheavy syllable. If there isn't one, the penultimate syllable is stressed if heavy (or if there are only two syllables), otherwise the antepenult is stressed (see e.g. Brame 1972, 1973).

The application of Syncope in the imperfective is illustrated in (8). Stress falls on the prefix vowel and the first stem vowel is subsequently deleted. The output of the first cycle yields the form of the singular imperfective. With the addition of the suffix -u in the second cycle, the context for Syncope is once more defined and the second stem vowel deletes.

- (8)
- |          |          |
|----------|----------|
| 1. Input | CV+CVVCV |
| Stress   | CVVCVVC  |
| Syncope  | CVCCVC   |
| -----    |          |
| 2. Input | CVCCVC+u |
| Syncope  | CVCCCu   |
|          | [CVCCCu] |

Independent evidence for Syncope comes from the observation that this rule also accounts for the realization of perfective verb forms of the first measure, for example. This is illustrated in (9) below, where I give the perfective of the verb [ʔasam]. Once again, the verb stem is derived from a bisyllabic canonical template, corresponding to the form of the third person masculine singular perfective.

- (9) Perfective, first measure trilateral verb
- |          |    |          |                      |
|----------|----|----------|----------------------|
| ʔasam    | -> | [ʔasam]  | 'he broke'           |
| ʔasam+et | -> | [ʔasmet] | 'she broke'          |
| ʔasám+t  | -> | [ʔsámt]  | 'I, you (sg.) broke' |
| ʔasam+u  | -> | [ʔásmu]  | 'they broke'         |
| ʔasám+na | -> | [ʔsámna] | 'you (pl.) broke'    |
| ʔasám+tu | -> | [ʔsámtu] | 'we broke'           |

## Maltese Metathesis

Thus, by positing an underlying bisyllabic template -CVCVC- in conjunction with the independently motivated rule of Syncope, we are able to derive the typical formation of singular and plural imperfectives.

### 2.2 Vowel Quality

In this section I provide some relevant background concerning the vowel quality of perfective and imperfective verbs. For more detailed discussions, I refer the reader to Puech (1979) and Hume (1992).

Listed in (10) below are representative examples of imperfective and perfective verbs. To the right of each set of verbs, the underlying quality of the stem vowel is indicated. Although in some verbs the surface quality of vowels may differ, I claim that each stem has an underlying vocalism of a single quality, /i/, /e/, /o/ or /a/. This claim will be seen to be of particular importance in accounting for the realization of the imperfective prefix vowel and the stem vowel which occurs in the class of imperfective plurals evidencing metathesis. The analyses in this section owe much to the insights of Berrendonner et al (1983) who were the first, I believe, to suggest that each stem is associated with a single vowel quality in UR.

(10)	Imperfective	Perfective	Stem	
	3rd p.m.sg.	3rd p.pl.	3rd p.m.sg.	Vowel
	jo+ktor	jo+ktr+u	kotor	/o/ 'to increase'
	jo+htob	jo+htb+u	hotob	/o/ 'to propose marriage'
	jo+nfor <sup>4</sup>	jo+nfr+u	nafar	/a/ 'to expose'
	ja+?sam	ja+?sm+u	?asam	/a/ 'to break'
	ja+hbat	ja+hbt+u	habat	/a/ 'to strike, hit'
	je+hbel	je+hblu	hebel	/e/ 'to rave'
	je+hber	je+hbru	heber	/e/ 'to predict'
	ji+kfef	ji+kff+u	kifef	/i/ 'to discover'
	ji+nzel	ji+nzl+u	nizel	/i/ 'to descend'
	ja+hdem	ja+hdm+u	hadem	/i/ 'to work'
	ja+?bel	ja+?bl+u	?abel	/i/ 'to agree'
	ji+lha?	ji+lh?+u	laha?	/i/ 'to reach'
	ji+tħan	ji+tħn+u	tħan	/i/ 'to grind'
	ji+ftaħ	ji+ftħ+u	fetaħ	/i/ 'to open'
	jo+bzo?	jo+bz?+u	beza?	/i/ 'to spit'

In many verbs, the surface quality of all vowels within a given verb stem is identical (excluding, of course, the imperfective plural suffix which is invariably [u]). This is the case in verbs such as [kotor]/[joktor] 'he increased/he increases', [habat]/[jahbat] 'he struck/he strikes', and

<sup>4</sup>This verb is representative of a small class of verbs in which the vowel quality of the imperfective is systematically realized as [o], regardless of the quality of stem vowels in the perfective (see Hume 1992 for related discussion).

[heber]/[jehber] 'he predicted/he predicts'. Given the absence of vowel alternations in these cases, we may assume, in accordance with the null hypothesis, that there is a vocalism of a single quality in underlying representation. In the first case it is /o/, in the second it is /a/, and in the third it is /e/. Note that for each of these verbs, the quality of the imperfective prefix vowel is identical to that of the underlying vocalic melody.

In other forms, the quality of vowels within a given verb may differ. In [nizel]/[jinzel] 'he descended/he descends', for example, the prefix vowel and the first stem vowel surface as [i] whereas the stem-final vowel is [e]. There is strong evidence to suggest, however, that the underlying vocalism of the stem is /i/. To maintain such a claim, we are required to posit that the quality of the stem-final vowel is /i/. This position is well-motivated given the fact that [i] regularly alternates with [e] (Brame 1972, 1973; Puech 1979; Berrendonner et al. 1983). We see this alternation in the perfective, e.g. [nizel] 'he descended', [nzilt] 'I, you (sg.) descended' (note that the first stem vowel is deleted by the rule of Syncope.) This alternation is evidenced more widely as exemplified by the third person feminine suffix.

- (11) 3rd pers. fem. suffix [-it]~[-et]  
 (examples from Brame 1972:26)  
 [hatf+it+kom] 'she grabbed you' cf. [hatf+et] 'she grabbed'  
 [bezʔ+it+l+ek] 'she spit to you' cf. [bezʔ+et] 'she spit'

As these examples illustrate, [e] occurs when followed by a single word-final consonant, otherwise the vowel surfaces as [i]. Following Puech (1978), we may account for this alternation by the rule of I-lowering given in (12).

- (12) I-lowering  
 i -> e/ \_\_\_C#  
 The vowel /i/ is realized as [e] before a single word-final consonant.

With the rule of I-lowering, we are able to account for the i~e alternations in verbs such as [nizel]/[jinzel] by positing a single underlying vocalism /i/. Thus, the stem is derived from /nizil/. It is important to emphasize that, consistent with the verbs discussed just above, the imperfective prefix vowel is identical in quality to the underlying vocalism.

I turn now to verbs in which the vowel sequence of the perfective is [a-e], as exemplified by [hadem] 'he worked' ([jahdem]/[jahdmu] 'he works/they work'). For such verbs, it is also claimed that the underlying vocalism is /i/. Positing /i/ as the quality of the final stem vowel is well-motivated given that the final stem vowel shows i~e alternations, e.g. [hadem] 'he worked', [hdimt] 'I, you (sg.) worked' (see I-lowering in (12)).



## Maltese Metathesis

This still leaves the [a] quality of first stem vowel of the perfective and the prefix vowel to be accounted for. A property shared by all [a-e] verbs such as [ħadem] is the occurrence of a guttural consonant, i.e. [ħ ʔ], in stem-initial position. McCarthy (1989a) and Herzallah (1990) argue, based on a wide range of evidence, that these consonants are members of a natural class which may be characterized by the articulator feature [pharyngeal]. In Herzallah's study of Palestinian Arabic, she provides strong evidence that the vowel [a] is also best characterized as [pharyngeal]. Given the common place specification of these sounds, I would suggest that by positing an underlying /i/ vocalism, the quality of the vowel [a] in verbs such as [ħadem] is the result of assimilation to an adjacent guttural consonant. Following Brame (1972), the rule describing this change appears in (13)<sup>5</sup>.

- (13) Guttural Assimilation:  
 /i/ -> [a] % \_\_\_ [ħ ʔ]  
 The high front vowel /i/ changes to [a] when adjacent to [ħ ʔ] (mirror image).

Partial motivation for this rule comes from the observation that although [e, o, a] may occur adjacent to a guttural consonant in underived verb forms<sup>6</sup>, e.g. [ħebel] 'he raved', [boloʔ] 'he was past his prime', [ħabat] 'he struck', [i] is excluded. The rule of Guttural Assimilation accounts for this distributional gap.

Further evidence comes from an examination of verbs such as the following.

(14) Imperfective		Perfective	
3rd p.m.sg.	3rd p.pl.	3rd p.m.sg.	
ji+lħaʔ	ji+lħʔ+u	laħaʔ	'to reach'
ji+shaʔ	ji+shʔ+u	saħaʔ	'to pound'
ji+tħan	ji+tħn+u	taħan	'to grind'
ji+tjħad	ji+tjħd+u	tjħad	'to deny'

It will be noticed that in each of these verbs, the imperfective prefix vowel surfaces as [i], despite the fact that the quality of the stem vowels is [a]. Recall that in the groups of verbs discussed previously, the surface quality of the prefix vowel is identical to that of the underlying vocalism of the stem. In keeping with this generalization, we posit /i/ as the underlying melody for verbs in (14). The realization of the stem vowels as [a] is accounted for by Guttural Assimilation since in each of these verbs there is a guttural consonant in at least medial position. Thus, by assuming that the underlying vocalism of the verbs in (14) is

<sup>5</sup>For the purposes of this paper, the descriptive rules in this section are sufficient. For a nonlinear characterization, see Hume (1992).

<sup>6</sup>[u] does not occur in verb stems of the first measure.

/i/, we correctly predict the prefix vowel to be identical in quality to the underlying vocalism.

To anticipate the discussion below, the quality of the prefix vowel is best analyzed as being the result of assimilation to the stem's vocalism. For our present purposes, I refer to this rule as Prefix Vowel Assimilation, stated in prose in (15). In section 5, I return to the question of how this rule is formally represented.

- (15) Prefix Vowel Assimilation (PVA) (preliminary formulation):  
The imperfective prefix vowel assimilates in quality to the underlying vocalism of the stem.

The partial derivations of the imperfective and perfective of the verb 'to reach' are given in (16).

- |      |                     |              |              |
|------|---------------------|--------------|--------------|
| (16) |                     | jV+lihi?     | lihi?        |
|      | Prefix Vowel Assim. | jilihi?      | n/a          |
|      | Syncope             | jilhi?       | n/a          |
|      | Guttural Assim.     | jilha?       | laha?        |
|      |                     | [jilha?]     | [laha?]      |
|      |                     | 'he reaches' | 'he reached' |

Note that for the prefix vowel to surface as [i], Guttural Assimilation must apply after the prefix vowel has acquired its quality from the stem vocalism. Were this not the case, we would incorrectly predict the prefix vowel to surface as [a].

Reconsider now verbs such as [hadem]/[jahdem] 'he worked/he works'. With the rules of I-lowering and Guttural Assimilation, we may posit /i/ as the underlying vocalism. As shown in (17) for the verb 'to work', the imperfective prefix vowel first acquires the vowel quality of the underlying vocalism, i.e. /i/. Consistent with the ordering in (16), Syncope then applies to delete the first stem vowel of the imperfective. Guttural Assimilation then applies. This changes the imperfective prefix vowel, as well as the first stem vowel of the perfective to [a]. Note that Guttural Assimilation applies bidirectionally: right to left in the imperfective and left to right in the perfective. The final stem vowel lowers to [e] by the independently motivated rule of I-lowering. (The ordering of Guttural Assimilation before I-lowering is not crucial to this account.)

- |      |                     |            |             |
|------|---------------------|------------|-------------|
| (17) |                     | jV+hidim   | hidim       |
|      | Prefix Vowel Assim. | jihidim    | n/a         |
|      | Syncope             | jihdim     | n/a         |
|      | Guttural Assim.     | jahdim     | hadim       |
|      | I-lowering          | jahdem     | hadem       |
|      |                     | [jahdem]   | [hadem]     |
|      |                     | 'he works' | 'he worked' |

## Maltese Metathesis

Similar to the preceding example, the underlying vocalic melody of verbs such as [fetaħ]/[jiftaħ] 'he opened/he opens' is also /i/. Motivation for this view comes first, from the fact that the prefix vowel surfaces as [i]. Second, it will be observed that the final stem consonant is a guttural consonant. Given the independently motivated rule of Guttural Assimilation, positing /i/ as the underlying quality of the stem-final vowel comes at no extra cost. Remaining to be accounted for is the stem-initial vowel of the perfective which surfaces as [e]. As observed by Berrendonner et al. (1983), in all surface vowel sequences, [a] is only preceded by [e] within the stem; [i] is excluded from this position. I account for this gap for positing /i/ as the underlying quality of the first stem vowel. Due to the effect of a following pharyngeal vowel, the vowel /i/ lowers to [e]. This is stated descriptively as the rule of A-assimilation in (18).

(18) A-assimilation  
/i/ -> [e]/ \_\_\_ C a

As shown in (19), A-assimilation applies after Guttural Assimilation. The second vowel changes to [a] due to Guttural Assimilation, and the first vowel lowers to [e] due to the effect of the following vowel [a].

(19)	/fitiħ/	
Guttural Assim.	fitah	
A-Assimilation	fetaħ	
Output	[fetaħ]	'he opened'

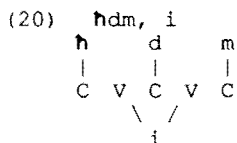
By taking into account the rules of Guttural Assimilation and A-assimilation, both stem vowels of the perfective verb in (19) are treated as underlyingly /i/. Consequently, like all other verbs presented above, we posit a single vocalism in underlying representation. Furthermore, the quality of the imperfective prefix is once again identical to the underlying vocalism.

In this section I have argued that each verb stem has a vocalic melody of a single quality in underlying representation. Moreover, the imperfective prefix vowel is typically identical in quality to this melody. One rule, Guttural Assimilation, has been shown to account for the vowel quality in a number of verbs. It will be seen that this rule also plays a central role in the discussion of plural imperfectives evidencing metathesis. Of particular relevance is the assumption that Guttural Assimilation applies after general Tier Conflation. In the following section I elaborate on why this is so.

### 2.3 Guttural Assimilation and Tier Conflation

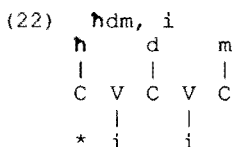
In McCarthy's (e.g. 1979, 1981) analysis of Classical Arabic, he argues that consonantal and vocalic melodies map

onto the prosodic template prior to the phonology. Moreover, the melodies of consonants and vowels are completely segregated. As applied to Maltese Arabic, the perfective verb [ħadem] /ħidim/ 'he worked', which is comprised of the consonantism /ħdm/, the vocalism /i/, and the bisyllabic template CVCVC, can be characterized as in (20).

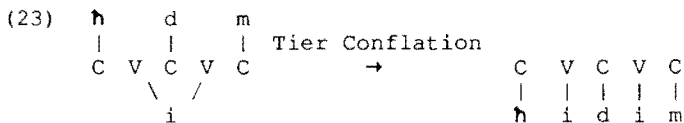


Of particular importance is the fact that the vowel /i/ is multiply-linked to both V-slots of the prosodic template. Were, on the other hand, /i/ linked to each V-slot individually as in (22), the configuration would violate the Obligatory Contour Principle, stated in (21), since it contains identical adjacent instances of /i/.

- (21) Obligatory Contour Principle (McCarthy 1988)  
Adjacent identical autosegments are prohibited.



McCarthy (1986), following Younes (1983), motivates a process of general Tier Conflation which conflates the consonantal and vocalic melodies at a specific point in the phonology, thus resulting in the linear ordering of consonants and vowels. The application of general Tier Conflation to the representation in (22) is given in (23).



Recall that two rules must apply in order to derive the correct surface form [ħadem] from underlying /ħidim/: Guttural Assimilation and I-lowering. Of particular relevance to subsequent discussions is the observation that Guttural Assimilation must apply after general Tier Conflation in order to obtain the correct result. As noted above, after general Tier Conflation has applied, the multiple-linking of non-skeletal adjacent elements is eliminated (see (23)). Given this configuration, only the first stem vowel will

## Maltese Metathesis

undergo Guttural Assimilation, as desired. I-lowering is also correctly predicted to apply only to the stem-final vowel.

(24)     C V C V C     Guttural Assim.     C V C V C  
           | | | | |     I-lowering     | | | | |  
           h i d i m     →               h a d e m → [ħadem]

Conversely, if we were to assume that Guttural Assimilation applied prior to Tier Conflation, as in (25), we would incorrectly predict both stem vowels to surface as [a]. This results from the fact that Guttural Assimilation is defined on /i/, and since /i/ is multiply-linked to both V-slots, both vowels would be affected.

(25)     h       d       m  
           |       |       |     Guttural Assim.     |       |       |  
           C V C V C     →               C V C V C     - \*[ħadam]  
                   \ /                            \ /  
                   i                               a

Consequently, in order to obtain the correct surface forms, it is important to assume that vowels undergo Guttural Assimilation after the application of general Tier Conflation.

### 3. Plural Imperfectives

#### 3.1 The Problem

In section 2.1, it was shown that the typical form of the imperfective plural, first measure triliteral verb, consists of a stem made up of three consonants. This stem is derived from a bisyllabic template, -CVCVC-, with vowel deletion accounted for by the rule of Syncope. In (26), I provide representative examples of verbs which constitute exceptions to this general formation. These involve verbs in which the medial stem consonant is sonorant, i.e. [m n l r], and where a vowel occurs to the left of this consonant. Note that the quality of the vowel is identical to the underlying vocalism of the stem, indicated on the right. Given that the forms in (26) form a regular class of exceptions, an adequate analysis of the imperfective must address a number of questions. First, how do we account for the presence of the stem vowel which occurs in only this subset of plural imperfectives? And second, what are the factors which determine the surface quality of the plural stem vowel? Is it predictable and if so, how?

(26)	Imperfective	Perfective	Stem	
	3rd p.m.sg.	3rd p.pl.	3rd p.m.sg.	Vowel
	ja+h <sup>h</sup> rab	ja+h <sup>h</sup> arb+u	h <sup>h</sup> arab	/a/ 'to run away'
	ja+h <sup>h</sup> rat	ja+h <sup>h</sup> art+u	h <sup>h</sup> arat	/a/ 'to plough'
	jo+bloʔ	jo+bolʔ+u	boloʔ	/o/ 'to be past one's prime'
	jo+frok	jo+fork+u	forok	/o/ 'to limp'
	jo+brod	jo+bord+u	barad	/a/ 'to file'
	ji+fred	ji+fird+u	fired	/i/ 'to separate'
	ji+dneb	ji+dinb+u	dineb	/i/ 'to sin'
	ja+h <sup>h</sup> leb	ja+h <sup>h</sup> ilb+u	h <sup>h</sup> aleb	/i/ 'to milk'
	ja+ʔleb	ja+ʔilb+u	ʔaleb	/i/ 'to overturn'
	ji+fla <sup>h</sup>	ji+fil <sup>h</sup> +u	felah <sup>h</sup>	/i/ 'to be strong'
	ji+sraʔ	ji+sirʔ+u	seraʔ	/i/ 'to steal'
	je+h <sup>h</sup> mez	je+h <sup>h</sup> emzu	h <sup>h</sup> emez	/e/ 'to pin'

One potential means of accounting for the presence of the plural stem vowel in the forms above is to posit that the vowel fails to undergo Syncope and as such remains to the left of the medial sonorant consonant throughout the entire derivation. This could be achieved by reformulating the rule of Syncope such that it applies just in case the medial stem consonant is [-sonorant], as stated in (27).

- (27) Syncope II:  
 V → ∅ / C \_\_\_ C<sub>1</sub> V  
 Condition: if C<sub>1</sub> is a medial stem consonant then it must be [-sonorant]

The application of the revised Syncope rule is illustrated in the derivation of [jokorbu] in (28). As can be seen, the first stem vowel fails to delete since it is followed by a medial sonorant consonant. With the addition of the plural suffix, the final stem vowel does delete, as desired. Thus, by blocking syncope from applying just in case the medial consonant is [+sonorant] we are able to derive the correct form of [jokorbu].

(28)	jV+korob
Prefix Vowel Assim.	jokorob
Syncope	-blocked-
-----	
Input	jokorob+u
Syncope	jokorbu
	[jokorbu] 'they groan'

Despite this approach's success in handling verbs such as [jokorbu], it has two principal weaknesses. First, we are required to include the seemingly arbitrary stipulation that the rule applies just in case the medial consonant is [-sonorant]. Second, and more importantly, the analysis is unable to account for the surface quality of the stem vowel in verbs such as [ja<sup>h</sup>ilbu] 'they milk', derived from /jV+h<sup>h</sup>ilib+u/. As shown in section 2.2 above, the realization

## Maltese Metathesis

of the prefix vowel as [a] is due to Guttural Assimilation: the prefix vowel first assimilates to the underlying vocalism /i/, then assimilates to the stem-initial guttural consonant, thus surfacing as [a]. Note that if we were to assume that the first stem vowel of the plural imperfective did not undergo Syncope, as in (29) below, this vowel would also be expected (incorrectly) to undergo Guttural Assimilation.

(29)	jV+hilib
Prefix Vowel Assim.	jihilib
Syncope	-blocked-
-----	
Input	jihilib+u
Syncope	jihilbu
Guttural Assimilation	jaħalbu
	*[jaħalbu]
	([jaħilbu] 'they milk')

Restricting the directionality of Guttural Assimilation to apply from right to left is not a possible solution since, it will be recalled, Guttural Assimilation also applies from left to right, e.g. [ħaleb] < /ħilib/ 'he milked'. (The final stem vowel is realized as [e] by I-lowering.) Consequently, it cannot be assumed that the plural stem vowel remains to the left of the medial sonorant consonant throughout the entire derivation.

As pointed out by Puech (1979), the quality of the stem vowel in verbs such as [jaħilbu] 'they milk' may be correctly accounted for if we assume that the plural stem vowel originates to the right of the medial consonant but then undergoes metathesis after the application of Guttural Assimilation. Berrendonner et al. (1983) make use of the following transformational notation to describe metathesis.

(30) Metathesis:

V	C	R	V	C	V	→	1	2	4	3	5	6
1	2	3	4	5	6							(where R = nasal or liquid)

I follow the essentials of Puech's analysis to illustrate this point. In order for the second stem vowel to resist deletion, the rule of Syncope must be revised once again as in (31).

(31) Syncope III:

V	→	∅	/	C <sub>1</sub>	___	C	V
Condition: if C <sub>1</sub> is a medial stem consonant then it must be [-sonorant]							

Although the rule's revision is trivial, it is nonetheless successful in blocking Syncope from applying to the second stem vowel when preceded by a sonorant consonant. The derivation of 'they milk' incorporating this revision is given in (32).

(32)		
Input	jV+hilib	
Prefix Vowel Assim.	ji <sup>h</sup> ilib	
Syncope	ji <sup>h</sup> lib	
-----		
Input	ji <sup>h</sup> lib+u	
Syncope	-blocked-	
Guttural Assimilation	ja <sup>h</sup> libu	
Metathesis	ja <sup>h</sup> ilbu	
Output	[ja <sup>h</sup> ilbu] 'they milk'	

In this analysis, the first stem vowel deletes, yet Syncope fails to apply to the second vowel since it is preceded by a medial sonorant consonant, i.e. [l]. Thus, Guttural Assimilation changes only the prefix vowel to [a]. Metathesis then applies and the medial consonant and following vowel switch positions. Through the crucial ordering of Guttural Assimilation before Metathesis, the plural stem vowel is correctly realized as [i]. It is important to note that if the ordering were reversed, we would predict the stem vowel as well as the prefix vowel to surface as [a], identical to the output in (29).

I would suggest that the view that the plural stem vowel originates to the right of the medial consonant is the correct approach. Any analysis in which the stem vowel were to remain to the left of the medial consonant throughout the derivation would run into problems for precisely the reasons indicated above. Nonetheless, there are also problems associated with this approach as it now stands. First, we are again required to formulate Syncope in such a way as to include the ad hoc stipulation that it applies just in case the medial consonant is [-sonorant]. Yet, more importantly, there are a number of verbs that the analysis in (32) will not account for. Consider, for example, the verb [jifilhu] < /jV+fili<sup>h</sup>+u/ 'they are strong' (cf. [jifla<sup>h</sup>] 'he is strong'). Identical to the verb [ja<sup>h</sup>ilbu], the metathesized vowel surfaces as [i]. However, as illustrated in column I in (33), applying Guttural Assimilation before Metathesis as is required in (32) causes the metathesized vowel in the verb 'to be strong' to surface incorrectly as [a].

(33)	I.	II.	
Input	jV+fili <sup>h</sup>	jV+fili <sup>h</sup>	Input
Prefix Vowel Assim.	jifili <sup>h</sup>	jifili <sup>h</sup>	Prefix Vowel Assim.
Syncope	jVfli <sup>h</sup>	jVfli <sup>h</sup>	Syncope
-----			
Input	jifli <sup>h</sup> +u	jifli <sup>h</sup> +u	Input
Syncope	-blocked-	-blocked-	Syncope
Guttural Assim.	jifla <sup>h</sup> u	jifil <sup>h</sup> u	Metathesis
Metathesis	jifal <sup>h</sup> u	n/a	Guttural Assim.
Output	*[jifal <sup>h</sup> u]	[jifil <sup>h</sup> u]	Output



## Maltese Metathesis

The ordering needed to obtain the correct result is given in column II, in which Metathesis applies before Guttural Assimilation. In other words, the vowel first shifts to the left of the medial consonant and then Guttural Assimilation fails to apply since the context of the rule is not met, i.e. /i/ is not adjacent to a guttural consonant. Note that Guttural Assimilation does apply stem-internally in the singular imperfective of this verb, i.e. [jiflaħ] 'he is strong'. For verbs such as [jifilħu] then, Metathesis must apply before Guttural Assimilation, the exact opposite ordering from that needed to obtain the correct result in (32).

The problem then is this: in order to account for forms such as 'to be strong' in (33), Guttural Assimilation cannot apply when the stem vowel is still to the right of the medial consonant; in other words, Metathesis has to precede Guttural Assimilation. Yet, for verbs such as 'to milk' in (32), Guttural Assimilation cannot apply when the stem vowel is already to the left of the medial consonant. Rather, Metathesis has to follow Guttural Assimilation. Thus, in order to account for all forms correctly, Guttural Assimilation needs to apply *after* the point in which the second stem vowel has left its position to the right of the medial consonant so that the final stem vowel in [jifilħu] will not be affected, but *before* the final stem vowel resurfaces to the left of the medial consonant, so that the metathesized vowel in [jaħilbu] will not be affected. Put another way, when Guttural Assimilation applies, the plural stem vowel cannot be "visible" to the rule. As such, the vowel will retain its underlying quality when it surfaces to the left of the medial consonant.

Given the common view of metathesis as a one-step operation, accounting for the realization of the plural stem vowel in all verbs is problematic. The solution to this problem, I would suggest, lies in viewing metathesis as the *product* of more than one operation. These include delete, insert and associate. As I show in the following sections, the first two operations are independently motivated rules of Maltese phonology: Syncope and Epenthesis, respectively. The third operation, associate, takes the form of Vocalic Mapping, a universal association convention. Before elaborating further, however, the question of why a vowel should occur in these plural imperfectives is addressed.

### 4. The Solution

#### 4.1 Syllable Structure Conditions

All plural imperfectives which contain a stem vowel share the property of having a medial sonorant consonant. As will be seen in this and the following sections, the presence of the plural stem vowel is required due to restrictions on the distribution of sonorant consonants in Maltese syllables.

In general, word-internal sequences of the form CRC, where R represents a sonorant consonant ([m,n,l,r]) do not

occur in Maltese (Aquilina 1959, Brame 1972, Puech 1979, Sutcliffe 1936). In addition to the plural imperfectives seen above, we also observe that in the plural of certain nouns, for example, the vowel [i] occurs before a sonorant consonant when this consonant would otherwise occur medially between two consonants, e.g. *frief* 'mattress'/'*ifirfa* 'mattresses', *znied* 'flint'/'*izinda* 'flints', cf. *lsien* 'language'/'*ilsna* 'languages'.

With respect to initial consonant clusters in Maltese, in words where a sonorant consonant is followed by another consonant, the cluster is preceded by a vowel. Consequently, there are no word-initial consonant clusters beginning with a sonorant consonant. This is seen, for example, in nouns with the definite article prefix given in (34). Before nouns beginning with a consonant, the prefix surfaces as [il-] whereas before vowel-initial nouns, its form is [l-]<sup>7</sup>.

- |      |            |               |
|------|------------|---------------|
| (34) | il+belt    | 'the city'    |
|      | il+fellus  | 'the chicken' |
|      | il+?attus  | 'the cat'     |
|      | il+?itan   | 'the walls'   |
|      | il+mo?dief | 'the oar'     |
| cf.  | l+abt      | 'the armpit'  |
|      | l+omm      | 'the mother'  |

As a further example, in verbal nouns a consonant cluster beginning with a sonorant consonant is preceded by the vowel [i]. In the forms on the right, the vowel does not occur since the initial consonant is non-sonorant.

- |      |        |                 |     |       |                  |
|------|--------|-----------------|-----|-------|------------------|
| (35) | irbiit | 'act of tying'  | cf. | ?tiil | 'act of killing' |
|      | infii? | 'act of paying' |     | tliib | 'act of praying' |
- (from Brame 1972:34-35)

A similar situation arises with respect to word-final consonant clusters: sonorant consonants rarely occur as the final member of a complex coda. This observation is based on my examination of approximately 31,000 words in the Maltese lexicon of Busuttil (1981). Numerous examples of final consonant clusters comprised of two non-sonorants (continuant or non-continuant) occur, e.g. *irmosk* 'trash', *?abd* 'ready money', *dalwa?t* 'soon, now'. Final geminates also frequently occur, e.g. *boll* 'sting ray', *bonn* 'swelling in the groin', *da??* 'he played, sounded' (cf. *da?* 'he tasted, experienced'). Moreover, many examples with sonorant consonants followed by obstruents can be found, e.g. *bint* 'daughter', *dars* 'dental', *kelb* 'dog'. However, only five words were found which contain a sonorant consonant as the final member of a consonant cluster. In each case, the final consonant is a nasal and the preceding consonant is a liquid, i.e. *bu?arn*

<sup>7</sup>The definite article assimilates completely to a following coronal consonant (see e.g. Comrie 1980).

## Maltese Metathesis

'horned beetle' (*ʔarn* 'horn'), *skalm* 'oar peg', *sorm* 'backside, rear', *infern* 'hell, infernal'.

The organization of Maltese syllables, as discussed above, falls out naturally from the observation, dating at least as far back as Sievers (1881) and Jespersen (1904), that the sequencing of segments within a syllable is associated with the sonority of the segments involved. The most sonorous segments are vowels, followed in decreasing sonority by glides, liquids, nasals, fricatives and stops. Cross-linguistically, recurrent syllable patterns emerge which show sonority generally rising toward the syllable peak and then falling away from the peak. The sequencing of segments within the syllable in Maltese can be properly accounted for by Jespersen's (1904, 1950) Sonority Principle.

- (36) Sonority Principle (Jespersen 1950:131)  
Between a given sound and the peak are only found sounds of the same, or a higher, sonority class.

The Sonority Principle expresses the observation that as you move out from the syllable peak, sonority cannot increase. It may, on the other hand, decrease or alternatively, remain relatively constant. It is then not surprising that complex codas comprised of an obstruent followed by a sonorant consonant do not occur in Maltese. Similarly, complex onsets made up of a sonorant consonant followed by an obstruent are also correctly predicted to be absent. Moreover, the observation that word-internal sequences of CRC (where R is a nasal or liquid) do not occur in Maltese is consistent with the Sonority Principle: a medial sonorant consonant is more sonorous than both a preceding and following nonsonorant consonant. As I show in the following section, when such sequences do arise, Epenthesis applies to allow for the syllabification of all consonants.

### 4.2 Epenthesis

As observed in the forms in (34) and (35) just above, the vowel [i] precedes a word-initial sonorant consonant which would otherwise form a complex onset with a following consonant of lesser sonority. Without this vowel, the sonorant consonant would be unsyllabifiable given the Sonority Principle in (36). I would suggest that the initial vowel is inserted by Epenthesis in order to provide a nucleus for an unsyllabifiable consonant (see (37)).

- (37) Epenthesis:  $\emptyset \rightarrow \underline{V} / \underline{\quad} C'$   
(where  $\underline{V}$  characterizes an empty V-slot and  $C'$  an unsyllabifiable consonant)

Informally stated, a V-slot is inserted before an unsyllabifiable consonant. In the absence of feature-filling assimilation rules, this vowel receives the feature values

[coronal, +high] and surfaces as [i] by default (see section 5 below for further evidence for these default values).

Sutcliffe (1936) notes that in certain words, a medial sonorant consonant need not be preceded by a vowel. Interestingly, in each of these cases, the medial sonorant is adjacent to a sonorant consonant, e.g. *filmhu* 'they perceive', *iħmla* 'stacks of wheat', *imarmru* 'they murmur', *izma* 'times'. The non-application of Epenthesis in these cases is consistent with the Sonority Principle since the medial consonant is syllabifiable in all forms. In the first three examples, the nasal is able to form a consonant cluster with an adjacent [l] or [r]. In the last example, [m] is able to syllabify with the following syllable forming the complex onset [mn] since the [m] is of the same relative sonority as the [n].

Sutcliffe (1936) also observes that although a vowel generally occurs before a word-initial consonant cluster beginning with a sonorant, a vowel is not required when the preceding word ends in a vowel (see (38) below), suggesting that Epenthesis is a phrase-level rule. I assume then that Epenthesis is post-lexical since it applies both within and across word boundaries.

- (38) ma kenuf inʔas minn tmenin bit(ʔt)ja li ndiebu  
 'the pieces brought were not less than eighty'  
 (Sutcliffe 1936:16)

In this section I have motivated Epenthesis as a rule of Maltese which provides a nucleus for an unsyllabifiable consonant. In the following section I discuss the role of Epenthesis in accounting for metathesis in plural imperfectives.

#### 4.3 Syncope and Vocalic Mapping

Above it was noted that earlier analyses of the plural imperfective have attributed the position of the stem-initial vowel to consonant/vowel metathesis. In Puech's (1979) account, the second stem vowel of the plural fails to undergo Syncope since the medial root consonant is [+sonorant]. The medial consonant and following vowel then undergo metathesis (see (32)). However, I have shown that this account is unable to account for the quality of the stem vowel in all verbs. Given the independently motivated rules of Syncope and Epenthesis, in conjunction with the language's syllable structure conditions, an alternative solution presents itself.

In accounting for the presence of the plural stem vowel, I would suggest that Syncope applies to all verbs, including those in which the medial consonant is [+sonorant]. Consequently, it is unnecessary to include the ad hoc stipulation that Syncope fails to apply just in case the medial consonant is [+sonorant]. Note that by applying Syncope to all verbs, a medial sonorant consonant is left in

## Maltese Metathesis

an unsyllabifiable position due to the Sonority Principle. As shown above, Epenthesis typically applies in a situation such as this. Thus, I assume that by Epenthesis a V-slot is inserted to the left of the medial consonant and, as such, the medial consonant is able to syllabify as the coda of the newly-formed syllable. Within this approach the fact that a vowel occurs to the left of the medial sonorant falls out directly from the language's syllable structure conditions, in conjunction with the independently motivated rules of Syncope and Epenthesis. A full derivation illustrating the application of these rules will be given below.

However, before doing so it is still necessary to account for how the epenthetic vowel acquires its quality in plural imperfectives. In the discussion of Epenthesis in section 4.2, it is claimed that in the absence of feature-filling assimilation, the epenthetic vowel surfaces as [i] by default. This was seen in the forms in (34) and (35) in which the epenthetic vowel is realized as [i] (see also discussion of the imperfective prefix vowel below). Given that the plural stem vowel is [i] in certain verbs, e.g. [jaħilbu], it might be argued that the plural stem vowel is simply a default vowel. Attributing the quality of this vowel to default assignment fails, however, since we would expect the stem vowel in the plural forms on the left in (39) to be [i] as well.

(39)	jo+korb+u	'they groan'	jo+krob	'he groans'
	ji+solħ+u <sup>8</sup>	'they skin'	ji+sloħ	'he skins'
	je+ħemz+u	'they pin'	je+ħmez	'he pins'
	ja+ħarb+u	'they run away'	ja+ħrab	'he runs away'

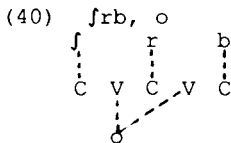
Rather, as shown above, the quality of the plural stem vowel is identical to the underlying vocalism of the stem. This then raises the question: if the final stem vowel is deleted, how does the quality of this vowel surface on the metathesized (epenthetic) vowel?

It is commonly assumed that when a vowel deletes, the features which characterize the vowel also delete. Yet, for the epenthetic vowel to surface as a copy of the syncopated vowel in plural imperfectives, the stem's vocalism cannot delete. Of relevance to this point is the observation that in Maltese, Syncope need only be defined on the skeletal tier; reference to the specific quality of the vowel is unnecessary. Bearing this in mind, I would suggest that when Syncope applies, the vowel slot deletes, whereas the vocalic melody remains afloat until there is a melody-bearing unit for it to map onto. This is reminiscent of the notion of 'stability' in tonal phenomena. It has been observed that when a vowel is deleted, the tone that was previously associated with the vowel does not delete. Instead, it links up to the nearest tone-bearing unit. Given the common view

<sup>8</sup>The prefix vowel is systematically realized as [i] when followed by a stem-initial coronal obstruent (see Hume 1992).

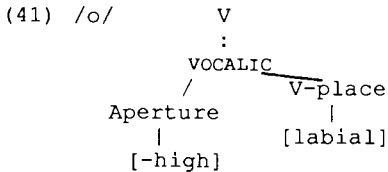
that segmental features, like tones, are autosegments, it is not surprising that the features which comprise the vocalic melody behave in a manner similar to tones.

One might suppose that the reason the melody does not delete along with the V-slot is because it is a morpheme in and of itself which "belongs" to a given verb stem whether or not it is mapped onto a melody-bearing unit. The unassociated melody that remains after Syncope is thus assuming, in a certain sense, the same status that it had prior to the phonology. Let me be more explicit. Recall that in Maltese, trilateral verbs of the first measure are associated with a consonantism, e.g.  $\sqrt{\text{rb}}$  'drink', and a single vocalism, e.g. /o/. These elements map onto the prosodic template prior to the phonology, as illustrated in (40) below.



Without a template to map onto, the melodies remain unassociated, or floating. Thus, when the V-slot is deleted as a result of Syncope, we might suppose that the melody resumes the unassociated status that it had prior to the phonology<sup>9</sup>.

Consider now the features that make up a stem's vocalism and thus, the ones which I claim are not deleted. Only the features that distinguish one vowel from others in the system crucially characterize the vocalism. These refer to place of articulation and height since all other features, e.g. [+sonorant, -consonantal, +continuant, +voice] are redundant. Following Clements (1989, 1991), I assume that a vowel's place and height features form a constituent dominated by the node VOCALIC, as illustrated in (41) for the vowel /o/.



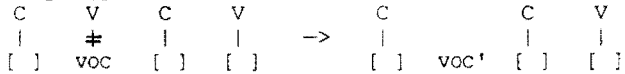
Given this representation, when Syncope applies it will be the VOCALIC node and the features that it dominates that

<sup>9</sup>One might also assume that there is a special principle in Maltese which overrules the more general convention which typically deletes a vocalic melody in syncope rules. For example, we might suppose that in Maltese conventions cannot totally delete morphemes.

## Maltese Metathesis

remain afloat. I reformulate the rule of Syncope incorporating this point in (42) below (irrelevant structure is omitted).

(42) Syncope (final version):



Informally stated, the V-slot and noncontrastive features of an unstressed vowel in a non-final open syllable delete. The VOCALIC node remains afloat and will be realized phonetically if, at some point in the derivation, there is an empty V-slot available for it to map onto. In imperfective plurals with a medial sonorant consonant, the rule of Epenthesis provides precisely this. Thus, by universal association conventions (Haraguchi 1977, Clements & Ford 1979, Pulleyblank 1986), the floating vocalic melody will map onto the epenthetic V-slot in a feature-filling manner. For concreteness, I refer to the association of the floating VOCALIC node to an empty V-slot as Vocalic Mapping as shown in (43).

(43) Vocalic Mapping:



A floating vocalic melody maps onto an unspecified V-slot (where voc' indicates an unassociated vocalic melody and V an empty V-slot).

In the full derivation given in section 6 below, it will be seen that by incorporating Syncope, Epenthesis and Vocalic Mapping into the analysis of plural imperfectives, we are able to account for the observation that it is the underlying quality of the stem vowel which surfaces in all verbs. Moreover, by applying these three operations within a single derivation, the product is metathesis. However, it is important to point out that this analysis also accounts for the realization of the imperfective prefix vowel, as I show just below.

### 5. The Realization of the Imperfective Prefix Vowel

In section 2.2 above, it was seen that the imperfective prefix vowel in verbs of the first measure is typically identical in quality to the underlying vocalism of the stem<sup>10</sup>. It is important to point out that it is only in the

<sup>10</sup>The only examples in which this is not the case is when the vocalism /i/ is subsequently changed to {a} by Guttural Assimilation.

first measure that the quality of the prefix vowel differs, i.e. it can be realized as [i], [e], [o] or [a]. In all other measures which contain a prefix vowel, the vowel always surfaces as [i], regardless of the quality of following vowels or consonants. This is illustrated in (44) below in which perfective and imperfective forms of representative fifth through tenth measure verbs are compared with [jaʔsam] 'he broke' of the first measure (the parenthesized [i] is epenthetic)<sup>11</sup>.

(44)

Measure	Perfective	Imperfective	
First	ʔasam	ja+ʔsam	to break
Fifth	tʔattel	ji+tʔattel	to destroy oneself
Sixth	tbierək	ji+tbierək	to be blessed
Seventh	(i)nʔabad	ji+nʔabad	to be caught
Eighth	(i)rtabat	ji+rtabat	to be bound
Ninth	hdaar	ji+hdaar	to grow green
Tenth	stenbaħ	ji+stenbaħ	to awaken

Two properties of first measure verbs distinguish them from verbs of other measures. First, it is only in the first measure that the quality of the prefix vowel may differ, and second, it is only in the first measure that stem vowels undergo Syncope. These two observations are not unrelated. In my account of the realization of the metathesized vowel just above, it was claimed that the melody of a syncopated vowel remains afloat, mapping onto an empty V-slot if one is available. Consider how this proposal accounts for the differences between the realization of the prefix vowel in first measure verbs and those of other measures. Syncope of the first stem vowel in first measure verbs has been independently motivated in section 2.1 above. Now, if we assume, as shown in (45), that the prefix vowel enters into the derivation as an empty V-slot, the floating melody of the syncopated vowel will associate to this V-slot by Vocalic Mapping. For verbs of other measures, the structural description of Syncope is not met. Hence, there will be no floating melody to map onto the prefix vowel. In these cases, the prefix vowel surfaces as [i]. Recall from the discussion of Epenthesis in section 4.2 that the default values for vowels in Maltese are [coronal, +high]. Consequently, it is reasonable to conclude that these values are assigned to the prefix V-slot, thus providing the prefix vowel with its quality as [i].

<sup>11</sup>The fourth measure is obsolete in Maltese. In verbs of the second and third measures, there is no prefix vowel.



## Maltese Metathesis

	jV+ <sup>2</sup> asam	jV+r <sup>2</sup> abat
Syncope	j V ? s a m a'	n/a
Vocalic Mapping	j V ? s a m a'	n/a
Default Assignment	n/a	jirtabat
	[ja <sup>2</sup> sam] 'he breaks'	[jirtabat] 'he is bound'

Independent evidence supports the claim that the prefix vowel enters into the derivation as an empty V-slot. Recall that the rule of Guttural Assimilation changes the vowel /i/ to [a] when adjacent to a guttural consonant. The rule of Guttural Assimilation may be considered a postcyclic lexical rule since it applies in both derived and non-derived environments. For example, in [laha<sup>2</sup>] 'he reached' < /lihi<sup>2</sup>/, Guttural Assimilation applies within the stem. Conversely, in [ja+h<sup>2</sup>dem] 'he works' < /jV+h<sup>2</sup>idim/, the rule applies to the prefix vowel in the derived imperfective verb (I-lowering changes the last stem vowel to [e]). Since GA applies in both derived and non-derived environments, the rule is best viewed as postcyclic. I am not aware of any cases in which the rule applies across word boundaries, suggesting that it is a lexical rule.

Although Guttural Assimilation regularly affects the prefix vowel in verbs such as [ja+h<sup>2</sup>dem] 'he works', it fails to apply in verbs such as [jih<sup>2</sup>daar] 'it grows green' (9th measure), despite the fact that the stem-initial consonant is guttural. The failure of GA to apply in the latter instance receives a straightforward account by assuming that the prefix vowel enters into the derivation as an empty V-slot.

This is illustrated in (46a,b) by comparing the derivations of [jih<sup>2</sup>daar] and [ja+h<sup>2</sup>dem], where in both instances the prefix vowel starts out as a V-slot. Verbs of the ninth measure such as [jih<sup>2</sup>daar] are derived from a stem of the form CCVVC, which again corresponds to the third person masculine singular perfective form of the verb. Syncope applies to delete the first stem vowel in (b) but is not applicable in (a). By Vocalic Mapping the floating melody links up to the unspecified prefix vowel in (b). Guttural Assimilation then applies to change the prefix vowel from /i/ to [a] in [ja+h<sup>2</sup>dem]. However, since the prefix vowel remains an empty V-slot at this point in the derivation for [jih<sup>2</sup>daar] in (a), Guttural Assimilation is not applicable. Consequently, it will receive the default values [coronal, +high] and surface as [i]. Thus, by incorporating the view that the prefix vowel enters into the derivation as an empty V-slot, in conjunction with Syncope and Vocalic Mapping, we are able to account for the differences between these verbs with respect to the applicability of Guttural Assimilation.

(46)	a.	j V h d a a r	b.	j V h i d i m
Cyclic				
Syncope	n/a			j V h i d i m
				i'
Vocalic				
Mapping	n/a			j V h i d i m
				i'
Postcyclic				
Guttural	n/a			j a h d i m
Assimilation				
I-lowering	n/a			j a h d e m
Default		j i h d a a r		n/a
Assignment		[jihdaar]		[jahdem]

Accounting for the realization of the imperfective prefix vowel by Syncope and Vocalic Mapping is advantageous for a number of reasons. First, it accounts for the asymmetry observed between verbs of the first measure and those of other measures. Second, it obviates the need to posit that an additional rule, i.e. Prefix Vowel Assimilation, is responsible for deriving the quality of this vowel. Third, the quality of the imperfective prefix vowel and that of the imperfective plural stem vowel can be accounted for by the same operations, thus resulting in a more unified analysis. In the following section, I provide full derivations illustrating how the proposals in this and preceding sections allow for the realization of both the prefix and plural stem vowels.

#### 6. A Nonlinear Account of Metathesis

In the preceding sections I have discussed Syncope, Epenthesis and Vocalic Mapping. The first two are independently motivated rules of Maltese, and the latter a universal association convention.

The test cases for my proposed analysis are verbs in which Guttural Assimilation also applies. Recall that accounting for the realization of the metathesized vowel in all plural imperfectives was shown to be problematic for an analysis in which metathesis is viewed as a one-step process. Within this approach, Guttural Assimilation would need to apply before metathesis in a form such as [jahilbu], yet after metathesis in order to obtain the correct form for [jifilhu]. In (47) below, I provide the derivations of these two verbs within the view of metathesis as the product of more than one operation.

Maltese Metathesis

(47)			
Lexical	jV́ + h i l i b	jV́ + f i l i h	
Syncope	jV h l i b	jV f l i h	
	i'	i'	
Vocalic Mapping	jV h l i b	jV f l i h	
	i'	i'	
-----			
Input	ji h l i b + u	ji f l i h + u	
Syncope	ji h l b u	ji f l h u	
	i'	i'	
-----			
Postcyclic			
Guttural Assim.	ja h l b u	-n/a-	
	i'		
-----			
Post-lexical			
Epenthesis	ja h V l b u	ji f V l h u	
	i'	i'	
Vocalic Mapping	ja h V l b u	ji f V l h u	
	i'	i'	
Output	[jahilbu]	[jifilhu]	
	'they milk'	'they are strong'	

As shown in this derivation, Syncope applies first to delink the vocalic melody from superordinate structure of the first stem vowel. By Vocalic Mapping, the floating melody maps leftward onto the empty V-slot of the prefix. With the addition of the plural suffix, Syncope applies to the second stem vowel. Yet, since there is no empty slot at this point in the derivation, the melody remains afloat. Guttural Assimilation applies noncyclically to change the prefix vowel of the first verb, its only target, from /i/ to [a]. Note that due to the second application of Syncope the medial sonorant consonant is in an unsyllabifiable position. Thus, in the post-lexical component an empty V-slot is inserted to the left of the sonorant consonant by the rule of Epenthesis. At this point, the floating melody is able to map onto the V-slot by Vocalic Mapping. Note that all rules are intrinsically ordered as a result of their stratal assignments.

By viewing metathesis as the product of more than one operation, we are able to account for the full range of plural imperfectives. Central to this account is the view that Syncope does not delete the vocalic constituent of the vowel. Rather, it remains afloat. Not only does this account for the failure of Guttural Assimilation to apply to the plural stem vowel, it also extends in a simple way to the realization of the prefix vowel.

7. Implications and Conclusion

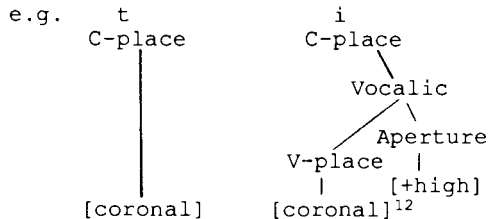
7.1 Tier Conflation and Total Vowel Assimilation

In section 2.3 above, it was shown that Tier Conflation must apply prior to the application of Guttural Assimilation. Recall that if this were not the case, we would predict both vowels of verbs such as [ħadem] < /ħidim/ 'he worked' to surface as [a]. Invoking Tier Conflation prior to the application of Guttural Assimilation requires conflation to occur at least by the postcyclic lexical level.

The relevance of this point bears directly on the nonlinear representation of vowel movement. Recall that in the derivation of the verbs [jaħilbu] and [jifilħu] in (47), the vocalic melody of the vowel /i/ spreads across the medial consonant and links up to the epenthesized V-slot after the application of Guttural Assimilation. This was shown to be crucial in order to account for the correct quality of the vowel in all cases. Given that Tier Conflation must occur prior to Guttural Assimilation, and that Vocalic Mapping may apply after Guttural Assimilation, it follows that Vocalic Mapping may apply after Tier Conflation. This is significant since it means that total vowel movement across an intervening consonant does not imply entire planar segregation, as suggested in McCarthy (1989).

Moreover, given an enriched model of feature geometry such as that developed in the work of Clements (1989, 1991), Clements and Hume (forthcoming), Herzallah (1990), Hume (1992), planar segregation is not required as a means of representing total vowel movement across an intervening consonant. In this model, consonants and vowels are specified for the same set of articulator features, [labial, coronal, dorsal, pharyngeal]. As illustrated in (48), the place features of consonants link to a C-place node and vowel place features link to a V-place node. Vowel place and height features (dominated by an Aperture node) form a Vocalic constituent which is embedded under C-place (see Clements 1991, Clements & Hume forthcoming; Hume 1992 for evidence supporting this organization).

(48) Feature Organization

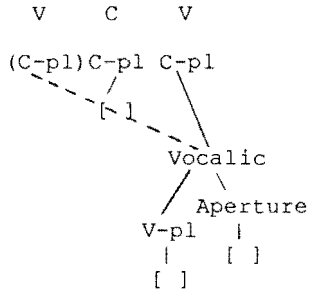


<sup>12</sup>All values of a given feature are arrayed on the same tier although consonantal place features link to C-place, and vocalic place features link to V-place.

## Maltese Metathesis

This model makes a number of strong predictions. One is that consonants and vowels which are specified with a common place feature should pattern together as a natural class. A wide range of evidence supporting this claim can be found in works cited just above. This model also predicts that in the unmarked case, vowel movement should occur across an intervening consonant without crossing association lines. This is illustrated in (49). The Vocalic node of the vowel, dominating its place and height features, spreads across an intervening consonant. Spreading does not result in crossed association lines since consonants do not bear a Vocalic node (Only relevant structure is given. Interpolated nodes on the target are enclosed in parentheses.)

(49) Vowel Movement



Accounting for total vowel movement across an intervening consonant is thus represented in simple terms without invoking complete planar segregation.

### 7.2 Metathesis

Consonant/vowel metathesis has traditionally been treated as a one-step process in which the linear ordering of segments in a string switches. It is of particular interest that although great advancements have been made to eliminate linear notation in processes such as assimilation and dissimilation, the formal mechanisms used to represent metathesis in nonlinear phonology have changed little. Many current analyses of metathesis continue to make use of a linear transformational notation and treat it as a one-step operation. As I have shown for Maltese, this view of metathesis is unsatisfactory. Alternatively, I have suggested that C/V metathesis is the product of three elementary operations: delete (Syncope), insert (Epenthesis) and associate (Vocalic Mapping). Positing an additional rule of metathesis simply duplicates rules which are already independently motivated in the phonology.

This approach is advantageous for a number of reasons. First, it provides a straightforward account of the seemingly complex and poorly understood process of metathesis by

drawing on elementary operations of nonlinear phonology. Moreover, under the assumption that metathesis involves more than one operation, it elucidates why this process is less common cross-linguistically than, for example, processes such as assimilation which could arguably be viewed as the result of one or at most two operations: spread, delink.

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