Nonconcatenative Morphology in Coptic*

Ruth Kramer

1. Introduction

One of the most distinctive features of many Afroasiatic languages is nonconcatenative morphology. Instead of attaching an affix directly before or after a root, languages like Modern Hebrew interleave an affix within the segments of a root. An example is in (1).

(1) *Modern Hebrew*

gadal	'he grew'
gidel	'he raised'
gudal	'he was raised'

In the mini-paradigm in (1), the discontinuous affixes /a a/, /i e/, and /u a/ are systematically interleaved between the root consonants /g d l/ to indicate perfective aspect, causation and voice, respectively. The consonantal root /g d l/ 'big' never surfaces on its own in the language: it must be inflected with some vocalic affix. Additional Afroasiatic languages with nonconcatenative morphology include other Semitic languages like Arabic (McCarthy 1979, 1981; McCarthy and Prince 1990), many Ethiopian Semitic languages (Rose 1997, 2003), and Modern Aramaic (Hoberman 1989), as well as non-Semitic languages like Berber (Dell and Elmedlaoui 1992, Idrissi 2000) and Egyptian (also known as Ancient Egyptian, the autochthonous language of Egypt; Gardiner 1957, Reintges 1994). The nonconcatenative morphology of Afroasiatic languages has come to be known as root and pattern morphology, where roots like /g d l/ are called consonantal roots, and affixes like /a a/ are called melodies or patterns.

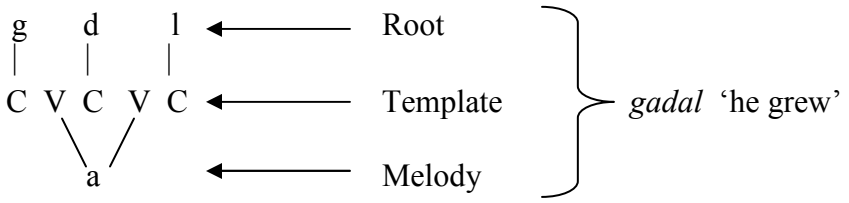
The primary goal of this paper is to develop an Optimality Theory (Prince and Smolensky 1993/2004) analysis of the root and pattern morphology of Coptic, the last stage of the Egyptian language, which has not been previously analyzed synchronically within a generative linguistic

* Thanks to Armin Mester, Junko Ito, Jaye Padgett, Kyle Rawlins, David Teeple, Aaron Kaplan, Adam Savel, and Randall Orr for invaluable discussion and assistance. Thanks also to audiences at LASC 2005, P-Trend 2005, and NELS 36 for helpful comments and discussion. Any errors remaining are those of the author.

framework.[1] However, the aim is not only to contribute to the typology of root and pattern languages, but also to provide evidence for the existence of the consonantal root, whose central role has been strongly questioned in much recent work on root and pattern morphology.

The crucial background for current research is the seminal analysis of root and pattern morphology developed by McCarthy (1979, 1981). McCarthy used autosegmental representations (Goldsmith 1976) to separate roots from melodies through distinct consonantal and vocalic tiers. Prosodic templates (independent morphemes themselves) connect the two tiers and associate each consonant and vowel with a specific slot, as in (2).

(2)



The output of the derivation is a form like *gadal* "he grew."

In more recent research, though, the traditional root and pattern morphology account has been fundamentally reconsidered, and not just by moving away from autosegmental representations. Many researchers have proposed that the consonantal root is irrelevant for some or all nonconcatenative word formation processes (McCarthy 1993a; Bat-El 1994, 2003ab; Ratcliffe 1998; Ussishkin 1999, 2000, 2005; Benmamoun 2003, et al.). The base for word formation is instead taken to be output forms that have already been derived (e.g. *gadal*), and the word formation process is subject to Output-Output Faithfulness (Benua 2000). The vowels of the base are overwritten by the vowels of the affix, and this overwriting occurs instead of a concatenative morphological process (like suffixation or prefixation) in order to satisfy strict prosodic constraints. These constraints are the Optimality Theoretic counterpart of the template in (2), in that they limit the output of a derivation to a certain prosodic size and shape.

Modern Semitic languages have received the most attention under this approach (Hebrew: Bat-El 1994, 2003ab, Ussishkin 1999, 2000; Arabic: Ratcliffe 1998, Gafos 2003, Benmamoun 2003, Ethiopian Semitic: Rose 2003, Buckley 2003). However, Egyptian was indisputably a root and pattern language as well, and remained as such throughout its four-thousand year history (Gardiner 1957; Reintges 1994, 2004). The theoretical objective of this paper is thus to determine whether an output-based approach or a root-based approach is best for Coptic root and pattern morphology. I will argue that a root-based approach must be adopted, and subsequently develop an Optimality Theory analysis where the consonantal root is an essential element in the input.

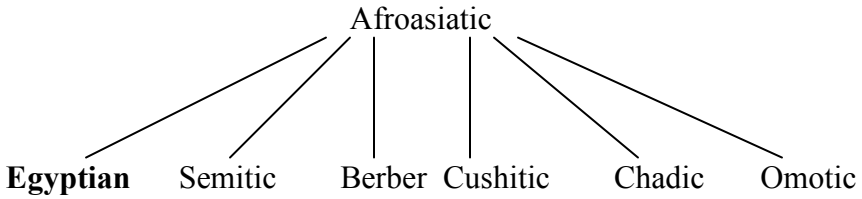
The paper is structured as follows. Section two contains an overview of Coptic, describing the verbal system and establishing the basic generalizations about syllable structure and stress. In section three, roots and outputs are contrasted with respect to data from the verbal system, and I conclude that roots must be referenced in any analysis of Coptic verbal morphology. Section four contains the Optimality Theory analysis, and section five concludes.

[1] Reintges (1994) analyzes Egyptian root and pattern morphology, but his approach is wholly diachronic. He assumes that the input to phonological derivations is Middle Egyptian (spoken ca. 2000-1300 B.C.E.) and the output is Coptic (spoken ca. 500 to 1300 C.E.).

2. Coptic Verbal Morphology and Prosody

The Egyptian language had five distinct stages of development (Old Egyptian, Middle Egyptian, Late Egyptian, Demotic and Coptic), but comprises only one language and is its own separate branch of the Afroasiatic family tree, diagrammed in (3).

(3)



Coptic is the last stage of the language, and it was spoken from approximately the fourth to the fourteenth centuries C.E. It is still used liturgically in the Coptic church. It was written using the Greek alphabet, but with the addition of six new letters for uniquely Egyptian phonemes. Some basic words in Coptic orthography and phonetic transcription are in (4). All Coptic data in this paper come from Lambdin 1983, Layton 2000, or Reintges 2004.

(4)	a. ⲯⲱⲛⲉ	[ʃo.nə]	‘to become ill’
	b. ⲕⲃⲁ	[kβa]	‘vengeance’
	c. ϭϩⲟⲥ	[kʲhɔs]	‘gazelle’
	d.ϫⲓⲣ	[tʃir]	‘salted fish’

The two primary dialects of Coptic are Sahidic and Bohairic, and there a handful of less common dialects (Fayuumic, Akhmimic, Subakhmimic, Lycopolitan and Mesokemic). I will focus on Sahidic, the dialect in which the classical works of Coptic literature were written, and the best-researched dialect overall.

In the remainder of this section, I present a description of Coptic verbal morphology and introduce the main generalizations about Coptic syllable structure and stress.

2.1 Verbal Morphology

In Coptic, most verbal affixes are prefixes.

(5)[2]	a. a-solP	PAST-break	‘broke’
	b. na-solP	FUTURE-break	‘will break’
	c. Nta-solP	PLUPERFECT-break	‘has broken’

However, the stative (an aspectual class) and the infinitive are expressed by word-internal vocalic changes, i.e., root and pattern morphology.

[2] X = x is a syllable peak. Any segment can be a peak in Coptic -- see the discussion of syllable structure in Section 2.2.1.

(6)

Root Type	Root		Infinitive		Stative	
Biconsonantal	a. kt	'build'	kot	'to build'	ket	'is built'
Triconsonantal	b. stm	'hear'	so.tM	'to hear'	sɔ.tM	'is heard'
Quadriconsonantal	c. wstn	'broaden'	wɔs.tN	'to broaden'	wS.ton	'is broadened'

In (6a), the biconsonantal root /k t/ is inflected by interleaving an affix [o] in the infinitive and an affix [e] in the stative. In (6b), the triconsonantal root /s t m/ also is inflected with [o] in the infinitive but [ɔ] in the stative. The quadriconsonantal root in (6c) is /w s t n/, which is inflected with [ɔ] in the stative but [o] in the infinitive. These three patterns are the most common alternations in the data, and the analysis I develop will concentrate on accounting for them.

There are two additional processes that superficially seem to involve root and pattern morphology in Coptic: the so-called prenominal and prepronominal forms of verbs. I will not be treating either of these phenomena, since it is unclear whether they are root and pattern morphology or even morphological processes at all. The prenominal form of the verb is used when a verb and a following noun form a compound (most likely one prosodic word). All the vowels in the verb are reduced to schwa, and since Coptic makes extensive use of vowel reduction in unstressed syllables (see Section 2.2.2), it seems reasonable to say that the verb is no longer stressed in the compound and therefore has had its vowels reduced. The prepronominal form of the verb is more mysterious. It is used when the verb has a pronominal suffix, but instead of the vowels in the verb reducing to a schwa, at least one becomes [ɔ]. The prepronominal form deserves closer investigation, but will not be discussed further.

2.2 Phonotactics and Prosody

2.2.1 Phonotactics

The template for a Coptic syllable is in (7).

(7) $(C)(C)(C)V(C)$

Onset consonant clusters of up to three consonants are permitted (e.g. [skʲra.hT] 'to pause'), and there need not be an onset at all (e.g. [ɔn] 'again'). Codas are permitted (e.g. [koh] 'to become jealous'), but there are no coda clusters.

Any segment can be a syllable nucleus in Coptic, from a voiceless stop to a low vowel. Direct evidence about syllable nucleus status is available through an orthographic notation called the superlinear stroke, a straight line which was placed above consonantal nuclei (see Sethe 1918, Worrell 1934, and Depuydt 2005 for description and discussion). The table in (8) contains examples of syllable nuclei for several different kinds of segments, both in Coptic orthography with the superlinear stroke, and in phonetic transcription.

(8)

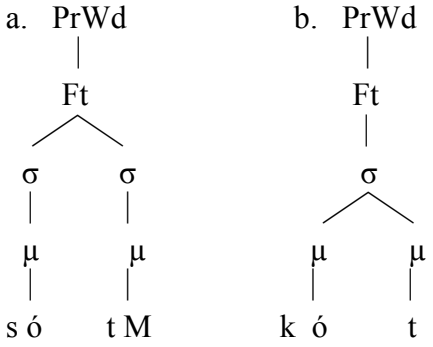
Nucleus	Coptic : IPA	Gloss
voiceless stop[3]	ⲙⲟⲣⲧ̄ : mɔ.rT	beard
voiceless fricative	ⲥⲁϣⲭ̄ : sa.ʃF	seven
voiceless affricate	ⲡⲱⲣϫ̄ : po.rTʃ	to divide
voiced fricative	ⲧⲃ̄ⲧ : tβt	fish
nasal	ⲟⲩⲛ̄ⲧ : wNt	the hold (of a ship)
liquid	ⲥⲱⲧⲣ̄ : so.tR	to turn
high vowel	ⲕⲟⲩⲛ : kun	bosom
mid vowel	ⲕⲟⲧ : kɔt	basket
low vowel	ⲕⲁⲙ : kam	reed

This is very much like Imdlawn Tashlhiyt Berber, a distant genetic relation of Coptic whose consonantal nuclei were famously discussed in Prince and Smolensky (1993/2004). Prince and Smolensky's analysis was based on data from Dell and Elmedlaoui (1985, 1988), however, and this data has recently been disputed. Coleman (1996, 1999, 2001) has argued that, in Berber, syllables with alleged consonantal nuclei actually contain a very reduced schwa (see also Padgett and Ni Chiosáin 1997). Without phonetic evidence, it may be impossible to determine whether this holds for Coptic as well, so the question is left open. In my analysis below, for the sake of consistency, I will treat the consonantal nuclei as if they were genuine syllable nuclei.

2.2.2 Prosody

Coptic has moraic trochaic feet, like the feet in (9).

(9)



It may seem that any descriptive generalizations about Coptic foot form would be difficult, if not impossible, to prove since Coptic is no longer spoken natively. However, Coptic does have extensive vowel reduction to schwa or a syllabic consonant in unstressed syllables. In short words, there is often only one syllable that has a full vowel, so it is easy to see where the stress falls.

Using the vowel reduction diagnostic, then, there is evidence that Coptic has trochaic feet. In bisyllabic words, the stressed syllable is most often on the left.

[3] Coptic does not have voiced stops, except in loan words from Greek.

(10)	a. só.tM	‘to listen’	e. ké.mə	‘Egypt’
	b. té.nə	‘dam, dike’	f. βó.tə	‘to pollute’
	c. nú.rə	‘vulture’	g. pó.rK	‘foal’
	d. mú.kH	‘to afflict’	h. só.pS	‘to pray’

Not only are the words in (10) trochees, they all seem to be moraic trochees. I will assume henceforth that Coptic has moraic trochaic feet, an assumption which is supported by the fact that approximately a third of all morphologically simplex words are monosyllabic, which would be an extremely large a number of degenerate feet in a syllabic trochaic system.

I also maintain that Coptic has one main stress per word, as far to the right edge of the word as possible, and no secondary stress. In trisyllabic words with three light syllables, the stressed syllable is usually word-medial, indicating that there is a trochaic foot at the rightmost edge of the word, e.g., for (11a), the prosodic structure is [hR.(ʃí.rə)].

(11)	a. hR.ʃí.rə	‘young person’	d. N.k^{j}ó.nS	‘to attack’
	b. vL.ví.lə	‘kernel’	e. ʃM.ʃé.k^{y}ə	‘to whisper’
	c. ə.má.tə	‘greatly’	f. mʃ.tó.tə	‘comb’

Additional evidence comes from compound words and from very long words. Whenever two words are compounded, the vowels in the leftmost element reduce and the stress remains at the right edge.

(12) /romə N kemə/ ‘man of Egypt’ → [rM.N.(ké.mə)] ‘Egyptian’

In (12), stress falls on the left syllable of a moraic trochaic foot on the right edge of the word. All the other syllables have been reduced to consonantal nuclei, indicating that there probably was no secondary stress.

In certain very long words, a similar effect occurs. There is often only one full (non-reduced) vowel on or near the right edge.

(13) [N-tN-Nt-mNt-(sá.βə)]
and-1PL-bring-ABSTRACTNOUN-wise
‘and we bring wisdom’ [4]

(13) has only one trochaic foot (sá.βə) on the right edge, and since all other vowels have been reduced, there is no evidence for secondary stress.

The basic generalizations about Coptic prosody are listed in (14).

(14) a. Coptic has moraic trochaic feet.
b. Coptic assigns stress as far to the right edge as possible.
c. Coptic does not have secondary stress.

[4] Example modified from Worrell 1934.

The generalizations will be crucial building blocks in the analysis to follow. They form the basis for the prosodic constraints that are responsible for templatic effects in Coptic root and pattern morphology.

3. Root or Word

In this section, I will investigate whether consonantal roots or output forms are the base for nonconcatenative morphology in Coptic. Contrary to what I ultimately conclude, I start by assuming that a word-based, output-output approach is correct, adopting an Optimality Theory analysis like the one proposed for Modern Hebrew by Ussishkin (1999, 2000, 2005). Initially, this kind of account looks promising, and its advantages are explored in Section 3.1. However, a battery of different kinds of empirical evidence indicates that the consonantal root must be the base for affixation, and this evidence is presented in Section 3.2.

3.1 Output-Output Approach

To begin, I will briefly summarize Ussishkin's (2000) Output-Output faithfulness-based account of Modern Hebrew, since there are many aspects of Ussishkin's analysis that seem to be directly applicable to the Coptic data.

The Modern Hebrew verbal system has seven different classes (called *binyanim*, singular = *binyan*), and Ussishkin's (2000) basic proposal is that one class serves as the base for the others.

(15)

Binyan Name[5]	Example	Gloss
paʕal	gadal	'he grew'
nifʕal	nirdam	'he fell asleep'
piʕel	gidel	'he raised'
puʕal	gudal	'he was raised'
hitpaʕel	hitkabel	'he was received'
hifʕil	higdil	'he enlarged'
hufʕal	hugdal	'he was enlarged'

Instead of having each of the binyanim in (15) derived from a consonantal root, Ussishkin argues that the paʕal is the base of affixation for all the other binyanim. For example, to form [gidel], the input would be /gadal + i e/, i.e. the relevant verb inflected in the paʕal binyan plus a discontinuous affix. The vowels of the base form end up overwritten by the vowels of the affix primarily because of high-ranking constraints on prosodic size and shape, but the crucial part of Ussishkin's analysis for now is why one might think that the paʕal is the base for affixation, and that consonantal roots are not involved.

[5] Not all consonantal roots are associated with each binyan. The root /g d l/ does not have a nifʕal or hitpaʕel form, hence the use of other roots in the examples of these forms.

There are several facts that indicate that the paʕal is not derived from a consonantal root and, instead, is lexically listed with all its vowels. First, the paʕal binyan is the most "basic" pattern semantically (according to Horvath's (1981) classification) since it is used in many different morphological contexts. If it were derived by combining a consonantal root with an affix, the meaning of the affix would be very difficult to characterize. Also, it is the only binyan that contains monosyllabic forms (e.g. [kam] 'he got up,' [sam] 'he put,' [gar], 'he lived); all other binyanim are minimally bisyllabic. This suggests that the paʕal is lexically listed, and as such, it is subject to Input-Output (IO) faithfulness constraints. However, crucially, the other binyanim would be subject to Output-Output (OO) faithfulness constraints (Benua 2000), since the paʕal (an already derived form) serves as the base of affixation for their formation.

Ussishkin demonstrates that there are two levels of faithfulness at play by proposing an Emergence of the Unmarked effect (TETU; McCarthy and Prince 1994) in the bisyllabic binyanim. He proposes a constraint PRWDBRANCH that states that a prosodic word must minimally consist of a single bisyllabic foot. PRWDBRANCH must be ranked below FAITH-IO so that monosyllabic paʕal forms can surface, as illustrated in the following tableau.

(16)

/kam/	FAITH-IO	PRWDBRANCH
☞ a. kam		*
b. kamam	*!	

However, if PRWDBRANCH is ranked above FAITH-OO, it requires that all the other binyanim will be minimally bisyllabic, emerging as less marked (according to this constraint) than the paʕal forms.

In Modern Hebrew, then, Ussishkin proposes that there is a base of affixation for nonconcatenative morphology which is more basic semantically but more marked phonologically (i.e. has monosyllables) than the other verb classes, that there are two levels of faithfulness (FAITH-IO for the base and FAITH-OO for the other binyanim), and that there is an observable TETU effect involving a constraint on prosodic structure.

I now return to Coptic, focusing for the moment on how the stative is formed. The key data is repeated below in (17).

(17)

Root		Infinitive		Stative	
a. stm	'hear'	so.tM	'to hear'	sɔ.tM	'is heard'
b. kt	'build'	kot	'to build'	ket	'is built'
c. wstn	'broaden'	wɔs.tN	'to broaden'	wS.ton	'has broadened'

If an Ussishkin-style account is to be constructed for the stative, a base of affixation is required that is less marked semantically yet more marked phonologically than the stative. In fact, the infinitive fits both of these qualifications. It is "the main lexical form of the verb" (Lambdin 1983: 21), and used in a wide variety of different morphological contexts. The stative, in contrast, has an easily characterizable meaning (state aspect, roughly in the sense of Vendler

1967) and is only used in contexts where that meaning is required. As for phonological markedness, monomoraic (degenerate) feet are allowed in the infinitive, but never in the stative, very much like monosyllabic forms are only allowed in the paʕal for Modern Hebrew.

(18)

Infinitive	Stative	Gloss
a. kβɔ	keβ	'make cool'
b. si	seu	'satisfy'

In (18a), [kβɔ] in the infinitive has just one mora as its nucleus, but [keβ] in the stative has two moras since it has a nucleus and a coda. Similarly, in (18b), [si] has just one mora in the infinitive, but [seu], with a diphthong, has two moras. The relevant markedness constraint that distinguishes the infinitives and the statives is FTBIN(μ).

(19) FTBIN(μ)
Feet are binary on the moraic level.

FTBIN(μ) ensures that each foot has at least two moras, and it is violated by the infinitives in (18), but not by the statives. If the infinitive is the base of affixation, then FTBIN(μ) must be ranked below FAITH-IO, which the infinitive is subject to, but above FAITH-OO, which the stative is subject to, in the TETU ranking in (20).

(20) FAITH-IO >> FTBIN(μ) >> FAITH-OO

This is illustrated in Tableaux (21) and (22). (21) shows the derivation of an infinitive which surfaces with a degenerate foot.

(21)

/kβɔ/ 'to make cool'	FAITH-IO	FTBIN(μ)
☞ a. (kβɔ)		*
b. (kɔβ)	*!	

Candidate (a) is the winner, despite the fact that it has only one mora and thus violates FTBIN(μ). Candidate (b) does not violate FTBIN(μ), but the [□ ̣and the [ɔ] have undergone metathesis, causing a violation of FAITH-IO (specifically, the constraint LINEARITY; McCarthy and Prince 1999).

(22)

/kβɔ + e / 'make cool' + STAT	FTBIN(μ)	FAITH-OO
☞ a. (keβ)		*
b. (kβe)	*!	

The input for (22) is the infinitive output plus a vocalic stative affix. Candidate (a), the winning candidate, is not fully faithful because it violates the faithfulness constraint O-CONTIGUITY ("No Intrusion"), which states that the output must form a contiguous string (McCarthy and Prince 1999; note that I am ignoring faithfulness violations from the deletion of the base vowel since they affect both candidates). The affix [e] is inserted between the two consonants to satisfy FTBIN(μ), but at the expense of separating [k] and [β]. Candidate (b) is a degenerate foot, like the winning candidate in (21), but it loses because faithfulness between output forms can be sacrificed to satisfy foot structure, unlike faithfulness between an input and an output.

So far, an output-output approach seems to account for the data well, and there is one additional reason to consider this account attractive. The infinitive acts as the base for the prefixal (i.e., non-root and pattern) verbal morphology in Coptic as well. In (5) (repeated below as (23)), the prefixes all attach to an infinitive form.

(23) a. a-solP PAST-breakINF 'broke'
b. na-solP FUTURE-breakINF 'will break'
c. Nta-solP PLUPERFECT-breakINF 'has broken'

The verbal morphology system would be elegantly unified if the infinitive were the base for the root and pattern morphology as well.

Despite initial promise, though, an output-output account cannot be correct. There is substantial morphophonological evidence that the consonantal root plays a crucial role in the formation of the stative. In the following section, I present the evidence for the consonantal root, and conclude with a proposal for how the base-like properties of the infinitive can still be captured under an account that uses consonantal roots.

3.2 Evidence for the Root

If the relationship between the infinitive and the stative were subject to Output-Output faithfulness constraints, the stative might be expected to preserve at least some of the properties of the infinitive. Several researchers (Bat-El 1994, Ussishkin 1999) have used these so-called "transfer effects" between a base and an output form to argue for an Output-Output relationship. However, the stative for any given verb in Coptic is completely insensitive to the phonological properties of the infinitive. Instead, the form of the stative can only be reliably predicted from the number of root consonants, i.e., there is a basic biconsonantal stative pattern, a basic triconsonantal pattern, and so on for each kind of root. This strongly suggests that the base for the stative is a consonantal root, and not an infinitive.

There are two specific lines of evidence that support the root-based approach. First, there are infinitives that have some kind of modification to the root and/or the prosodic shape of the verb, which I will call anomalous infinitives. Under an OO-account, it is surprising that none of these modifications transfer into the stative. Second, the stative does not display "classic" OO-transfer effects, like consonant cluster transfer and vowel dependence. Clusters in fact do not reliably transfer, and the vowel of the stative is predictable only from the number of root consonants in the verb.

3.2.1 Anomalous Infinitives

Some biconsonantal verbs have an anomalous final vowel, most often a schwa, in the infinitive. However, the statives of these verbs are like the statives for any other biconsonantal verb, with a CeC pattern.

(24)

Root	Infinitive	Stative	Gloss
a. βt	βo.tə	βet	'to pollute' / 'to be polluted'
b. st	si.tə	sit	'to throw' / 'to have thrown'
c. fk^{J}	fo.k^{j}ə	fek^{J}	'to leap' / 'to have leapt'

Under an OO-analysis, the loss of the final schwa from the infinitive to the stative would not be predicted, as shown in the tableau in (25).

(25)

/βotə + e/ pollute + STAT	FAITH-OO	NOCODA
💣 a. (βé.tə)	*	
☞ b. (βét)	**	*

In Candidate (a), the [o] of the base has been overwritten with the affix vowel [e], causing a FAITH-OO violation. Other than this, though, the candidate is well-formed: it is a good moraic trochee, and has unmarked CVCV syllable structure. In Candidate (b), the attested form, the first vowel has likewise been overwritten, but the final schwa has been deleted, which causes a seemingly needless additional FAITH-OO violation. Moreover, Candidate (b) has worse syllable structure than (a), since it has a coda. An OO-account thus does not predict that Candidate (b) is the winner.[6]

However, if the base for the stative is a consonantal root, then the attested, regular form of the stative can be accurately predicted. Despite their anomalous infinitives, the roots for the verbs in (24) are exactly like other biconsonantal roots, and thus their statives would be predicted to follow the regular biconsonantal pattern.

A similar effect can be observed in deadjectival infinitives. Descriptively, deadjectival infinitives conform to a CCɔC template, and in order to fill the final consonantal slot, the second consonant of biconsonantal roots spreads.

[6] A constraint like FINAL-C ("All words end in a consonant," McCarthy 1993b) ranked between FAITH-IO and FAITH-OO could potentially eliminate Candidate (a). However, there are several classes of statives that end in vowels, e.g. Classes III, V and VII under Layton's (2000) classification.

(26) *Deadjectival Verbs: Infinitives*

Root	Infinitive	Gloss
a. kns	knɔs	'to become stinky'
b. km	kmɔm	'to become black'
c. hm	hmɔm	'to become hot'
d. kʲn	kʲnɔn	'to become soft'

(26a) illustrates the CCɔC template for a verb with a triconsonantal root. In contrast, (26b-d) have biconsonantal roots and final spread consonants in the infinitive, as in (26b) where the root /k m/ has the infinitive [kmɔm] with a final spread [m].[7] It is not possible that the verbs in (26b-d) have triconsonantal roots with two final nasal consonants since other words derived from the same roots show only two root letters, like [ke.mə] "the black land (Egypt)" from /k m/ and [kʲɔn] 'soft' from /kʲ n/.

Crucially, in the stative, (26b-d) have a regular biconsonantal pattern, CeC.

(27) *Deadjectival Verbs: Infinitives and Statives*

Root	Infinitive	Stative	Gloss
a. km	kmɔm	kem	'to become black' / 'to be black'
b. hm	hmɔm	hem	'to become hot' / 'to be hot'
c. kʲn	kʲnɔn	kʲen	'to become soft' / 'to be soft'

The final spread consonant in the infinitive is not transferred to the stative, which is unexpected under an OO-analysis, just like the lack of transfer of the final vowel in the vowel-final infinitives above. It is particularly revealing to compare the statives in (28a-c) to the stative of [knɔs] in (28d).

(28)

Root	Infinitive	Stative	Gloss
a. km	kmɔm	kem	'to become black' / 'to be black'
b. hm	hmɔm	hem	'to become hot' / 'to be hot'
c. kʲn	kʲnɔn	kʲen	'to become soft' / 'to be soft'
d. kns	knɔs	kɔ.nS	'to become stinky' / 'to be stinky'

Despite the fact that their infinitives are strikingly similar, the statives for (28a-c) and (28d) are very different. (28a-c) have the typical biconsonantal pattern CeC, whereas (28d) has the typical triconsonantal pattern. This is strong evidence that the stative is taking the consonantal root as its base, mapping (28a-c) to the typical biconsonantal pattern and (28d) to the typical triconsonantal pattern, without any reference to their identical infinitives.[8]

[7] It is unclear whether spreading only happens with nasals.

[8] It is worth noting that if (28a-c) had statives like (28d), the syllable structure might be marked. For example, for the root /k m/, the associated stative would be [kɔ.mM] where [m] is both the onset and the nucleus of the second

3.2.2 Lack of OO-Effects

In this section, evidence is presented for the lack of traditional output-output transfer effects between the infinitive and the stative. There is no reliable consonant cluster transfer, as there is in the formation of Modern Hebrew denominal verbs (Bat-El 1994), and the vowel in the purported base (the infinitive) has no effect on the prosodic shape or vowel of the purported derived form (the stative), as it does in Modern Hebrew denominal verbs (Ussishkin 1999, 2000) and in Ethiopian Semitic frequentatives (Rose 2003).

An example of how consonant cluster transfer holds in the OO-formation of Modern Hebrew denominal verbs is in (29). The basic template for denominal verbs is in (29a), whereas the forms that transfer clusters are in (29b).

(29)					
	a.	telefon	'telephone'	tilfen	'to call'
		mispar	'number'	misper	'to enumerate'
	b.	praklit	'lawyer'	priklet	'to practice law'
		traklin	'salon'	triklen	'to make something new'

Looking at (29a), from a noun like [telefon], a verb like [tilfen] is derived via a CiCCeC template. However, in (29b), a noun like [praklit] does not have an associated CiCCeC verb *[pirklet]. Instead, the denominal verb is [priklet] where the onset cluster [pr] is preserved from noun to verb. Bat-El (1994) argues that (29b) is evidence that the denominal verb formation takes as its base the already-derived noun, and wishes to remain faithful to its syllable structure, as opposed to taking as its base the consonantal root.

However, in contrast to the Modern Hebrew data, consonant clusters are not reliably preserved from the infinitive to the stative in Coptic, as demonstrated in (30).

(30)	Infinitive	Stative	Gloss
	a. kβɔ	keβ	'make cool'
	b. shai	seh	'write'
	c. knɔs	kɔ.nS	'stink'
	d. sβɔk	sɔ.βK	'to be few'

No consonant clusters, in fact, are ever transferred in any of the three most common patterns of the stative.

Besides consonant cluster transfer, a dependence between the vowel of the base and certain properties of the derived form has been used to argue for an output-output relationship between two words. For example, Ussishkin (1999) develops an intricate account of Modern Hebrew denominal verbs (building on Bat-El 1994) where he explains how the vowel in the base noun affects the prosodic shape of the denominal verb, and how it can even transfer over directly

---

syllable. It is possible that there is some constraint that would rule out syllables where the same kind of segment is both the onset and the nucleus, but even granting this and perhaps deleting the final [m], we still do not arrive at the correct form. Instead, we have [kɔm] with an incorrect vowel, and it will be demonstrated below that the correct matching of stative with vowel can only be achieved by referencing the consonantal root.

into the denominal verb. However, in Coptic, the vowel of the infinitive varies quite widely with no effect on the stative. Moreover, the vowel quality of the stative affix correlates most naturally with the number of root consonants: [eu] for monoconsonantal roots, [e] for biconsonantals, [ɔ] for triconsonantals, and [o] for quadriconsonantals.

Looking at monoconsonantal roots first, it is clear from (31) that the vowel in the infinitive can vary to a large extent ([i], [ɔ], [ɛ], [ai]), but the vowel in the stative is always the same ([eu]).

(31) *Monoconsonantal Roots*

Infinitive	Stative	Gloss
a. si	seu	'to enjoy' / 'is sated'
b. tʃɔ	tʃeu	'to sow' / 'is sown'
c. wɛ	weu	'to be distant' / 'has become distant'
d. ʃai	ʃeu	'to measure' / 'is measured'

For the biconsonantal roots in (32), there is not only variation in the vowel, but some variation in prosodic shape (CVC, CCV, CCVV). However, all of the forms have the same kind of stative, the biconsonantal pattern CeC.

(32) *Biconsonantal Roots*

Infinitive	Stative	Gloss
a. pot	pet	'to run' / 'has run'
b. kβɔ	keβ	'to make cool' / 'has been made cool'
c. shai	seh	'to write' / 'is written'

I will discuss below how constraints on prosodic structure cause all the statives of a certain root to have similar prosodic structure, i.e. cause templatic effects. For now, though, note that the same effect holds for the triconsonantal roots in (33). There is variation in the vowel and in the prosodic shape of the verb, yet the statives are a uniform CɔCC shape.

(33) *Triconsonantal Roots*

Infinitive	Stative	Gloss
a. so.tM	sɔ.tM	'to listen to' / 'to be listened to'
b. knɔs	kɔ.nS	'to stink'/ 'to be stinky'
c. misəʔ[9]	mɔ.səʔ	'to bear' / 'to be born'

[9] I assume that [misəʔ] has essentially the same syllable structure as [sɔ.tM], that is, that the vowel is so reduced that the glottal stop was almost syllabic. I have not written it as such for primarily orthographic reasons; there was no letter for the glottal stop in Coptic, so that [misəʔ] is just written ⲙⲓⲥϵ. See Loprieno 1995 for evidence for the existence of the glottal stop in Coptic, particularly in word-final position.

To sum up, I conclude that the consonantal root must comprise part of the input to the stative. There is no evidence that any phonological properties of the infinitive have any effect on the form of the stative, which is the opposite of what an OO-account would predict. Instead, the form of the stative is always predictable from the number of root consonants a verb has, no matter what its infinitive may look like, and this is exactly what is predicted from an account where the input to the stative is a consonantal root.

However, it is necessary to account for the apparent TETU effect described in Section 3.1, that is, the fact that monomoraic feet are allowed in the infinitive, but not in the stative. Under a consonantal root approach, the TETU effect can still be achieved, albeit through a different means than different levels of faithfulness. I propose that the infinitive is lexically listed with all its vowels, i.e. not derived from a root, just like the paʕal in Hebrew. This way, Input-Output faithfulness constraints can still outrank FTBIN(μ), so infinitives will surface with degenerate feet to preserve faithfulness. The statives lack degenerate feet due to two main properties: they are derived, and the alignment constraint on the stative affix is ranked fairly low. One of the main goals of the next section is to demonstrate how these properties act together in preventing the stative from surfacing with degenerate feet.

There are independent reasons for thinking that the infinitive is lexically listed. Above, it was shown that there can be extreme variation in the vowel of the infinitive (every vowel of Coptic is actually attested in some infinitive form), which is very surprising if the vowel is an affix combining with a root. It was also shown that there is significant variation in the prosodic shape of the infinitive, which is surprising if there is a single template. In conclusion then, I propose the infinitive is lexically listed, whereas the stative is derived from a consonantal root (plus a vocalic affix). In section four, I develop an Optimality Theory analysis based on these conclusions. [10]

4. Analysis

In this section, I advance an analysis of Coptic root and pattern morphology under the rubric of Generalized Template Theory (GTT; McCarthy and Prince 1994). GTT is an Optimality Theoretic descendant of Prosodic Morphology (McCarthy and Prince 1986 et seq.) where templatic effects in morphological processes are derived through independently necessary constraints. Many researchers have constructed accounts using GTT, including Colina 1996, Downing 1994, Spaelti 1997, Alderete et al. 1999, Ussishkin 1999, 2000, Buckley 2003, Graf 2005, et al. Most research has been focused on reduplication phenomena, and has utilized a TETU ranking between Input-Output faithfulness constraints and Base-Reduplicant faithfulness constraints to capture templatic effects in reduplication. The independently necessary markedness constraints responsible for the templatic effects are ranked in-between FAITH-IO and FAITH-BR, and thus only affect the reduplicant.

Root and pattern morphology has not been extensively analyzed using GTT (to the best of my knowledge, the only accounts are Ussishkin 1999, 2000, Buckley 2003, and Graf 2005). Most GTT accounts assume some version of Ussishkin's treatment of Modern Hebrew, which

[10] The deadjectival infinitives described in 3.2.1 as conforming to a template might seem to indicate that not all infinitives are lexically listed. However, I do not believe that those infinitives are formed by a productive process anymore. Although all of the verbs that conform to that template are deadjectival, not all deadjectival verbs in Coptic conform to the template. This indicates that it might have been a former template for deadjectival verbs, and some deadjectival verbs have changed since, whereas others have not.

utilizes a TETU ranking between Input-Output and Output-Output-Faithfulness constraints, as discussed in 3.1. One verb class is the base of affixation, and is subject to FAITH-IO, while the other classes are subject to FAITH-OO. The templatic effects of root and pattern morphology are derived by ranking various prosodic structure constraints between the two sets of faithfulness constraints (e.g. PRWDBRANCH in Section 3.1).

However, under my analysis, an Output-Output approach cannot be feasible for Coptic root and pattern morphology. It is the consonantal root, and not an output form, that is the base of affixation for the stative. Nevertheless, it is still possible to construct a GTT analysis of Coptic, without requiring two separate levels of faithfulness. I assume that the alignment constraint for the stative affix is ranked below prosodic constraints on syllable and foot structure, and this ranking leads to a templatic effect. The affix is placed within the root to optimally satisfy the constraints on syllable and foot structure -- to phrase it directly, it can be put anywhere for the sake of prosody. This kind of account predicts that the affix will be in the same position among verbs that are formed from the same kind of root (biconsonantal, triconsonantal, etc.), but it will differ across different kinds of roots since an extra consonant causes a difference in the prosodic structure. This prediction is borne out by the data.

As for the infinitives, they do not demonstrate templatic effects essentially since they are listed in the lexicon. If FAITH-IO is ranked above the constraints that are responsible for the templatic effects, the infinitives will not conform to any template. This corresponds to the data, where infinitives exhibit a wide degree of variation in prosodic shape.

In the following sections, I lay out the specifics of the analysis, concentrating on how having a consonantal root as an input can replicate the TETU effect discussed above, and on what constraints cause the templatic effects in the statives. Although the derivation of the infinitive is interesting from the perspective of phonotactics (since FAITH-IO is ranked high, the main conflicts to be resolved are in terms of syllable structure), it is too far afield from the primary discussion of the root and pattern morphology of Coptic to pursue in detail here.

4.1 The Basic Constraints

To begin, I will assume that several constraints are undominated, specifically, those constraints that seem to hold generally across the language. The first is a constraint that ensures that the left mora of a foot bears stress, i.e., that feet are trochaic.

(34) FTFORM
Feet are trochaic.

There is no evidence for iambic feet in Coptic, so I assume FTFORM is undominated.[11]

It was observed in Section 2.2.2 that stress falls as far to the right edge as possible in all Coptic words, and that there is no secondary stress. These effects can both be achieved through ALL-FT-R, an alignment constraint holding between feet and prosodic words.

[11] Some infinitives are possibly HL trochees, e.g. [wɔs.tN] 'to broaden.' It is worth noting, though, that they are clearly not iambic, and although they would violate FTBIN(μ), we have already seen forms that do so (the monomoraic infinitives). Nevertheless, I leave the proper characterization of these forms for future research both for purposes of space and because the syllabification facts are not always clear ([wɔ.stN] is also possible).

(35) ALL-FT-R (Align (Ft, R, PrWd, R))
Align the right edge of every foot with the right edge of a prosodic word.
(McCarthy and Prince 1993)

I assume that ALL-FT-R is undominated, so that every foot must be aligned with the right edge of a prosodic word. Since only one foot can have its edge aligned at a time, this ensures that there is only one foot per word, so that there is no secondary stress, and the foot is at the right edge.

The primary evidence for no secondary stress was from vowel reduction in morphologically complex words. To account for vowel reduction, I propose the constraint in (36), a modified version of a type of constraint first proposed by Crosswhite (2001).

(36) *Unstressed̃mid {e, ɛ, o, ɔ}

(36) penalizes mid vowels (except for schwas) that are not stressed, or, in other words, it causes any mid vowel to be stressed. Coptic permits only one mid vowel per word (Peust 1999: 270), which indicates that *Unstressed/mid was undominated. If mid vowels must receive stress, and there is only one stress per word, then there can only be one mid vowel per word.

There is one crucial syllable structure constraint that is undominated: *COMPLEX^{CODA}.

(37) *COMPLEX^{CODA}
No complex codas.

As mentioned in Section 2.2.1, it is a basic fact of Coptic that there are no coda consonant clusters.

FAITH-IO is one of the most crucial constraints (or more precisely, set of constraints) in this analysis, and I will assume that it is undominated.[12] However, there is one crucial exception: O-CONTIGUITY must be ranked low.

(38) O-CONTIGUITY
The portion of S_2 standing in correspondence forms a contiguous string. ("No Intrusion.")
(McCarthy and Prince 1999)

The fact that O-CONTIGUITY is ranked below the rest of the faithfulness constraints will be key in allowing the stative affix to infix (i.e., intrude) between root consonants that form a contiguous string.

(39) contains a list of the constraints seen so far and their basic effects.

[12] There are a handful of phonological alternations that happen in Coptic (labial nasal place assimilation, etc.) that indicate that FAITH-IO is not at the very top of the constraint hierarchy. However, the ranking of FAITH-IO within the highly-ranked constraints will not be relevant for the analysis -- it will work the same whether FAITH-IO is very high or truly undominated, so for the sake of tableau construction, I will assume it is undominated.

(39) FTBIN(μ), FTFORM = moraic trochaic feet
ALLFTR = stress on the right edge, no secondary stress
*Unstressed/mid = mid vowels must be stressed
*COMPLEX^{CODA} = no complex codas
FAITH-IO (O-CONTIGUITY)

4.2. Basic Tableaux

In this section, I present tableaux for the biconsonantal, triconsonantal and quadriconsonantal statives. I begin, though, by expanding Tableau (21) (seen in Section 3.1) which illustrates how degenerate feet are allowed in the infinitive.

(40)

/kβɔ/ 'to make cool'	FAITH-IO	FTBIN(μ)
☞ a. (kβɔ́)		*
b. (kɔ́β)	*!	
c. (kβɔ́:)	*!	

As discussed above, Candidate (a) is the winner, despite the fact that it has only one mora and thus violates FTBIN(μ). Candidate (b) does not violate FTBIN(μ), but the [□̣□̣and the [ɔ] have undergone metathesis, causing a violation of FAITH-IO. Candidate (c) is a similar case since it does not violate FTBIN(μ), but does violate FAITH-IO since the vowel has lengthened (i.e., a mora has been added). Thus, a ranking argument can be drawn from (40) that FAITH-IO must be ranked over FTBIN(μ).

(41)[13] FAITH-IO >> FTBIN(μ)

Tableau (42) demonstrates how a stative with historically the same root as the infinitive in (40) cannot have a degenerate foot output. I assume throughout the analysis that there are lexical rules that properly associate the correct form of the stative affix with the correct root. To the best of my knowledge, there are no prosodic generalizations about what quality of affix corresponds to what form, so it seems best to place the matching directly in the lexicon.

[13] The ranking in (41) does not necessarily indicate that syllables which are not part of a binary moraic foot are fundamentally altered from their input. It will be shown below that PARSE-σ is ranked quite low, which has the effect that "extra" syllables are usually just not parsed. However, the infinitive in (40) is a different kind of case since it is monosyllabic. Assuming that LX≈PR ("every prosodic word must be a lexical word " Prince and Smolensky 1993/2004) is highly ranked, a monosyllabic word must be parsed. Therefore, to foot the infinitive in (40) at all, a foot structure violation is necessary.

(42) *Biconsonantals*

/kβ + e/ 'make cool' + STAT	*COMPLEX^{CODA}	FTBIN(μ)	NOCODA	O-CONTIGUITY
☞ a. (kéβ)			*	*
b. (ékβ)	*!		*	
c. (kβé)		*!		

The winning candidate is Candidate (a), which violates NOCODA and O-CONTIGUITY since the stative affix is infixed (i.e. intrudes) between the two root consonants. In contrast to Candidate (a), Candidate (b) has the stative affix as a prefix, but it is ruled out because it has a complex coda.

Candidate (c) is a degenerate foot similar to the winning infinitive candidate in (40). However, its violation of FTBIN(μ) effectively eliminates it. Candidate (a) can easily win as long as NOCODA and O-CONTIGUITY are ranked below FTBIN(μ), and since FAITH-IO is over FTBIN(μ), the following ranking must hold.

(43) FAITH-IO >> FTBIN(μ) >> NOCODA, O-CONTIGUITY

Thus, the apparent TETU effect of no degenerate feet in the stative is derived through the interaction of several constraints. The fact that FTBIN(μ) is ranked over O-CONTIGUITY allows foot structure to take precedence over faithfulness in one specific case, causing an unmarked foot form to "emerge" in the stative. It does not emerge in the infinitive because there is no potential infinitive candidate that can violate O-CONTIGUITY and be optimal. The input to the infinitive does not contain any affixal material that can intrude between the portion of the output standing in correspondence, and any non-affixal material that intrudes would violate DEP and thus the higher-ranked set of faithfulness constraints.

However, it is important to note that the TETU effect cannot be characterized as a difference between derived and non-derived words. In the prefixal verbal morphology, affixes attach to an infinitive without any templatic effects (see (5)). The crucial difference there is that the alignment constraints on the prefixes must outrank the constraints on prosodic structure that are responsible for templatic effects (like FTBIN(μ)), so that the prefixes are placed at the left edge of the infinitive no matter what prosodic shape may result. However, the alignment constraint on the stative affix is ranked below the constraints that are responsible for templatic effects, so the affix can be placed to optimally satisfy those constraints. The TETU effect results, therefore, from O-CONTIGUITY and the affix alignment constraint being ranked below the template-replicating prosodic constraints, and is thus achievable with a consonantal root input and one dimension of faithfulness.

One of the goals of this section is to characterize the set of prosodic constraints that result in templatic effects, so returning to (42), it is FTBIN(μ) and *COMPLEX^{CODA} that are doing the work. They ensure that the stative affix [e] must be infixed between the two root consonants, and not suffixed or prefixed, giving the effect of a CeC template for any biconsonantal root. In the next tableau for the triconsonantals, there will be several different options for placing the affix, and two more constraints are needed to differentiate between candidates, namely, ONSET, and *COMPLEX^{ONSET}.

(44) *Triconsonantals*

/stm + ɔ/ 'listen' + STAT	FTFORM	*Unstr/mid	ONSET	*COMPLEX^{ONS}	NOCODA
☞ a. (sɔ́.tM)					
b. (sT́.mɔ)		*!			
c. (sT.mɔ́)	*!				
d. (ɔ́.stM)			*!	*	
e. (stɔ́m)				*!	*

The optimal candidate is Candidate (a), which violates none of the constraints in the tableau.[14] In Candidate (b) the stative affix is suffixed, and the vowel reduction constraint *Unstressed/mid is violated since [ɔ] is unstressed. In Candidate (c), which is just like Candidate (b) except that the mid vowel is stressed, FTFORM is violated since the stress falls on the right-hand mora of the foot.

Candidate (d) is particularly interesting since it is a well-formed moraic trochee, yet the affix is prefixed. However, its syllable structure is much more marked than Candidate (a) where the affix is infixed. The first syllable of Candidate (d) lacks on onset, and the second syllable has a complex onset, so it violates both ONSET and *COMPLEX^{ONSET}. A similar candidate is Candidate (e), which is a good moraic trochee where the affix is infixed in a slightly different position than Candidate (a). However, Candidate (e) has a complex onset and a coda, and is eliminated on the grounds of syllable structure like Candidate (d). Thus, the templatic effects in the triconsonantals are more complex than for the biconsonantals, resulting from a mix of stress-related constraints like FTFORM and *Unstr/mid, and syllable structure constraints like *COMPLEX^{ONSET} and ONSET.

For the quadriconsonantals, one last constraint is needed: PARSE-σ. It is clear that it is a violable constraint since the optimal candidate, in fact, violates it.

(45) *Quadriconsonantals, Part 1*

/wstn + o/ 'broaden' + STAT	ALL FTR	*Unstr/mid	FTBIN(μ)	ONSET	*COMP^{ONS}	PARSEσ	NO CODA
☞ a. wS.(tón)						*	*
b. (ów.stN)			*!	*	*		*
c. (wŚ.tno)		*!			*		
d. (wós).tN	*!					*	*

[14] It does violate a Peak constraint like *P/m "[m] should not be a syllable peak" (Prince and Smolensky 1993/2004), but the entire Peak Hierarchy is ranked very low in Coptic because any segment can be a peak; see Section 2.2.1.

Candidate (a) wins despite its violations of PARSE-σ and NOCODA. If the stative affix is prefixed, like in Candidate (b), violations of FTBIN(μ), *COMPLEX^{ONSET}, and ONSET result since the foot has three moras, a complex onset in the second syllable and no onset in the first syllable. If the stative affix is suffixed, like in Candidate (c), a good moraic trochee results, but the mid vowel [o] does not receive stress (and cannot unless FTFORM is violated). Candidate (d) is the reverse of Candidate (a), with the stative affix infixed in the initial syllable instead of the final syllable. However, since the right edge of the foot is not aligned with the right edge of the prosodic word, Candidate (d) violates ALL-FT-RIGHT and is ruled out.

There are two additional candidates to be considered, both of which can fully parse the input. These candidates are (b) and (c) in Tableau (46).

(46) *Quadriconsonantals, Part 2*

/wstn + o/ 'broaden' + STAT	FTBIN(μ)	*COMP^{ONS}	PARSEσ	NO CODA
☞ a. wS.(tón)			*	*
b. (wós.tN)	*!			*
c. (wó.stN)		*!		

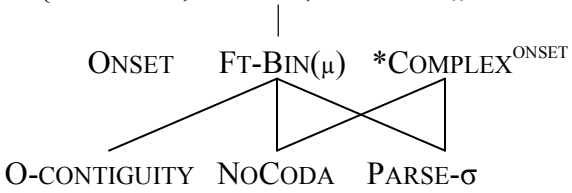
Candidate (b) is a heavy-light trochee, which might be an acceptable foot type in Coptic (see fn. 11). Even so, it would still violate FTBIN(μ), and can be ruled out by ranking FTBIN(μ) over PARSE-σ. Candidate (c) is a good moraic trochee and there are no unparsed syllables or codas, unlike the winning candidate. However, it does have a complex onset in the second syllable, and is ruled out for this violation of *COMPLEX^{ONSET}. Thus, the rankings in (47) must hold (recall that FTBIN(μ) has already been demonstrated to be ranked above NOCODA.)

(47) *COMPLEX^{ONSET}, FTBIN(μ) >> PARSE-σ, NOCODA

Looking at the prosodic constraints that create the templatic effects, again there is a mixture of markedness constraints. FTBIN(μ), syllable structure constraints like ONSET and *COMPLEX^{ONSET}, as well as *Unstr/mid and the alignment constraint ALL-FT-R all combine to restrict the affix to one optimal position.

(48) contains a summary ranking of the constraints used so far in the analysis.

(48) {ALL-FT-R, FTFORM, *Unstr/mi̯d*COMPLEX^{CODA}, FAITH-IO}



There are essentially three tiers of constraints: the undominated constraints at the top, the mid-level constraints in the center, and the lowest-ranked constraints at the bottom. All of the constraints in the top two tiers (except for FAITH-IO) have a hand in causing templatic effects in Coptic root and pattern morphology.

5. Conclusion

In this paper, I have demonstrated that the base for Coptic root and pattern morphology must be a consonantal root, and not an output form of the infinitive. All phonological properties of the stative for any given verb are predictable from the number of root consonants, and not from the form of the infinitive. Moreover, I have argued that the infinitive, which initially seemed to participate in the root and pattern morphology system, is actually lexically listed with all its vowels.

I developed an Optimality Theory analysis along these lines, positing a consonantal root and a vocalic affix as the input for the stative, and a non-consonantal root monomorphemic input for the infinitive. An apparent TETU effect was shown to follow despite not assuming two levels of faithfulness, and a variety of prosodic and phonotactic constraints were characterized as determining the templatic effects exhibited by the stative forms.

There is a substantial body of research that supports the existence of the consonantal root across root and pattern languages. Most psycholinguistic evidence demonstrates that the consonantal root exists at least on some level in the minds of speakers (see Prunet, Béland and Idrissi 2000, Shimron 2003, and references therein), as do language games where speakers flip around root consonants and leave vowels intact (McCarthy 1982). Many theoretical linguistics accounts depend on the root (Chaha: Taranto 2001, Maghrebi Arabic: Teeple 2005), and there are several combined accounts where both output-based and root-based processes play a role (Ethiopian: Rose 2003, Ammani-Jordanian Arabic: Davis and Zawaydeh 2001).

It is one of the combined accounts that may be the best direction for future research on the consonantal root in Coptic. Davis and Zawaydeh (2001) propose that Ammani-Jordanian Arabic hypocoristics are based on a consonantal root that has been extracted from the full name, i.e., an output form. While there is no direct evidence for the stative extracting a root from the infinitive in Coptic, there are several indirect arguments that favor this kind of account. As the present analysis stands, the consonantal roots are part of the lexicon but are only used by the stative. If roots were extracted from infinitives, they would no longer need to be in the lexicon at all. This kind of account would also give us a reason why the infinitive and the stative associated with same meaning have the same consonants, which at this point is just a diachronic byproduct of the root and pattern morphology having been more pervasive in the past. Finally, if roots were extracted from the infinitive, then the infinitive would be in some sense the conjugation base for the stative, which would provide a more unified account of verbal morphology.

References

Alderete, John, Jill Beckman, Laura Benua, Amalia Gnanadesikan, John McCarthy and Suzanne Urbanczyk. 1999. Reduplication with fixed segmentism. Linguistic Inquiry 30: 327-364.

Bat-El, Outi. 1994. Stem modification and cluster transfer in Modern Hebrew. Natural Language and Linguistic Theory 12: 571-596.

Bat-El, Outi. 2003a. The fate of the consonantal root and the binyan in Optimality Theory. Recherches Linguistiques de Vincennes 32: 31-69.

Bat-El, Outi. 2003b. Semitic verb structure with a universal perspective. In Language Processing and Acquisition in Languages of Semitic, Root-Based Morphology, ed. Joseph Shimron, 29-60. Philadelphia: John Benjamins.

Benmamoun, Elabbas. 2003. The role of the imperfective template in Arabic morphology. In Language Processing and Acquisition in Languages of Semitic, Root-Based Morphology, ed. Joseph Shimron, 99-114. Philadelphia: John Benjamins.

Benua, Laura. 2000. Phonological Relations Between Words. New York: Garland.

Buckley, Eugene. 2003. Emergent vowels in Tigrinya templates. In Research in Afroasiatic Grammar II, ed. Jacqueline Lecarme, 105-125. Philadelphia: John Benjamins.

Coleman, John. 1996. Declarative syllabification in Tashlhiyt Berber. In Current Trends in Phonology: Models and Methods, ed. Jacques Durand and Bernard Laks, 177-218. Salford, Manchester: European Studies Research Institute.

Coleman, John. 1999. The nature of vocoids associated with syllabic consonants in Tashlhiyt Berber. In Proceedings of The Fourteenth International Congress of Phonetic Sciences, Volume 1, 735-8. Department of Linguistics, University of California, Berkeley.

Coleman, John. 2001. The phonetics and phonology of Tashlhiyt Berber syllabic consonants. Transactions of the Philological Society 99: 29-64.

Colina, Sonia. 1996. Spanish truncation processes: the emergence of the unmarked. Linguistics 34: 1199-1218.

Crosswhite, Katherine. 2001. Vowel Reduction in Optimality Theory. New York: Routledge.

Davis, Stuart and Bushra Adnan Zawaydeh. 2001. Arabic hypocoristics and the status of the consonantal root. Linguistic Inquiry 32: 512-520.

Dell, François and Mohamed Elmedlaoui. 1985. Syllabic consonants and syllabification in Imdlawn Tashlhiyt Berber. Journal of African Languages and Linguistics 7: 105-130.

Dell, François and Mohamed Elmedlaoui. 1988. Syllabic consonants in Berber: some new evidence. Journal of African Languages and Linguistics 10: 1-17.

Dell, François and Mohamed Elmedlaoui. 1992. Quantitative transfer in the nonconcatenative morphology of Imdlawn Tashlhiyt Berber. Journal of Afroasiatic Languages 3: 89-125.

Depuydt, Leo. 2005. Sounds, syllables and strokes: the syllabic superlineation system in Sahidic Coptic manuscripts. Paper presented at the North American Conference on Afroasiatic Linguistics 33, Philadelphia, Penn.

Downing, Laura. 1994. SiSwati verbal reduplication and the theory of generalized alignment. In Proceedings of NELS 24, 81-95. GLSA, University of Massachusetts, Amherst.

Gafos, Adamantios I. 2003. Greenberg's asymmetry in Arabic: a consequence of stems in paradigms. Language 79. 317-355.

Gardiner, Sir Alan. 1957. Egyptian Grammar. 3rd ed. Oxford: Griffith Institute.

Goldsmith, John. 1976. Autosegmental phonology. Doctoral dissertation, MIT, Cambridge, Mass.

Graf, Dafna. 2005. A study on nominal reduplication in Modern Hebrew. ROA 717.

Hoberman, Robert D. 1989. The Syntax and Semantics of Verb Morphology in Modern Aramaic: A Jewish Dialect of Iraqi Kurdistan. American Oriental Series 69. New Haven, Conn.: American Oriental Society.

Horvath, Julia. 1981. On the status of vowel patterns in Modern Hebrew: morphological rules and lexical representation. In Extended Word-and-Paradigm Theory. Occasional Papers in Linguistics 4. 228-261. University of California, Los Angeles.

Idrissi, Ali. 2000. On Berber plurals. In Research in Afroasiatic Grammar, ed. Jacqueline Lecarme, Jean Lowenstamm, and Ur Shlonsky, 101-124. Amsterdam: John Benjamins.

Lambdin, Thomas O. 1983. Introduction to Sahidic Coptic. Macon, Ga.: Mercer University Press.

Layton, Bentley. 2000. A Coptic Grammar with Chrestomathy and Glossary: Sahidic Dialect. Wiesbaden: Harrossowitz.

Loprieno, Antonio. 1995. Ancient Egyptian: A Linguistic Introduction. Cambridge: CUP.

McCarthy, John. 1979. Formal problems in Semitic phonology and morphology. Doctoral dissertation, MIT, Cambridge, Mass.

McCarthy, John. 1981. A prosodic theory of nonconcatenative morphology. Linguistic Inquiry 12: 373-418.

McCarthy, John. 1982. Prosodic templates, morphemic templates and morphemic tiers. In The Structure of Phonological Representations, ed. Harry van der Hulst and Norval Smith, 191-223. Dordrecht: Foris.

McCarthy, John. 1993a. Template form in prosodic morphology. In Papers from the Third Annual Formal Linguistics Society of Midamerica Conference, 187-218. Indiana University Linguistics Club, Bloomington, Indiana.

McCarthy, John 1993b. A case of surface constraint violation. Canadian Journal of Linguistics 38: 169–195

McCarthy, John and Alan Prince 1986. Prosodic morphology. Ms., University of Massachusetts, Amherst, and Brandeis University, Waltham, Mass.

McCarthy, John and Alan Prince. 1990. Foot and word in prosodic morphology: the Arabic broken plural. Natural Language and Linguistic Theory 8: 209-282.

McCarthy, John and Alan Prince. 1993. Generalized alignment. ROA 7-0000.

McCarthy, John and Alan Prince. 1994. The emergence of the unmarked: optimality in prosodic morphology. Proceedings of NELS 24, 333-379. GLSA, University of Massachusetts, Amherst.

McCarthy, John and Alan Prince. 1999. Faithfulness and prosodic identity. ROA 216-0997.

Padgett, Jaye and Máire Ní Chiosáin. 1997. Markedness, segment realisation, and locality in spreading. Report no. LRC-97-01, Linguistics Research Center, UCSC, Santa Cruz, CA.

Prince, Alan and Paul Smolensky. 1993/2004. Optimality Theory: Constraint Interaction in Generative Grammar. Malden, MA: Blackwell's. (Originally published 1993, ms. Rutgers University, Rutgers, N.J., and Johns Hopkins University, Baltimore, Md. ROA 537-0802.)

Peust, Carsten. 1999. Egyptian Phonology: An Introduction to the Phonology of a Dead Language. Göttingen: Peust & Gutschmidt.

Prunet, Jean-Francois, Renée Béland, and Ali Idrissi. The mental representation of Semitic words. Linguistic Inquiry 31: 609-648.

Ratcliffe, Robert. 1998. The "Broken" Plural Problem in Arabic and Comparative Semitic Allomorphy and Analogy in Non-concatenative Morphology. Current Issues in Linguistic Theory 168. Philadelphia: John Benjamins.

Reintges, Chris H. 1994. Egyptian root-and-pattern morphology. Lingua Aegyptia 4: 213-244.

Reintges, Chris H. 2004. Coptic Egyptian (Sahidic Dialect): A Learner's Grammar. Köln: Rüdiger Köppe.

Rose, Sharon. 1997. Theoretical issues in comparative Ethio-Semitic phonology and morphology. Doctoral dissertation, McGill University, Montreal.

Rose, Sharon. 2003. The formation of Ethiopian Semitic internal reduplication. In Language Processing and Acquisition in Languages of Semitic, Root-Based Morphology, ed. Joseph Shimron, 79-98. Philadelphia: John Benjamins.

Sethe, Kurt. 1918. Die bedeutung der konsonantenverdoppelung im Sahidischen und die Andeutung des ˇ durch den übergesetzten strich. Zeitschrift für ägyptische Sprache und Altertumskunde 54: 129-31.

Shimron, Joseph, ed. 2003. Language Processing and Acquisition in Languages of Semitic, Root-Based Morphology. Philadelphia: John Benjamins.

Spaelti, Philip. 1997. Dimensions of variation in multi-pattern reduplication. Doctoral dissertation, University of California, Santa Cruz.

Taranto, Gina. 2001. Alternating [r] and [n] in Chaha. In MIT Working Papers in Linguistics 38, 179-193. MIT, Cambridge, Mass.

Teeple, David. 2005. Foot unarity: parsing effects in Maghrebi Arabic. Ms., University of California, Santa Cruz.

Ussishkin, Adam. 1999. The inadequacy of the consonantal root: Modern Hebrew denominal verbs and output-output correspondence. Phonology 16: 401-442

Ussishkin, Adam. 2000. The emergence of fixed prosody. Doctoral dissertation, University of California, Santa Cruz.

Ussishkin, Adam. 2005. A fixed prosodic theory of nonconcatenative morphology. Natural Language and Linguistic Theory 23. 169-218.

Vendler, Zeno. 1967. Verbs and times. In Linguistics in Philosophy. 97-121. Ithaca, N.Y.: Cornell University Press.

Worrell, William H. 1934. Coptic Sounds. Ann Arbor, Mich.: University of Michigan Press.

Ruth Kramer
Department of Linguistics
University of California, Santa Cruz
1156 High Street
Santa Cruz, CA 95064

rkramer@ucsc.edu