

Pausal Phonology and Morpheme Realization¹

John J. McCarthy

University of Massachusetts Amherst

1. Introduction

Among her many influential contributions to phonological theory, Lisa Selkirk initiated the study of prosodic domains (Selkirk 1980), and she developed ideas about the phonology-morphology interface (e.g., Selkirk 1984: chapter 3). This chapter addresses both of these topics in the context of an analysis of the pausal forms of Classical Arabic.

Words in Classical Arabic,² a few modern Arabic dialects (Fischer & Jastrow 1980: 111; Fleisch 1968: 29), and Biblical Hebrew (Goerwitz 1993; McCarthy 1979; Prince 1975) undergo some fairly complex morphophonemic alternations when they occur in utterance-final position. Traditionally, the utterance-final context is referred to as *pause*, and the words that appear there are described as *pausal forms* or *in pause*. These terms will be adopted here.

Among the observed alternations between contextual forms (marked with subscripted *Cont*) and pausal forms (marked with *Pau*) are the following:

(1) Some Classical Arabic pausal alternations³

a. No change

| | | |
|--------------------------|-------------------------|--|
| jaqtulu: _{Cont} | jaqtulu: _{Pau} | ‘kill (3 rd m. pl. subjv.)’ |
|--------------------------|-------------------------|--|

b. Absence of suffix vowel

| | | |
|-----------------------------|--------------------------|-------------------|
| ʔalkita:b-u _{Cont} | ʔalkita:b _{Pau} | ‘the book (nom.)’ |
|-----------------------------|--------------------------|-------------------|

c. Epenthesis of [h] after stem vowel

| | | |
|-------------------------|-------------------------|--|
| ʔiqtadi _{Cont} | ʔiqtadih _{Pau} | ‘imitate (3 rd m. sg. impv.)’ |
|-------------------------|-------------------------|--|

d. Metathesis of suffix vowel

| | | |
|---------------------------|-------------------------|--------------------------|
| ʔalbakr-u _{Cont} | ʔalbakur _{Pau} | ‘the young camel (nom.)’ |
|---------------------------|-------------------------|--------------------------|

e. Absence of suffixal [n]

| | | |
|---------------------------|-----------------------|-----------------|
| kita:b-un _{Cont} | kita:b _{Pau} | ‘a book (nom.)’ |
|---------------------------|-----------------------|-----------------|

| | | |
|---------------------------|--------------------------|-----------------|
| kita:b-an _{Cont} | kita:b-a: _{Pau} | ‘a book (acc.)’ |
|---------------------------|--------------------------|-----------------|

f. [ah] for suffix [at]

| | | |
|------------------------------|--------------------------|----------------------|
| ka:tib-at-un _{Cont} | ka:tib-ah _{Pau} | ‘a writer (f. nom.)’ |
|------------------------------|--------------------------|----------------------|

There is an obvious consistency here: pausal forms must end in a heavy syllable. But the various ways of achieving this result — apocope, epenthesis, metathesis — and the

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² The principal western references on Classical Arabic pausal forms are Birkeland (1940), Fleisch (1968: 28-30), Hoberman (1995), Howell (1986: 772-929), Schaade (1911: 55-63), and Wright (1971: vol. II, 368-373). For evidence that the pausal forms were productive in Classical Arabic, see Hoberman (1995: 162-164).

³ Abbreviations used in glosses: 1st, 2nd, 3rd first, second, third person subject; *m.* masculine; *f.* feminine; *nom.* nominative; *gen.* genitive; *acc.* accusative; *du.* dual; *pl.* plural; *perfv.* perfective; *impfv.* imperfective; *ind.* indicative; *impv.* imperative; *juss.* jussive; *subjv.* subjunctive.

ancillary phenomena — absence of [n] and debuccalization of [t] — are not so easily rationalized. Furthermore, it is already apparent that any account of these phenomena will need to be sensitive to morphology, phonology, and prosodic domains.

In this chapter I will present an analysis of these phenomena that is couched in terms of a derivational version of Optimality Theory in which morpheme realization interacts freely with the phonology. The key idea is that phonological markedness constraints on pre-pausal syllables — principally, a requirement that these syllables be heavy — affects morpheme realization. These constraints force non-realization of suffixes in (1)b and (1)e, epenthesis in (1)c, infixation in (1)d, and allomorphy in (1)f.

This chapter begins (section 2) with an overview of the theoretical background necessary to support the analysis. It then continues by looking at the various aspects of Classical Arabic pause: apocope and epenthesis (section 3), metathesis (section 4), absence of suffixal [n] (section 5), and the replacement of suffixal [at] with [ah] (section 6). Finally, section 7 draws some general conclusions.

2. Theoretical background

It is usually assumed that the mapping from underlying to surface forms happens in a single step in Optimality Theory (Prince & Smolensky 1993/2004). But there is also a derivational version of Optimality Theory, called Harmonic Serialism (HS). HS was briefly considered by Prince and Smolensky (1993/2004), but then set aside. HS and a related approach called OT-CC are explored at length in Kimper (2008), McCarthy (2000, 2002, 2007a, b, c, 2008b, c), Pruitt (2008), and Wolf (2008).

In HS, GEN is limited to making one change at a time. Since inputs and outputs may differ in many ways, the output of each pass through GEN and EVAL is submitted as the input to another pass through GEN and EVAL, until no further changes are possible. This is the sense in which HS is a derivational version of OT.

For example, suppose a language maps underlying /pat/ to surface [patʃi] by a combination of [i]-epenthesis and [t]-palatalization. On the first pass through GEN and EVAL, the competing candidates include [pat], [pati], and [patʃ], among others. Because GEN can make only one change at a time, doubly-changed [patʃi] is not a candidate at this time. The grammar selects [pati], which becomes the input to another pass through GEN. Now, the candidate set includes [patʃi], as well as [pati], [pat], and others. EVAL selects [patʃi], which is passed along to GEN. The new candidate set includes faithful [patʃi] and singly-unfaithful alternatives like [patʃ], [patʃi?], etc. EVAL finds none of the alternatives to be better than [patʃi], so [patʃi] is again the winner. We then say that the grammar has *converged* on its final output. The full derivation can be represented compactly as <pat, pati, patʃi>, or it can be spelled out in detail with the tableaux in (2). (On this tableau format, see Prince (2002) or McCarthy (2008a).)

(2) <pat, pati, patʃi> in detail

a. Step 1

| pat | CODA-COND | *ti | DEP | IDENT(anterior) |
|-----------|-----------|-----|-----|-----------------|
| i. → pati | | 1 | 1 | |
| ii. pat | 1 W | L | L | |
| iii. patʃ | 1 W | L | L | 1 W |

b. Step 2

| pati | CODA-COND | *ti | DEP | IDENT(anterior) |
|------------|-----------|-----|-----|-----------------|
| i. → patʃi | | | | 1 |
| ii. pati | | 1 W | | L |
| iii. pat | 1 W | | | L |

c. Step 3 — Convergence

| patʃi | CODA-COND | *ti | DEP | IDENT(anterior) |
|------------|-----------|-----|-----|-----------------|
| i. → patʃi | | | | |
| ii. pati | | 1 W | | 1 W |
| iii. patʃ | 1 W | | | |

Because EVAL applies repeatedly, each step in the derivation <pat, pati, patʃi> must better satisfy the constraint hierarchy than its predecessor. This property of HS is called *harmonic improvement*. Harmonic improvement is always determined relative to a particular constraint hierarchy that is invariant across all iterations of the GEN → EVAL → GEN ... loop.

Wolf (2008) proposes an important extension to HS called Optimal Interleaving theory (OI). The key idea is that morpheme realization is one of the operations that GEN performs, so derivational steps that realize morphemes are interleaved among steps that perform phonological operations. Concomitantly, constraints on morpheme realization are interleaved among phonological constraints in the ranking that EVAL applies.

Realizational theories of morphology, such as Distributed Morphology (Halle & Marantz 1993), assume that the phonological forms of morphemes are the result of processes that spell-out morphosyntactic features. Thus, OI's inputs are feature structures — trees whose terminal nodes are abstract morphemes represented by their morphosyntactic features, such as /DOG-PLURAL/. Spelling out each morpheme requires a separate step of the serial OT derivation, and phonological operations may occur at other steps, during or after spell-out.

In this chapter, I will adopt a compact representation for HS/OI derivations, such as <DOG-PLURAL, dɔg-PLURAL, dɔgs, dɔgz>. This representation, though

convenient, oversimplifies in one important respect: Despite appearances, [dɔg] does not literally replace DOG, nor does [s] replace PLURAL. Rather, the morphosyntactic feature and its phonological representation stand in a relation of correspondence. Thus, the input feature structure remains constant — and constantly accessible — throughout the derivation.

Spell-out has to improve harmony, or otherwise it would never occur. It is harmonically improving by virtue of OI's constraints (in the style of McCarthy and Prince (1995, 1999)) on the correspondence relation between features and their phonological realizations. For instance, MAX-M(PLURAL) is satisfied when input PLURAL is spelled out by the PLURAL-marked suffix [-s] or the root [gi:s]. Another OI correspondence constraint is DEP-M; it would be violated by a plural suffix added to a singular noun for phonological reasons. In section 5, we will also see evidence for the correspondence constraint UNIF-M, which is violated by synthetic inflection and portmanteau morphemes. In addition to the correspondence constraints, OI posits a set of MIRROR (MIR) constraints, which favor candidates where the phonological spell-out of a feature matches its location in morphosyntactic structure.

Atypical spell-out effects occur when OI constraints like MAX-M are dominated by familiar phonological markedness or faithfulness constraints. For example, one possible analysis of haplology in the English genitive plural is that MAX-M(GENITIVE) is dominated by a phonological constraint that disfavors the sequence of [s]s in *[dɔgss]. I will argue that atypical spell-out is the source of many of the pausal alternations in (1).

3. 'Apocope' and epenthesis in pause

As we already saw, Arabic words in pause have to end in a heavy syllable. This requirement is codified by the markedness constraint in (3), which prohibits monomoraic syllables utterance-finally.

(3) HEAVYINPAUSE (HIP)

Assign one violation mark for each configuration of the form $[\mu]_{\sigma}]_{\text{Utt}}$ (i.e., an utterance-final light syllable).

This constraint is presumably related to well-known utterance-final phonetic effects of lengthening and weakening. But it is clearly not reducible to the phonetics, since its diverse effects in Arabic are conditioned by the phonology and morphology.

Words whose contextual forms end in a heavy syllable satisfy HEAVYINPAUSE without further ado, and so in most cases their contextual forms are identical:

(4) Identical contextual and pausal forms with final heavy syllable

| | | |
|---------------------------|--------------------------|--|
| qatalat _{Cont} | qatalat _{Pau} | 'kill (3 rd f. sg. perfv.)' |
| jaqtulu: _{Cont} | jaqtulu: _{Pau} | 'kill (3 rd m. pl. subjn.)' |
| qatala: _{Cont} | qatala: _{Pau} | 'kill (3 rd m. du. perfv.)' |
| qatalata: _{Cont} | qatalata: _{Pau} | 'kill (3 rd f. du. perfv.)' |

When a word's contextual form ends in a short vowel, however, something has to give. What happens depends on the word's morphological and syllabic structure. When the word-final short vowel is a suffix, then it is absent in pause:

(5) Absence of final short suffixal vowels

| | | |
|-----------------------------|--------------------------|--------------------------------------|
| ?alkita:b-u _{Cont} | ?alkita:b _{Pau} | ‘the-book (nom.)’ |
| ?alkita:b-i _{Cont} | ?alkita:b _{Pau} | ‘the-book (gen.)’ |
| ?alkita:b-a _{Cont} | ?alkita:b _{Pau} | ‘the-book (acc.)’ |
| jaqtul-u _{Cont} | jaqtul _{Pau} | ‘kill (3 rd m. sg. ind.)’ |

Although this might look like a phonological apocope process, I will shortly argue that it is not. OI offers an alternative to apocope: the suffix vowel is absent not because it was deleted but rather because it was never realized in the first place. If HEAVYINPAUSE dominates MAX-M instead of phonological MAX, then the suffix will remain unrealized for phonological reasons: $\langle \text{BOOK-NOM}]_{\text{Utt}}, \text{kita:b-NOM}]_{\text{Utt}} \rangle$.⁴ The tableaux in (6) show how this derivation is obtained.

(6) $\langle \text{BOOK-NOM}]_{\text{Utt}}, \text{kita:b-NOM}]_{\text{Utt}} \rangle$

a. Step 1

| BOOK-NOM] _{Utt} | MAX-M(ROOT) | HIP | MAX-M |
|---------------------------------|-------------|-----|-------|
| i. → kita:b-NOM] _{Utt} | | | 1 |
| ii. BOOK-NOM] _{Utt} | 1 W | | 2 W |
| iii. BOOK-u] _{Utt} | 1 W | 1 W | 1 |

b. Step 2: Convergence

Ranking proven: HEAVYINPAUSE \gg MAX-M

| kita:b-NOM] _{Utt} | MAX-M(ROOT) | HIP | MAX-M |
|---------------------------------|-------------|-----|-------|
| i. → kita:b-NOM] _{Utt} | | | 1 |
| ii. kita:b-u] _{Utt} | | 1 W | L |

Top-ranked MAX-M(ROOT) is an ad hoc expedient to ensure that the root is spelled out first; see Wolf (2008: chapter 3) for the real story and section 5 below for related discussion. The interesting action — actually inaction — occurs at step 2. A candidate that leaves NOM unrealized competes against one that realizes it but in doing so violates HEAVYINPAUSE. Since HEAVYINPAUSE is ranked higher, the candidate with incomplete realization of the morphosyntactic feature structure is the winner of this evaluation and the point of convergence.

Before we continue, two issues must be dealt with. One involves the details of Arabic affixes, and the other involves the availability of information about utterance edges to the word finally.

The first issue is this: the analysis will produce the desired effect only when an entire affix remains unrealized; partial realization is not an option permitted to GEN. The textbook version of morpheme segmentation in Classical Arabic looks like a problem, because it posits many CV suffixes that appear to lose just their final vowel in pause:

⁴ Here and throughout, I assume that the edges of the utterance constituent are known in advance of spell-out. This is obviously a non-trivial assumption, and so I will return to it in section 7.

(7) CV suffixes?

| | | |
|------------------------------|----------------------------|--------------------------------------|
| jaqtul-u:-na _{Cont} | jaqtul-u:-n _{Pau} | 'kill (3 rd m. pl. ind.)' |
| qatal-tu-ka _{Cont} | qatal-tu-k _{Pau} | 'I killed you (m. sg.)' |
| qatal-tu-ki _{Cont} | qatal-tu-k _{Pau} | 'I killed you (f. sg.)' |
| qatal-na:-hu _{Cont} | qatalna:-h _{Pau} | 'we killed him' |

The textbook morpheme segmentation is almost certainly wrong, however. The following is an exhaustive list of multisegmental suffixes ending in a short vowel:

(8) Multisegmental suffixes with a final short vowel

a. Indicative mood

| | |
|-----|---|
| -na | '2 nd , 3 rd m. pl.' |
| -ni | '2 nd , 3 rd m. & f. du.' |

b. Subject agreement

| | |
|-----|--|
| -tu | '1 st sg.' |
| -ta | '2 nd sg. m.' |
| -ti | '2 nd sg. f.' |
| -na | '2 nd , 3 rd pl. f.' |

c. Pronominal object or possessor

| | |
|--------|--|
| -ka | '2 nd sg. m.' |
| -ki | '2 nd sg. f.' |
| -hu | '3 rd sg. m.' (cf. -ha: '3 rd sg. f.') |
| -kunna | '2 nd pl. f.' (cf. -kum '2 nd pl. m.') |
| -hunna | '3 rd pl. f.' (cf. -hum '3 rd pl. m.') |

Although these affixes are traditionally analyzed as monomorphemic, the resemblances among them justify a finer morphological analysis (McCarthy 1979: 295ff.; Trager & Rich 1954). For example, [ta] and [ti] mark second person singular subjects, while [ka] and [ki] mark the corresponding objects. This suggests an analysis where [a] and [i] are separate suffixes with the meaning 'masculine' and 'feminine', respectively. If this more careful morpheme segmentation is correct, then there is no reason to prefer the apocope analysis to the realizational one.

The second issue is this: information about a word's location in the utterance is available at the point of morpheme spell-out. In classic OT, this would come as no surprise, since all aspects of output structure are determined simultaneously. But in a derivational version of OT like HS/OI, we might expect derivations to proceed from the bottom up, as they do in Lexical Phonology (Kiparsky 1982; Mohanan 1982 and many others). One possibility is that Lexical Phonology is simply wrong on this point, as Dresher (1983, 2008) has argued from the evidence of Tiberian Hebrew pausal alternations. Another imaginable approach is precompiled phrasal phonology, but this is clearly not appropriate when pause is the conditioning factor (Hayes 1990: 107).

A third option is to recognize the special status of the utterance constituent in the prosodic hierarchy. In an extensive body of research (e.g., Kratzer & Selkirk 2007; Selkirk 1986, 1995), Lisa Selkirk has shown how prosodic constituents like phonological phrase or intonation phrase are projected from the syntax. The utterance is an exception, however. Utterances have no necessary or even regular relationship with the syntax. An utterance can consist of a single word or several sentences. An utterance can even consist of a part of a word: Q: *Did you say abduct or adduct?* A: *Ab.*

All that can be said about an utterance is that it is bounded by pauses and contains no internal pauses. Perhaps this is the reason why the utterance confounds the intuition that structure is built bottom-up.

Back to the main line of analysis and argument. There is a very good reason to prefer an analysis based on morphological realization over one based on phonological apocope: the realizational analysis explains why only affix vowels disappear in pause. When an utterance-final short vowel belongs to the stem rather than an affix, the obligations of HEAVYINPAUSE are met by epenthesizing [h]:

(9) Epenthesis of [h] after final short stem vowels

| | | | |
|----|-------------------------|-------------------------|--|
| a. | ʔiqtadi _{Cont} | ʔiqtadih _{Pau} | ‘imitate (m. sg. imptv.)’ |
| | ʔirmi _{Cont} | ʔirmih _{Pau} | ‘throw (m. sg. imptv.)’ |
| | jarmi _{Cont} | jarmih _{Pau} | ‘throw (3 rd m. sg. juss.)’ |
| | qi _{Cont} | qih _{Pau} | ‘guard (m. sg. imptv.)’ |
| b. | kajfa _{Cont} | kajfah _{Pau} | ‘how?’ |
| | θumma _{Cont} | θummah _{Pau} | ‘then’ |

The verbs in (9)a are derived from roots with final [w] or [j], and that is the source of the stem-final vowel. Since the imperative and jussive moods have no suffix, the final vowel could not be affixal. The final vowels in (9)b could not be affixal because these words do not belong to any of the inflectable lexical categories noun, verb, and adjective. Hence, these final vowels are also part of the stem.

When words like those in (9) occur in pause, non-realization of a suffix is not an option, since there is no suffix. In that case, [h]-epenthesis takes over the job of satisfying HEAVYINPAUSE. The derivation in (10) shows the ranking that produces this result.

(10) [h]-epenthesis

a. Step 1

| | HOW] _{Utt} | MAX-M(ROOT) | HIP | DEP | MAX-M |
|-----|-------------------------|-------------|-----|-----|-------|
| i. | → kajfa] _{Utt} | | 1 | | |
| ii. | HOW] _{Utt} | 1 W | L | | 1 W |

b. Step 2

Ranking proven: HEAVYINPAUSE >> DEP

| | kajfa] _{Utt} | MAX-M(ROOT) | HIP | DEP | MAX-M |
|-----|--------------------------|-------------|-----|-----|-------|
| i. | → kajfah] _{Utt} | | | 1 | |
| ii. | kajfa] _{Utt} | | 1 W | L | |

Tableau (10)a shows that MAX-M(ROOT) must dominate HEAVYINPAUSE, since spelling out the root can introduce an utterance-final light syllable. Tableau (10)b establishes that HEAVYINPAUSE dominates DEP, so it can compel epenthesis.

To ensure the internal consistency of the analysis, we need to check that the introduction of dominated DEP does not affect the account of affix non-realization in (6). It does not because there is no point in (6) where non-realization competes against

a viable epenthetic alternative. That is, the intended winner [kita:b-NOM] never competes against [kita:buh], which realizes the nominative suffix as [u] and satisfies HEAVYINPAUSE by epenthesizing [h]. They do not compete because they come from different GEN “generations”. The ultimate input is [BOOK-NOM], and [kita:b-NOM] is one step away from that. But [kita:buh] is three steps away — spell-out of BOOK, spell-out of NOM, and epenthesis.

In sum, the OI analysis presented here explains two properties of the Arabic pausal system. It explains why affix vowels are absent in pause but stem vowels are not — non-realization is an option only for the former. It also explains why affix vowels never undergo [h]-epenthesis — non-realization wins before epenthesis is a viable option. Both explanations rely on OI’s eponymous ability to interleave phonological and morphological operations and constraints.

It is possible to construct a conventional OT analysis of these data, but then explanation gives way to stipulation. The trick is to invoke root faithfulness constraints (McCarthy & Prince 1995, 1999). MAX_{root} prevents stem vowels from deleting. If it dominates DEP, which itself dominates unadorned MAX, then the right results are obtained:

(11) Non-OI analysis

a. Deletion of suffix vowel

| kita:b-u | MAX_{root} | HIP | DEP | MAX |
|-------------------|--------------|-----|-----|-----|
| i. → kita:b]Utt | | | | 1 |
| ii. kita:bu]Utt | | 1 W | | L |
| iii. kita:buh]Utt | | | 1 W | L |

b. Epenthesis after stem vowel

| kajfa | MAX_{root} | HIP | DEP | MAX |
|-----------------|--------------|-----|-----|-----|
| i. → kajfah]Utt | | | 1 | |
| ii. kajfa]Utt | | 1 W | L | |
| iii. kajf]Utt | 1 W | | L | 1 W |

The ranking of MAX_{root} above DEP and plain MAX is this analysis’s way of stipulating that which the OI analysis succeeds in explaining. That is, these rankings stipulate why affix vowels are absent in pause but stem vowels are not, and why affix vowels never undergo [h]-epenthesis. As I argued above, the OI analysis better explains these properties because they follow from its very nature.

4. ‘Metathesis’ in pause

When a noun whose stem ends in a consonant cluster appears in the nominative or genitive case in pause, the suffix vowel appears to be metathesized into the cluster (12). This does not occur in the accusative case, however.

- (12) Metathesis in pause
 ?albakr-u_{Cont} ?albakur_{Pau} ‘the young camel (nom.)’
 ?albakr-i_{Cont} ?albakir_{Pau} ‘the young camel (gen.)’
but
 ?albakr-a_{Cont} ?albakr_{Pau} ‘the young camel (acc.)’

Although I call this phenomenon metathesis and will later present a metathetic analysis for comparison purposes, OI offers an alternative approach. The idea is that the nominative suffix [-u] is not *moved* into the preceding cluster; rather, the morphosyntactic feature NOM is *realized* in that position. This suffix is, in short, infixes for phonological reasons.

Consider the fate of utterance-final [CAMEL-NOM] (ignoring the definite article). At the second step of the derivation, the root has already been spelled out and the input to GEN is [bakr-NOM]. One option for spelling out NOM is [bakur], with NOM realized internally to the stem. This is a violation of MIRROR, which says (approximately) that the phonological exponent of NOM has to follow the phonological exponent of CAMEL, mirroring in phonological structure the relation between these morphemes in morphosyntactic structure. Wolf (2008: 81) defines MIRROR so it assesses violations gradiently by segments. Therefore, [bakur] receives one mark from this constraint.

Infixation of the desinence occurs with cluster-final stems like [bakr], but not with stems ending in a single consonant, such as [kita:b], [dʒabal] ‘hill’, or [θaʃlab] ‘fox’. In pause, these latter nouns opt for non-realization of NOM, as we have already seen. The explanation for this difference is that infixation avoids the final consonant cluster of *[bakr-NOM]. On this view, *COMPLEXCODA (*CMP) dominates MIRROR, thereby compelling infixation in cluster-final stems like the one in tableau (13). *COMPLEXCODA is irrelevant in non-cluster-final stems, as tableau (14) shows.

- (13) Step 2 of <CAMEL-NOM]_{Utt}, bakr-NOM]_{Utt}, bakur]_{Utt}>
 Ranking proven: HEAVYINPAUSE, *COMPLEXCODA, DEP ≫ MIRROR

| | bakr-NOM] _{Utt} | HIP | *CMP | DEP | MIR | MAX-M |
|------|---------------------------|-----|------|-----|-----|-------|
| a. → | bakur] _{Utt} | | | | 1 | |
| b. | bakr-NOM] _{Utt} | | 1 W | | L | 1 W |
| c. | bakir-NOM] _{Utt} | | | 1 W | L | 1 W |
| d. | bakru] _{Utt} | 1 W | | | L | |

- (14) Step 2 of <FOX-NOM]_{Utt}, θaʃlab-NOM]_{Utt}> — Convergence
 Ranking proven: MIRROR ≫ MAX-M

| | θaʃlab-NOM] _{Utt} | HIP | *CMP | DEP | MIR | MAX-M |
|------|----------------------------|-----|------|-----|-----|-------|
| a. → | θaʃlab-NOM] _{Utt} | | | | | 1 |
| b. | θaʃlabu] _{Utt} | 1 W | | | | L |

| | | | | | |
|----|-------------------------|--|--|-----|---|
| c. | θaʕulab] _{Utt} | | | 3 W | L |
|----|-------------------------|--|--|-----|---|

These two tableaux merit close study. From previous discussion we know that HEAVYINPAUSE dominates DEP and MAX-M. These tableaux introduce two more constraints, *COMPLEXCODA and MIRROR. Tableau (13) shows that MIRROR has to be dominated by three constraints: *COMPLEXCODA, to rule out non-realization with cluster-final stems; DEP, to prevent *COMPLEXCODA from being satisfied by ordinary vowel epenthesis; and, as usual, HEAVYINPAUSE. But MIRROR must itself dominate MAX-M, as shown in (15), so that infixation does not become a more generally applicable alternative to non-realization.⁵

Interestingly, it is not possible in OI to construct a metathesis analysis of these data that is consistent with the rankings supported in the previous section. To get to the output by metathesis, the derivation would have to go <CAMEL-NOM]_{Utt}, bakr-NOM]_{Utt}, bakru]_{Utt}, bakur]_{Utt}>. At step 2, NOM is realized at the expense of violating HEAVYINPAUSE — an impossibility because the previous section established that MAX-M is ranked below HEAVYINPAUSE. In OI, as in HS generally, there is no look-ahead, so the prospect of fixing [bakru]’s HEAVYINPAUSE violation is not in sight. Derivations must steadily improve harmony, and violating undominated HEAVYINPAUSE is not the way to do that.

In the previous section I also noted that the OI analysis has an explanation for why stem vowels are preserved in pause: the missing vowels are the result of non-realization of an affix rather than a process of apocope. The analysis in this section has a similar explanation for why words like [ʔirmi] in (9)a become [ʔirmih] rather than *[ʔirim] in pause. Because the stem-final [i] is not a suffix, there is no way to realize it in a different place. A metathesis process could move it, but metathesis is not at work here.

The analysis to this point is crucially incomplete in one respect: it does not account for the contextual ~ pausal alternation in accusative nouns like [ʔalbakr-a]_{Cont} ~ [ʔalbakr]_{paus}. Evidently the accusative suffix resists infixation. It is by no means unusual for similar-looking affixes to differ in infixability within a language. For example, Prince and Smolensky’s (1993/2004) analysis of the Tagalog infix [um] ‘actor focus’ relies on the fact that it starts with a vowel and ends in a consonant. But [ipag] ‘benefactive focus’ is also vowel-initial and consonant-final, yet it does not infix. Facts like this show that MIRROR, like the affixal alignment constraints it replaces, is morpheme-specific. Tagalog assigns a different ranking to MIRROR(ACTOR FOCUS) and MIRROR(BENEFACTIVE FOCUS), violating the former but not the latter. In Arabic, MIRROR(ACC) is unviolated, but MIRROR(NOM) and MIRROR(GEN) are ranked lower.

Tableau (15) illustrates this effect of MIRROR(ACC). The behavior of MIRROR(NOM) is already shown in (13), if MIRROR(NOM/GEN) is substituted for MIRROR.

⁵ In (15) I use a noun with a medial cluster, [θaʕlab], rather than [kita:b] or [ɕabal], because *[kita:ub] or *[ɕabu.al] are independently ruled out by ONSET.

(15) Convergence at step 2 of $\langle \text{CAMEL-ACC}]_{\text{Utt}}, \text{bkr-ACC}]_{\text{Utt}} \rangle$

Ranking proven: $\text{HEAVYINPAUSE}, \text{MIRROR(ACC)} \gg * \text{COMPLEXCODA}$

| | $\text{bkr-ACC}]_{\text{Utt}}$ | HIP | MIR(ACC) | *CMP | DEP | MIR(NOM/GEN) | MAX-M |
|------------------|--------------------------------|-----|----------|------|-----|--------------|-------|
| a. \rightarrow | $\text{bkr-ACC}]_{\text{Utt}}$ | | | 1 | | | 1 |
| b. | $\text{bakar}]_{\text{Utt}}$ | | 1 W | L | | | L |
| c. | $\text{bakra}]_{\text{Utt}}$ | 1 W | | L | | | L |

A final point about this analysis. When the final short vowel is not affixal, it is not “metathesized” into the preceding cluster. This is exemplified by $[\text{?irmi}]_{\text{Cont}} \sim [\text{?irmih}]_{\text{Pau}}$ and several other words in (9). The pausal form $*[\text{?irim}]_{\text{Pau}}$ is impossible because there is no actual metathesis — no violation of the faithfulness constraint LINEARITY. The final vowel of $[\text{?irmi}]_{\text{Cont}}$ is not affixal, so there is no possibility of treating it as an infix. Thus, although DEP has to dominate MIRROR(NOM/GEN) (see (13)), $*[\text{?irim}]_{\text{Pau}}$ is not a successful challenger to $[\text{?irmih}]_{\text{Pau}}$.

I will now compare this OI account with the alternative OT analyses that are available if OI is not assumed. There are two: infixation in the style of Prince and Smolensky (1993/2004) and McCarthy and Prince (1993), which I will refer to alignment-based infixation (ABI); and infixation by phonological metathesis, as proposed by Horwood (2002, 2004).

The main premise of ABI is that morphemes are unordered in the input and affix placement is determined by the ranking of affix-specific alignment constraints, such as $\text{ALIGN-R}(u_{\text{stem}}, \text{stem})$ in Tagalog. In Arabic, ranking $\text{ALIGN-R}(u_{\text{NOM}}, \text{stem})$ below $* \text{COMPLEXCODA}$ and HEAVYINPAUSE will favor infixation of this suffix. In contrast, $\text{ALIGN-R}(a_{\text{ACC}}, \text{stem})$ is ranked above these two constraints. The form $*[\text{?irim}]_{\text{Pau}}$ is a non-starter because it has no affix to infix.

Although ABI can supply a working analysis of these Arabic data, it has bigger problems. Horwood’s (2002, 2004) critique of ABI is that independent ranking of affix-specific alignment constraints cannot capture generalizations subsumed by Baker’s (1985) Mirror Principle. For example, it is an accident of ranking that the case suffixes follow the feminine plural suffix $[\text{a:t}]$. The Mirror Principle and the cognate OI constraint MIRROR relate this observation about the phonological representation to properties of the morphosyntactic representation

Earlier, I argued that metathesis is not a viable approach to these facts in OI, but it is possible if OI is not assumed. The idea is that $/\text{bkr-u}/$ becomes $[\text{bakur}]$ in pause because LINEARITY is dominated by $* \text{COMPLEXCODA}$ and HEAVYINPAUSE :

(16) Fragment of metathesis analysis

| | bkr-u | *CMP | HIP | LINEARITY |
|------------------|------------------------------|------|-----|-----------|
| a. \rightarrow | $\text{bakur}]_{\text{Utt}}$ | | | 1 |
| b. | $\text{bakru}]_{\text{Utt}}$ | | W 1 | L |
| c. | $\text{bakr}]_{\text{Utt}}$ | W 1 | | L |

If LINEARITY dominates MAX, then this analysis will also account for why $/\theta\text{a}\text{flab-u}/$ becomes $[\theta\text{a}\text{flab}]$ and not $*[\theta\text{a}\text{fulab}]$ in pause.

This analysis also has to deal with the pausal forms where metathesis fails to occur: /bakra-/ → [bakra]_{pau}, *[bakar]_{pau}; and /ʔirmi/ → [ʔirmih]_{pau}, *[ʔirim]_{pau}. The obvious move in the case of /bakra-/ is to recruit a morpheme-specific faithfulness constraint LINEARITY_{ACC}, which is violated when the accusative suffix is metathesized. And /ʔirmi/ looks like a job for the root faithfulness constraint LINEARITY_{root} (McCarthy & Prince 1995, 1999). High-ranking LINEARITY_{ACC} and LINEARITY_{root} rule out *[bakar]_{pau} and *[ʔirim]_{pau}, respectively.

Though superficially plausible, this analysis does not actually work. The problem involves the locus of exceptionality in the sense of Pater (2006). Suppose MAX is indexed to a particular morpheme or class of morphemes. The scope of this indexed constraint is limited to segments that are exponents of that morpheme or morpheme class. Other segments that happen to occur in the same word as one of these morphemes are not protected by indexed MAX. Therefore, the locus of exceptionality is the segment whose deletion would violate MAX.

Unlike MAX and the other faithfulness constraints, LINEARITY refers to a pair of segments. If LINEARITY is morphologically indexed, do both segments have to meet the morphological condition, or is it enough that one of them does? Is the locus of exceptionality two segments or one? I do not know the answer to this question, but I do know that LINEARITY_{ACC} and LINEARITY_{root}, if they are to have the desired effect in Arabic, must be inconsistent in exactly this respect. To prevent the mapping /bakra-/ → *[bakar]_{pau}, LINEARITY_{ACC} has to be active when only one of the segments involved, the [a], is an exponent of ACC. But to prevent the mapping /ʔirmi/ → *[ʔirim]_{pau} while still allowing the mapping /bakra-/ → *[bakur]_{pau}, LINEARITY_{root} has to be active only when both of the segments involved, the [m] and the [i], are exponents of a root. It would, of course, be possible to solve this problem by stipulating for each indexed Linearity constraint how its locus of exceptionality will be reckoned, but then the *reductio* would be well on the road to the *absurdum*.

To sum up the analysis so far, I have argued that Wolf's (2008) Optimal Interleaving theory provides a framework for an explanatory account of the absence of final short vowels in pause that is superior to a more conventional OT approach. The central claim of the analysis is that the effects of the markedness constraint HEAVYINPAUSE are both morphological — blocking realization of affixes as final short vowels — and phonological — triggering epenthesis.

For convenience, I provide a list of all the ranking results and where they are established:

- (17) Ranking so far
- | | | | |
|-----------------|---|-----------------|-------|
| HEAVYINPAUSE | ≫ | MAX-M | (6)b |
| HEAVYINPAUSE | ≫ | DEP | (10)b |
| HEAVYINPAUSE | ≫ | MIRROR(NOM/GEN) | (13) |
| HEAVYINPAUSE | ≫ | *COMPLEXCODA | (15) |
| MIRROR(ACC) | ≫ | *COMPLEXCODA | (15) |
| *COMPLEXCODA | ≫ | MIRROR(NOM/GEN) | (13) |
| DEP | ≫ | MIRROR(NOM/GEN) | (13) |
| MIRROR(NOM/GEN) | ≫ | MAX-M | (14) |

As evidence that the analysis is internally consistent, note that HEAVYINPAUSE dominates MIRROR(NOM/GEN) by direct argument and by two arguments from transitivity of domination, one via DEP and the other via *COMPLEX-CODA. Likewise, the ranking of HEAVYINPAUSE above MAX-M is shown by direct argument and by transitivity through MIRROR(NOM/GEN). This may be seen as confirmation that the analysis is on the right track.

In the next section, we will see how this analysis extends to other pausal phenomena.

5. Consequences of sequential spell-out

In HS, GEN is limited to making one change at a time. Wolf (2008) takes this to mean that spell-out in OI can insert only one morpheme at a time. This means that, in the derivation of [ROOT-F1-F2], after ROOT has been spelled-out, there is a choice between spelling out the morphosyntactic feature F1 or F2, but not both, unless the lexicon supplies a single morpheme that matches both of these features. This sequential spell-out requirement, which follows from basic HS/OI assumptions, has important consequences for the phonology of pause in Classical Arabic.

Under certain circumstances, indefinite nouns are marked by a suffix [n], called “nunation”, that follows the case desinence. In the pausal forms of indefinite nominatives and genitives, the [n] is absent together with case (18)a. When indefinite accusatives occur in pause, the word ends in [a:] (18)b.

(18) Nunation disappears in pause

a. Nominative and genitive

| | | |
|----------------------------|-----------------------|------------------------|
| kita:b-u-n _{Cont} | kita:b _{Pau} | ‘a book (nom.)’ |
| bakr-u-n _{Cont} | bakur _{Pau} | ‘a young camel (nom.)’ |
| kita:b-i-n _{Cont} | kita:b _{Pau} | ‘a book (gen.)’ |
| bakr-i-n _{Cont} | bakir _{Pau} | ‘a young camel (gen.)’ |

b. Accusative

| | | |
|----------------------------|--------------------------|------------------------|
| kita:b-a-n _{Cont} | kita:b-a: _{Pau} | ‘a book (acc.)’ |
| bakr-a-n _{Cont} | bakr-a: _{Pau} | ‘a young camel (acc.)’ |

From the perspective of a standard OT or rule-based analysis, the forms in (18)a are puzzling. Since [kita:bun]_{Cont} ends in a heavy syllable, the contextual and pausal forms should be identical (cf. (4)). Furthermore, the data in (19) show that there is no general [n]-deletion process in pause. In fact, the absence of suffix vowels in pause can actually expose [n]s to utterance-final position, where they remain intact.

(19) [n] otherwise preserved in pause

a. Root [n]

| | | |
|---------------------------|------------------------|-----------------------|
| ?addi:n-i _{Cont} | ?addi:n _{Pau} | ‘the judgment (gen.)’ |
| hi:n-in _{Cont} | hi:n-in _{Pau} | ‘time (gen.)’ |

b. Suffix [n]

| | | |
|---------------------------------|------------------------------|-------------------------------------|
| ?alʕa:lam-i:n-a _{Cont} | ?alʕa:lam-i:n _{Pau} | ‘the worlds (gen.)’ |
| nastaʕ-i:n-u _{Cont} | nastaʕ-i:n _{Pau} | ‘seek (1 st pl. impfv.)’ |

From all of this evidence, it is clear that the absence of nunation in pause is not the result of some conventional phonological process.

In fact, the absence of nunation in pause follows from the OI analysis already proposed, without any additional stipulations. Tableau (20) addresses the situation that obtains after root spell-out, when there is a choice between realizing the case suffix or failing to realize it. HEAVYINPAUSE and *COMPLEX-CODA dominate MAX-M, and these candidates violate no other constraints under discussion. Hence, the candidate that fails to spell out NOM or INDEF is the winner. And since this candidate is identical with the latest input to GEN, the derivation converges.

(20) Convergence at step 2 of $\langle \text{BOOK-NOM-INDEF} \rangle_{\text{Utt}}$, $\text{kita:b-NOM-INDEF} \rangle_{\text{Utt}}$

| $\text{kita:b-NOM-INDEF} \rangle_{\text{Utt}}$ | HIP | *CMP | MAX-M |
|---|-----|------|-------|
| a. $\rightarrow \text{kita:b-NOM-INDEF} \rangle_{\text{Utt}}$ | | | 2 |
| b. $\text{kita:b-u-INDEF} \rangle_{\text{Utt}}$ | 1 W | | 1 L |
| c. $\text{kita:b-NOM-n} \rangle_{\text{Utt}}$ | | 1 W | |

Tableau (20) shows that nunation is absent in indefinite nominative and genitive singular nouns because the case suffix is absent, and the case suffix is absent because nunation is absent. Nunation is not allowed by the phonotactics without the case suffix to support it, and the case suffix is not allowed utterance-finally without nunation to protect it. Case and nunation are therefore mutually dependent in pause, but they cannot be added simultaneously, so both are missing.

The pausal form of the indefinite accusative also lacks nunation, but it satisfies HEAVYINPAUSE in a different way: $[\text{kita:b-a:}]_{\text{pau}}$.⁶ The [a:] suffix, I propose, is a portmanteau morpheme. That is, it realizes two morphosyntactic features that the language usually spells out with separate morphemes. In the derivation $\langle \text{BOOK-ACC-INDEF} \rangle_{\text{Utt}}$, $\text{kita:b-ACC-INDEF} \rangle_{\text{Utt}}$, $\text{kita:b-a:} \rangle_{\text{Utt}}$, suffixation of [a:] at the final step spells out both ACC and INDEF without running afoul of HEAVYINPAUSE:

(21) The portmanteau suffix [a:]

| $\text{kita:b-ACC-INDEF} \rangle_{\text{Utt}}$ | HIP | *CMP | MAX-M |
|--|-----|------|-------|
| a. $\rightarrow \text{kita:b-a:} \rangle_{\text{Utt}}$ | | | |
| b. $\text{kita:b-a-INDEF} \rangle_{\text{Utt}}$ | 1 W | | 1 W |
| c. $\text{kita:b-ACC-n} \rangle_{\text{Utt}}$ | | 1 W | 1 W |

As tableau (21) shows, no changes in the grammar are necessary to account for why [a:] appears in the pausal indefinite accusative. But the introduction of this morpheme does require some revision of prior analysis. These changes are needed to explain why [a:] does not appear (i) in definite accusative pausal forms like $[\text{?alkita:b}]_{\text{pau}}$ or (ii) in indefinite accusative contextual forms like $[\text{kita:b-a-n}]_{\text{Cont}}$. I take each issue in turn.

⁶ The [a:] indefinite accusative suffix is limited to nouns that are formally masculine, like $[\text{kita:b}]$. Nouns that are formally feminine, such as $[\text{ka:tib-at}]$ ‘writer (fem.)’, have no desinence in the indefinite accusative.

(i) $[\text{?alkita:b}]_{\text{pau}}$ and not $*[\text{?alkita:b-a:}]_{\text{pau}}$ is the pausal form of the definite accusative. The loser $*[\text{?alkita:b-a:}]_{\text{pau}}$ has a featural mismatch: the noun is definite, but [a:] carries the meaning indefinite as well as accusative. In OI, DEP-M constraints apply to situations like this. Specifically DEP-M(INDEF) rules out suffixing INDEF [n] or INDEF ACC [a:] when the input feature structure lacks the feature INDEF. To rule out $*[\text{?alkita:b-a:}]_{\text{pau}}$, DEP-M(INDEF) has to dominate MAX-M(ACC), since $[\text{?alkita:b}]_{\text{pau}}$ fails to spell out the input ACC feature.

(ii) $[\text{kita:b-a-n}]_{\text{cont}}$ and not $*[\text{kita:b-a:}]_{\text{cont}}$ is the contextual form of the indefinite accusative. In OI, MAX-M prefers a portmanteau morpheme to a sequence of non-portmanteau morphemes with identical meaning (Wolf 2008: 191 ff.). The reason is that the portmanteau morpheme achieves in a single derivational step what takes two or more steps with non-portmanteaux. In this particular case, we need the intermediate form $[\text{kita:b-a-INDEF}]_{\text{cont}}$ to beat $[\text{kita:b-a:}]_{\text{cont}}$. Since MAX-M(INDEF) favors the latter, it has to be dominated by a constraint that the portmanteau violates. That constraint is UNIF-M, which, like its counterpart in phonological correspondence theory (McCarthy & Prince 1995, 1999), militates against output merger of distinct input elements.⁷ The following tableaux show this analysis at work:

(22) No portmanteau [a:] in contextual indefinite accusative

| $\text{kita:b-ACC-INDEF}]_{\text{cont}}$ | HIP | MAX-M(ACC) | *CMP | UNIF-M | MAX-M(INDEF) |
|---|-----|------------|------|--------|--------------|
| a. $\rightarrow \text{kita:b-a-INDEF}]_{\text{cont}}$ | | | | | 1 |
| b. $\text{kita:b-a:}]_{\text{cont}}$ | | | | 1 W | L |
| c. $\text{kita:b-ACC-INDEF}]_{\text{cont}}$ | | 1 W | | | |
| d. $\text{kita:b-ACC-n}]_{\text{cont}}$ | | 1 W | 1 W | | L |

(23) Portmanteau [a:] in pausal indefinite accusative (expanding (21))

| $\text{kita:b-ACC-INDEF}]_{\text{pau}}$ | HIP | MAX-M(ACC) | *CMP | UNIF-M | MAX-M(INDEF) |
|---|-----|------------|------|--------|--------------|
| a. $\rightarrow \text{kita:b-a:}]_{\text{pau}}$ | | | | 1 | |
| b. $\text{kita:b-a-INDEF}]_{\text{pau}}$ | 1 W | | | L | 1 W |
| c. $\text{kita:b-ACC-INDEF}]_{\text{pau}}$ | | 1 W | | L | 1 W |
| d. $\text{kita:b-ACC-n}]_{\text{pau}}$ | | | 1 W | L | |

Between the two of them, these tableaux show that UNIF-M dominates MAX-M(INDEF) and that UNIF-M is dominated by HEAVYINPAUSE, MAX-M(ACC), and *COMPLEX-CODA.

6. Allomorphy

In Korean, the nominative suffix has two alternants, [i] and [ka]. There is no reasonable way of deriving them from a single underlying representation, but their

⁷ I am indebted to Matt Wolf for suggesting UNIF-M.

occurrence is determined phonologically: [i] follows vowel-final stems and [ka] follows consonant-final stems:

(24) Korean nominative suffix allomorphy

cib-i 'house (nom.)'
c^ha-ga 'car (nom.)'

The standard approach to allomorphy in OT is based on the following premises (Burzio 1994; Hargus 1995; Hargus & Tuttle 1997; Mascaró 1996; Mester 1994; Tranel 1996a, b; 1998; and others):

- (i) The allomorphs of a morpheme are listed together in the underlying representation: /cip-{i, ka}/, /c^ha-{i, ka}/.
- (ii) GEN creates candidates that include all possible choices of an allomorph: [cib-i], [cip-ka], [c^ha-i], [c^ha-ga]. (The last example also shows the effects of intervocalic voicing.)
- (iii) Faithfulness constraints like MAX and DEP treat all allomorph choices equally.
- (iv) So markedness constraints determine which allomorph is most harmonic. In Korean, the markedness constraints ONSET and NO-CODA correctly favor [cib-i] and [c^ha-ga]. Because no faithfulness violation is involved in allomorph selection, the markedness constraints that make the choice may be emergent in the sense of McCarthy and Prince (1994).

The following tableaux illustrate:

(25) Allomorph selection in Korean

a.

| | /cip-{i, ka}/ | ONSET | NO-CODA |
|------|---------------|-------|---------|
| i. → | cibi | | |
| ii. | cipka | | 1 W |

b.

| | /c ^h a-{i, ka}/ | ONSET | NO-CODA |
|------|----------------------------|-------|---------|
| i. → | c ^h aga | | |
| ii. | c ^h a.i | 1 W | |

NO-CODA is an emergent constraint in Korean — it is unable to compel faithfulness violation, since the language permits syllables with codas

OI's theory of allomorphy is similar, except for one not unexpected difference: allomorphs compete at the point of spell-out, not at surface structure (Wolf 2008: chapters 2 & 3). Thus, [c^haga] and *[c^ha.i] compete as different ways of continuing the derivation that begins with <CAR-NOM, c^ha-NOM, ...>. This difference is important when we apply OI to the problem of allomorphy in the feminine singular suffix of Classical Arabic.

The feminine singular suffix is normally [at], but it takes the form [ah] when it occurs utterance-finally:

- (26) Feminine singular suffix [at] in pause
 ka:tib-at-un_{Cont} ka:tibah_{Pau} ‘a writer (f. nom.)’
 ħamz-at-a_{Cont} ħamz-ah_{Cont} ‘Hamza (masc. name) (acc.)’

When [t] comes from any other source, such as the root, the feminine plural suffix [a:t], or the homophonous third person feminine singular subject agreement suffix [at], it does not alternate with [h] (Hoberman 1995: 168):

- (27) Other [t]s in pause
 mustanbat-un_{Cont} mustanbat_{Pau} ‘cultivated (nom.)’
 ka:tib-a:t-un_{Cont} ka:tiba:t_{Pau} ‘writers (f. nom)’
 katab-at_{Cont} katab-at_{Pau} ‘write (3rd f. sg. perfv.)’

As in Korean, the [t]~[h] alternation is phonologically conditioned, but no general phonological process is involved. This too is an example of allomorphy, as Hoberman (1995) argues.

It follows that the feminine singular suffix has two synonymous allomorphs, [at] and [ah]. They compete at the point of spell-out of FEM, and phonological constraints determine which is more harmonic. These constraints must favor, e.g., [ka:tib-at-NOM-INDEF]_{Cont} over *[ka:tib-ah-NOM-INDEF]_{Cont}, and they must also favor [ka:tib-ah-NOM-INDEF]_{Pau} over *[ka:tib-at-NOM-INDEF]_{Pau}. In short, they must favor [h] over [t] utterance-finally and [t] over [h] elsewhere. The effects of these constraints are emergent in allomorph selection but not in unfaithful mappings, since the language otherwise allows utterance-final [t] (as in (27)) and non-utterance-final [h] (as in [ʔahlaka] ‘ruin (3rd m. sg. perfv.)’).

I will now elucidate these constraints. One piece of the analysis comes from the observation that some languages limit codas to the laryngeals [h] and [ʔ] (Kaneko & Kawahara 2002; Lombardi 1995/2001; Parker 2001). This follows if laryngeals are placeless and the constraint CODA_{COND} bans place from codas (Goldsmith 1990: 123-128; Ito 1989). Another key piece of the analysis comes from Flack’s (2007, to appear) proposal that conditions on the onsets or codas of syllables are paralleled by conditions on the ‘onsets’ or ‘codas’ of words, phrases, or utterances. Thus, we expect to find a constraint CODA_{COND}_{Utt} that is violated by non-laryngeal consonants utterance-finally. It is this constraint that favors [ka:tib-ah-NOM-INDEF]_{Pau} over *[ka:tib-at-NOM-INDEF]_{Pau}. Its effect is limited to allomorph selection because it is ranked below faithfulness, so it does not cause, say, [mustanbat]_{Pau} to become [mustanbah]_{Pau}.

There is some independent support for CODA_{COND}_{Utt} in Classic Arabic. It explains why [h] and not some other consonant is epenthesized in the pausal forms in (9), since all other consonants except [ʔ] violate it. This too is an emergent effect. Furthermore, CODA_{COND}_{Utt} is plausibly implicated in insertion of final [h] in phrases beginning with the so-called [wa:] of lamentation (Wright 1971: vol. i, 295): lamentations like [wa: ʔami:ra lmuʔmini:na:h] ‘alas for the Prince of Believers’. The closest analogue in another language is Sanskrit *visarga*, which Selkirk (1980: 118) analyzes as a rule replacing [s] and [r] by [h] utterance-finally.

Another emergent constraint disfavors the [ah] allomorph in non-pausal contexts. This constraint, HAVE-PLACE, is violated by the laryngeals [h] and [ʔ] because of their placelessness (Padgett 1995; Parker 2001; Smith 2002). With CODA_{COND}_{Utt} ranked above HAVE-PLACE, the correct allomorph is selected in both contexts:

(28) Pausal allomorph

| ka:tib-FEM-NOM-INDEF] _{Pau} | CODACOND _{Utt} | HAVE-PLACE |
|--|-------------------------|------------|
| a. → ka:tib-ah-NOM-INDEF] _{Pau} | | 1 |
| b. ka:tib-at-NOM-INDEF] _{Pau} | 1 W | L |

(29) Non-pausal allomorph

| ka:tib-FEM-NOM-INDEF] _{Cont} | CODACOND _{Utt} | HAVE-PLACE |
|---|-------------------------|------------|
| a. → ka:tib-at-NOM-INDEF] _{Cont} | | |
| b. ka:tib-ah-NOM-INDEF] _{Cont} | | 1 W |

After the step in (29), the derivation continues with spell-out of NOM and INDEF, in that order. The derivation in (28) converges at the next step, however, for reasons discussed previously.

The [at]~[ah] alternation in Classical Arabic is a rather typical example of phonologically conditioned allomorphy. It is not very interesting in itself, but it is important in the context of the other pausal alternations, as I will explain in the conclusion.

7. Conclusion

This chapter has examined the phonology of utterance-final words in Classical Arabic. Although well-motivated markedness constraints determine the properties of utterance-final syllables, the satisfaction of these markedness constraints is deeply entangled with the morphology. Wolf's (2008) Optimal Interleaving theory, I have argued, offers the best account of how phonology and morphology interact in these phenomena.

OI's principal contribution to the understanding of Arabic pausal forms is that it establishes a formal connection among four seemingly disparate phenomena: missing suffixes, infixation, portmanteau morphology, and allomorphy. The connection is that all are types of (non-)realization. Suffixes remain unrealized or are infixated for phonological reasons; a portmanteau morpheme appears under phonological conditions; and phonological constraints choose between allomorphs. OI also accommodates the one purely phonological consequence of pause, epenthetic [h].

It is clear from these results that OI offers a new and valuable perspective on phonology-morphology interaction.

Personal remark

I first met Lisa Selkirk in 1976 at NELS VII. She was a dashing figure who wore an École Polytechnique cape and gave a talk in which she boldly laid out a novel theory of syntax-phonology relations. She impressed me more, however, because she took a genuine interest in my work even though I was just a second-year graduate student at another school.

I later learned that Lisa's intellectual boldness at NELS was not unusual. When she engages with a topic, she does not hesitate to set out all the premises of her approach. This might seem dangerous, but experience shows that more often than not she is on the right track.

Having Lisa as a colleague was one of the most important reasons why I came to UMass in 1985. She has been a good friend and a continuing inspiration. I am excited to see how her work develops in the future.

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