

On the Mental Representation of Arabic Roots

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In Prunet, Béland, and Idrissi 2000, we presented evidence from an aphasic subject that argued for the morphemic status of Arabic consonantal roots. We predicted that inaudible glides in weak roots should resurface in metathesis and template selection errors, but at the time the relevant data were unattested. Here, we present such data, obtained from a new series of experiments with the same aphasic subject. Arabic hypocoristic formation offers another case of glide resurfacing. Both sources of data confirm that Arabic consonantal roots are abstract morphemic units rather than surface phonetic units.

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1 Glide Resurfacing in Aphasic Errors

The morphemic status of the consonantal root in Semitic is of special interest to morphologists because it provides a test for competing theories of word formation, most current versions of which reflect Hockett's (1954) distinction between *morpheme-based* item-and-arrangement and *word-based* item-and-process and word-and-paradigm models. Morpheme-based models, such as Halle's (1973), operate in an input-to-output fashion by appealing solely or partly to affixation processes. By contrast, word-based models function in an output-to-output fashion and posit morphological rules turning words into other words (e.g., Aronoff 1976, S. R. Anderson 1992) or redundancy rules (e.g., Jackendoff 1975) and functions (e.g., Stump 2001, Blevins 2003) relating fully formed words to one another.

Morpheme-based analyses of Semitic recognizing the consonantal root have represented the majority position in Western linguistics for most of the last two centuries. Word-based analyses of Semitic, on the other hand, deny the existence of the consonantal root, often seeing it as

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nothing more than a convenient way to list words in dictionaries. Researchers espousing this view include—in addition to most traditional Arabic grammarians (see Troupeau 1984:241)—Mahadin (1982), Heath (1987), Schramm (1991), Bat-El (1994), McOmber (1995), Ratcliffe (1997, 2003), Benmamoun (1999), Ussishkin (1999), and Rubio (2005). Bohas (2006) also argues against consonantal roots, but on the grounds that consonantal morphemes more abstract than the root—namely, biconsonantal morphemes he calls *etymons*—form the core of Semitic words. Recent discussions of morphological and psycholinguistic research on the Semitic root can be found in, for example, Idrissi 2001, Gafos 2003, Arad 2005, Prunet 2006, and several of the contributions to Lowenstamm 2003, Shimron 2003, and Larcher and Cassuto 2007.

In Prunet, Béland, and Idrissi 2000 (henceforth PBI 2000), we presented psycholinguistic evidence for the morphemic status of the consonantal root in Arabic. ZT, an Arabic-French bilingual deep dyslexic, produced errors metathesizing root consonants to the exclusion of vowels as well as affixal or epenthetic consonants (e.g., *ʔis-t-iʔtaaf* ‘begging (n.)’ → error *ʔis-t-iʔtaaf* nonword, where only the root test $\sqrt{ʔtʔ}$ is affected). ZT produced such errors 25 times more often in Arabic than in French, an empirical result that we interpreted as favoring a representation of word structure in which the root consonants of Arabic stand on a separate autosegmental tier, as in McCarthy 1981.

In PBI 2000:615, fn. 10, we point out that analyzing consonant metathesis as an operation on the root tier leads one to expect both the metathesis of audible glides—as in attested (*/lawh-at/* →) *lawh-a* ‘painting’ → error *walh-a* in PBI 2000:614—and the *resurfacing* of silent glides—as in the hitherto unattested (*/mawat-al/* →) *maat* ‘he died’ → error *ʔawmaat* nonword (built on the template of *ʔamwaat* ‘the dead ones’). Yet errors on silent glides happened to be absent from ZT’s production in our previous experiments. Expanding on the results in Idrissi, Prunet, and Béland 2002, the present article fills this empirical gap and shows, on the basis of new data, that ZT does metathesize silent glides. Cases of glide resurfacing induced by metathesis will be presented in section 3.1.¹

Template selection errors, such as *waasiʔ* ‘wide’ → error *wasiʔ* nonword, where the root is mapped onto a different template, also form a subset of ZT’s morphological errors. Like metathesis errors, template selection errors may be interpreted as evidence for the autosegmental representation of Arabic word structure and the morphemic status of the root, as Idrissi and Kehayia (2004) argue. If ZT’s errors access and operate on abstract roots, one should also expect instances of glide resurfacing induced by template misselection, as in hitherto unattested (*/mawat-al/* →) *maat* ‘he died’ → error *mawt* ‘death’ or (*/sayar-al/* →) *saar* ‘he walked, adjusted’ → error *m-usaayir*

¹ We use the term *resurfacing* to refer to situations where a sound that is underlyingly present but phonetically silent in a target word appears phonetically in an error. In the remainder of this article, we also use the following analytic conventions. (a) For the sake of explicitness, we sometimes indicate between forward slashes the underlying representation of the surface form we quote. (b) The arrow after the underlying representation indicates the direction of the derivation. (c) The feminine singular nominal suffix *-at* is notated */at/* in the underlying representation (e.g., */lawh-at/* ‘painting’), [a] (its pausal allomorph) in the phonetic representation (e.g., [lawħa]), and (t) in the graphemic representation (e.g., ⟨lwh-t⟩). (d) Hyphens are always added to indicate morpheme boundaries. (e) The third person masculine subject suffixes *-a* and *-u* (as in *katab-a* ‘he wrote’ and *y-aktub-u* ‘he writes’) are usually deleted before a pause (see Hoberman 1995: 161, Kaye 2007:208); we note these suffixes only in the phonetic representations of those errors where ZT actually pronounced them.

‘adjusting’. Cases of glide resurfacing induced by template misselection will be documented in section 3.2.

Adding to the aforementioned empirical gap in ZT’s metathesis errors, Davis and Zawaydeh (2001) note the comparable absence of glide resurfacing in Arabic hypocoristics and argue for a new concept of *output root* that combines properties of both the traditional lexical roots and surface stems. In section 5, we examine the lexical and morphological properties of proper names and the alleged lack of glide resurfacing in hypocoristics. We then conclude that output roots are unnecessary.

This article is organized as follows. In sections 2 and 3, we present ZT’s errors obtained in the new experiments. In section 4, we examine alternative explanations of these errors that are not based on the consonantal root. In section 5, we evaluate the output-root alternative proposed by Davis and Zawaydeh (2001) on the basis of hypocoristics. In section 6, we draw the conclusions of our study.

2 Testing Weak Roots in Aphasic Errors

To test the behavior of silent glides in Arabic aphasic errors, we designed a stimulus set that included a significant number of words based on weak roots (in Arabic grammatical terminology, *ʔal-ʒuḏuur ʔal-muʔtall-a*). A ‘weak’ root includes a glide in the first position of the root (Arabic *ʔal-ʒuḏuur ʔal-miθaal*, or ‘assimilated’ roots; e.g., $\sqrt{wʒd}$ in *waʒad* ‘he found’), in the second position (Arabic *ʔal-ʒuḏuur ʔal-ʒawfaaʔ*, or ‘hollow’ roots; e.g., \sqrt{mw} in *maat* ‘he died’), or in the third position (Arabic *ʔal-ʒuḏuur ʔal-naaqiʃa*, or ‘defective’ roots; e.g., \sqrt{kfy} in *kafaa* ‘it sufficed’); see Chekayri 2001 and Chekayri and Scheer 2004. Morphological opacity is introduced by the absence of this glide from some of the surface word forms based on this root (e.g., \sqrt{mw} in *maat* ‘he died’, *mawt* ‘death’, *y-amuut* ‘he dies’, *m-umiit* ‘causing death’, and *miit-a* ‘manner of death’) or by its alternating with the other glide (e.g., *maysit* ‘dead’, *mayt-a* ‘corpse’). By contrast, a ‘strong’ root includes only nonglides (e.g., \sqrt{dxl} in *daxal* ‘he entered’, *duxuul* ‘entering’, *m-adxal* ‘entrance’, and *y-adxul* ‘he enters’).

We first tested ZT in 1997, obtaining the results published in PBI 2000, and again in 2001 for the purposes of this article. In the present experiment, a total of 551 word stimuli were presented to ZT in a reading-aloud test. His responses were recorded online and immediately transcribed.² We opted for the reading task because it had earlier produced a higher rate of metathesis errors than had the repetition, writing-to-dictation, and picture-naming tasks (PBI 2000: 612). A total of 325 stimuli in the new experiment had an underlying glide that was inaudible in the PR (e.g., *maat* ‘he died’). The remaining 226 stimuli contained strong roots and displayed no discrepancy between the UR and PR of the root (e.g., *daxal* ‘he entered’). There were no stimuli based on weak roots displaying audible glides—such as *waasiʔ* ‘wide’ and *lawha* ‘paint-

² Our description uses the following abbreviations: *dial.*: dialectal form, intended to represent mainly ZT’s Lebanese Arabic output forms; *G*: glide; *LA*: Lebanese Arabic; *MSA*: Modern Standard Arabic; *PR*: phonetic representation; *UR*: underlying representation; *caus.*: causative; *f.*: feminine; *imp.*: imperative; *lit.*: literally; *m.*: masculine; *n.*: noun; *pl.*: plural; *sb.*: somebody; *sth.*: something. As for graphemic transcriptions, we use ⟨ʔ⟩ for the Arabic letter *aleph* to stand for the sounds [ʔ] and [aa], ⟨w⟩ for the letter *waaw* to stand for [w] and [uu], and ⟨y⟩ for the letter *yaaʔ* to stand for [y] and [ii].

ing’—because we know that these stimuli were treated by ZT no differently than stimuli based on strong roots (PBI 2000). Indeed, an audible glide may be metathesized in a metathesis error, as in *lawh-a* ‘painting’ → error *walh-a*, mentioned above, or lost in a template selection error, as in *mawt* ‘death’ → error *maat* ‘he died’. We included strong roots in the stimuli in order to be able to determine whether the weak or strong nature of the root influenced ZT’s rate of metathesis errors and to compare the pattern and distribution of metatheses obtained in the new experiment with those presented in PBI 2000, as ZT’s errors could have changed owing to the natural evolution of his language deficit.

Results show that ZT’s new errors display the same typology as did his earlier errors (PBI 2000:611, Béland and Mimouni 2001:120, Idrissi and Kehayia 2004:189). That is, he produced visual/phonological errors such as ⟨*fašyl-t*⟩ *fašiiil-a* ‘species’ → error ⟨*faðyl-t*⟩ *faðiiil-a* ‘virtue’, where the graphemes between angle brackets stand in one-to-one correspondence with those of Arabic spelling. (Note that the Arabic letters for ⟨*š*⟩ and ⟨*ð*⟩ have the same shape except that the latter has a superscripted dot, which must have led to ZT’s seeing *faðiiil-a* instead of *fašiiil-a* in this error.) ZT also produced semantic errors (e.g., *šaduw* ‘enemy’ → error *harb* ‘war’), visual-then-semantic errors (e.g., ⟨*hrwb*⟩ *huruub* ‘running away’ → error *žayš* ‘army’, via ⟨*hrwb*⟩ *huruub* ‘wars’), purely phonological errors (e.g., *nažm-a* ‘star’ → error *mižmiž* nonword), and morphological errors (e.g., *šaðaaš* ‘he broadcast’ → error *m-uðiiš* ‘radio announcer’).³

The new corpus also contains a number of metatheses in strong roots, similar to those discussed in PBI 2000. Some examples are given in (1). Some of these errors also involve template misselections.⁴

(1) Errors showing metatheses of consonants in strong roots

Target UR	Target		Output	
baraš	baraš	‘vitiligo’	→	bašar ‘sight’
fukaah-at	fukaah-a	‘humor’	→	kafaah-a nonword
luḡz	luḡz	‘riddle’	→	ḡliz (dial.) nonword
šušb	šušb	‘grass’	→	šubš nonword

ZT also produced a number of metathesis errors switching the nonglide consonants of weak roots. In (2b), the underlying glide of the output is silent, but we assume its presence in order to account for the length of the vowel, in line with standard analyses of Arabic phonology, to be discussed in section 4.1.

³ By *visual error*, we mean any error that shares more than half of the graphemes with the target (in the same order). So, although the Arabic grapheme for /h/ does not look like that for /ħ/, the word *huruub* ‘running away’ triggers the graphemically close *huruub* ‘wars’ because the two words share all their letters except the first one. The latter word then triggers semantically related *žayš* ‘army’, in a way typical of deep dyslexia’s frequent semantic errors.

⁴ As was the case in the first corpus, ZT did not err over affixal or epenthetic consonants. The new corpus contains only two errors that could possibly be construed as involving an affix: *m-udiiir* ‘director’ → error *marad* ‘he is recalcitrant, rebellious’, and *m-um-t-aaz* ‘excellent’ → error *ziit* ‘oil’ (dial.). The prefix *m-* in the first error and the infix *-t-* in the second error seem to be incorporated into the roots of the errors, but only in the second case is the affix affected by metathesis. We assume that inflectional affixes, such as third person singular *-a* and *-u* on verbs, are not part of the template. The URs that we provide for target words are meant to express a linearized representation of word structure. Within a morpheme-based model, a more accurate representation would represent each morpheme on its own autosegmental tier.

(2) Errors showing metatheses of nonglide consonants in weak roots

Target UR	Target			Output	
a. m-uryih	m-uriih	'comfortable'	→	hayr	'fenced-in garden'
numuw	numuw	'growth'	→	munuw	nonword
b. qawam-at	qaam-a	'stature'	→	maaqa	nonword
y-aḍwub-u	y-aḍuub	'it melts'	→	buuḍa	nonword
adwar-a	?adaar	'he turned'	→	?araad	'he wanted'
y-afyiḍ-u	y-afiḍ	'it overflows'	→	ḍaaf	'he stayed as a guest'

As mentioned earlier, metathesis errors involving audible/overt glide consonants were attested in the first corpus (PBI 2000:613–614): *ta-waqquf* 'stopping' → error *ta-qawwuf* nonword and *laymuun* 'lemon' → error *malyuun* 'million'. Errors involving both metathesis of an overt glide and template misselection were not attested in that corpus. This was accidental since these would be normal metathesis errors comparable to the attested *m-adxal* 'entrance' → error *xadal* 'stiffen, become numb' (PBI 2000:621). Such errors were indeed found in the new corpus: *bawl* 'urine' → error *balaa* 'he tested' and *s-t-aqaam* 'he stood straight' → error (/waqiim/ →) *wa?iim* nonword.

A review of ZT's new metathesis errors reveals two stable statistical generalizations. First, the proportion of metatheses in the present experiment is not significantly different from that reported in PBI 2000: 7.07% (39/551, including both glides and nonglides) currently versus 8.18% (119/1455) previously ($\chi^2 = .52, p > .05$). Idrissi and Kehayia's (2004:190) experiments with ZT revealed a 7.7% (64/836) proportion of consonant metathesis errors that was not significantly different either ($\chi^2 = .09, p > .05$). These consistent statistics show that the errors characteristic of ZT's deficit are stable. Second, in the present experiment the proportions of metatheses in strong roots (6.63%, 15/226) and weak roots (7.38%, 24/325) are not significantly different ($\chi^2 = .03, p > .05$). In addition, among the metathesis errors on weak roots, the proportions of those that involved the glide itself and those that did not are equal: 12/24 in each case. This indicates that silent glides are just as likely to be metathesized as nonglides.

3 Aphasic Evidence for Abstract Roots

We now turn to the two types of evidence indicating that ZT accesses the underlying root. We call the first type of error [+M, +T] *resurfacing* (short for *glide resurfacing induced by a metathesis error combined with a template selection error*) when the resurfacing of the silent glide results from a reordering of the target's underlying root consonants mapped onto a different template. We call the second type of error [-M, +T] *resurfacing* (short for *glide resurfacing induced by a template selection error with no metathesis*) because the resurfacing is caused by mapping the target's underlying root onto a different template. When the resurfacing glide is audible in the output, we call the resurfacing *overt* (hence, *overt* [+M, +T] or *overt* [-M, +T]). When the glide is inaudible in the output but must be assumed to account for the length (or identity and length) of the output vowel, we call the resurfacing *covert* (hence, *covert* [+M, +T] or *covert* [-M, +T]). The resulting four-way classification of the errors is summarized in (3).

(3) Classification of overt and covert glide resurfacing errors produced by ZT

	Overt	Covert
[+M, +T]	/qawaʕ/ → [qaaʕ] → error [waaqiʕ] (section 3.1.1)	/y-awʕid-u/ → [y-aʕid] → error [ʕuud] (section 3.1.2)
[-M, +T]	/aɖwaʕ-a/ → [ʔaɖaaʕ] → error [ɖawʕ] (section 3.2.1)	/aɖyaʕ-a/ → [ʔaɖaaʕ] → error [m-uɖiiʕ] (section 3.2.2)

In the presentation of the aphasic errors below, we occasionally refer to glide-specific rules of Arabic, all of which we will present more explicitly in section 4.1 when we assess the possible role of orthography in ZT's errors.

3.1 [+M, +T] Resurfacing

3.1.1 Overt [+M, +T] Resurfacing The new corpus contains errors in which glides that are silent in the target become audible because of metathesis. These are the very errors whose absence we pointed out in PBI 2000:615, fn. 10.⁵ We maintain that the metatheses in (4) do not operate on PRs since the resurfacing glides are absent from the target PRs. For these silent glides to resurface phonetically, ZT must retrieve them from underlying roots, since this is the only level where silent glides are present. For the sake of convenience, it should be noted that some word-medial radical glides can be assimilated to a neighboring vowel (/yi/ or /wi/ → [ii] in (4d) and (4h), /ya/ or /wa/ → [aa] in (4f) and (4a,i)), deleted between two vowels (/awa/ → [aa] in (4c)), or turned into a glottal stop word-finally (/aay/ → [aaʔ] in (4b)).

(4) Cases of overt [+M, +T] resurfacing

Target UR	Target		Output	
a. s-t-aqwam-a	s-t-aqaam	'he stood straight'	→	waʕiim nonword (MSA q → LA ?)
b. xafaay	xafaaʕ	'secrecy'	→	xaayif 'scared' (dial.)
c. qawaʕ	qaaʕ	'bottom'	→	waaqiʕ wiqiʕ 'reality' 'he fell down' (dial.)
d. m-adyin	m-adiin	'owing'	→	daniy nonword
e. aɖyaf-a	ʔaɖaaʕ	'he added'	→	fadɖy nonword
f. s-t-aɖyaf-a	s-t-aɖaaʕ	'he invited'	→	fadiy nonword
g. m-afyad	m-afaad	'summary'	→	fadiy nonword
h. m-uʕwib-at	m-uʕiib-a	'mishap'	→	ʕabiy 'little boy' (w → y / i ____)
i. m-alwam-at	m-alaam-a	'blame'	→	ʕimlaaʕ 'spelling' (w → ? / aa ____)

⁵ The new corpus contains no [+M, -T] errors even though the vast majority of the errors reported in PBI 2000 were of this type. Because the new corpus contains only nine metathesis errors, it is too small to draw statistically significant conclusions about what other errors could be found. Among the new metathesis errors collected, four do not belong to the paradigm of their respective targets (as befits [+M] errors) and five are nonwords. We expect, all other things being equal, that [+M, -T] errors would be found in a larger corpus of [+M] errors involving targets that include silent glides.

3.1.2 *Covert [+M, +T] Resurfacing* ZT produced a few errors that must be interpreted as metathesizing underlying glides, if we are to explain the length and position of the vowel in the output. These errors also involve template misselection, as did those in (4). We assume that ZT goes, for instance, from target *y-aʕid* to error *ʕuud* by accessing the underlying root of the target (i.e., $\sqrt{wʕd}$), since silent glides can only be retrieved at the root level.

(5) Cases of covert [+M, +T] resurfacing

Target UR	Target		Output UR	Output	
y-awʕid-u	y-aʕid	'he promises'	→ ʕuud	ʕuud	'stick'
y-awʕid-u	y-aʕid	'he finds'	→ ʒawad	ʒaad	'he was good'
bawl	bawl	'urine'	→ balaw	balaa	'he tested'
(w → a / a ____ #)					

3.2 [-M, +T] Resurfacing

The new corpus also contains template misselections that are not combined with metatheses. These errors occur when ZT combines the root consonants of the target with a different template. The output is often—but not always—semantically related to the target. When the outcome of the combination is unattested, the output is a nonword.

3.2.1 *Overt [-M, +T] Resurfacing* In cases of overt [-M, +T] resurfacing, ZT pronounced a glide that was silent in the target. In all of the examples in (6), we suggest that the glide is again retrieved from the underlying root of the target.

(6) Cases of overt [-M, +T] resurfacing

Target UR	Target		Output UR	Output	
a. aḍwaʔ-a	ʔaḍaaʔ	'he lit'	→ ḍawʔ	ḍawʔ	'light'
m-uḍwiʔ	m-uḍiiʔ	'luminous'	→ ḍawʔ	ḍawʔ	'light'
fawaz-a	faaz	'he won'	→ faawiz	faaʔiz	'winner'
(w → ʔ / aa ____)					
m-aṭyar	m-aṭaar	'airport'	→ ṭayyaar-at	ṭayyaar-a	'woman pilot, kite'
m-axwaf-at	m-axaaf-a	'fear'	→ xaawif	xaayif	'scared' (dial.)
(w → y / ____ i)					
m-aʒwaʕ-at	m-aʒaaʕ-a	'hunger'	→ ʒawʕ-aan-iin	ʒawʕ-aan-iin	'hungry (pl.)'
t-awʕil-u	t-aʕil	'you/she arrive(s)'	→ wiʕl	wiʕil	'he arrived' (dial.)
y-awqaʕ-u	y-aqaʕ	'he falls down'	→ wiqʕ	wiʔiʕ	'he fell down' (dial.)
(MSA q → LA ʔ)					
y-awqif-u	y-aqif	'he stops'	→ waqqf	waqqif	'make sb. stop (imp.)' (dial.)
ṭuwl	ṭuul	'height'	→ ṭawiil	ṭawiil	'tall'
b. m-uḍyaf	m-uḍaaf	'added'	→ ḍayyf	ḍayyif	'offer food to sb.' (dial.)
c. aʒwab-a	ʔaʒaab	'he answered'	→	ʔaʒwub-a	nonword
sawaq-a	saaq	'he drove'	→	saawiq	nonword

In (6a), the underlying glide surfaces in a morphologically related word. For instance, the [w] that resurfaces in the first error *daw?* is present neither in the target PR *ʔaḏaaʔ* nor in its spelling ⟨ʔḏʔʔ⟩. Under our interpretation, it must therefore be retrieved from the target root $\sqrt{ḏwʔ}$, which is only accessible in the UR of the target. The same conclusion holds for both (6b), where the output is a word but is—at least synchronically—semantically unrelated to the target, and (6c), where the output is a nonword.

The same argument can be deployed from the errors in (7). Arabic has a rule turning both /w/ and /y/ into a glottal stop after [aa] morpheme-finally (e.g., (/duʕaaw/ →) *duʕaaʔ* ‘call, prayer’ versus *daʕaw-tu* ‘I called, I prayed’ and (/xafaay/ →) *xafaaʔ* ‘secrecy’ versus *ʔaxfay-tu* ‘I hid’) and between [aa] and [i] in some morphological contexts (e.g., *m-axaawif* ‘afraid’ versus (/xaawif/ →) *xaaʔif* ‘fears’ and *m-usaayir* ‘adapting, adjusting’ versus (/saayir/ →) *saaʔir* ‘walking’). Though the contrast between the two glides is neutralized phonetically and graphemically (both are pronounced [ʔ] and are written ⟨ʔ⟩), the proper underlying glide resurfaces in these errors. This again suggests that errors are based on URs rather than surface forms.

(7) Other cases of overt [−M, +T] resurfacing

Target UR	Target		Output UR	Output	
faawiz	faaʔiz	‘winner’	→ fawz	fawz	‘victory’
			y-afwuz-u	y-afuuz	‘he wins’
ṭaayir-at	ṭaaʔir-a	‘airplane’	→ ṭayyaar-at	ṭayyaar-a	‘woman pilot, kite’

Given that the output glides of (6) and (7) can neither be heard—when the targets are spoken—nor seen—when the targets are written (except for *ṭuul* ⟨ṭwl⟩ ‘height’ in (6a))—their resurfacing cannot be attributed to operations on surface forms. The errors must have been mediated by the UR, the only level where weak roots are intact and from which a phonetically silent glide can be retrieved.

3.2.2 Covert [−M, +T] Resurfacing In addition to overt cases of [−M, +T] resurfacing, ZT produced covert cases of [−M, +T] resurfacing where the glide is not audible in the output but its presence manifests itself in the long vowel. These errors are classified in the same way as those in (6). In (8a), the target and the output belong to the same morphological paradigm. The same holds in (8b) except that the target and the output are semantically distant. In (8c), the output is a nonword.

(8) Covert cases of [−M, +T] resurfacing

Target UR	Target		Output UR	Output	
a. aḏyaʕ-a	ʔaḏaaʕ	‘he broadcast’	→ m-uḏyiʕ	m-uḏiiʕ	‘radio announcer (m.)’
anwar-a	ʔanaar	‘he shed light’	→ y-unwir-u	y-uniir	‘he sheds light’
bayaʕ-a	baaʕ	‘he sold’	→ bayʕ	beeʕ	‘selling’ (dial.)
ḏawaq-a	ḏaaq	‘he tasted’	→ ḏuuq, ḏwuq	ḏuuq	‘taste, taste (imp.)’ (dial.)

Target UR	Target		Output UR	Output	
iḍyaaʔ-at	ʔiḍaaʔ-a	'broadcasting'	→ m-uḍyiʔ	m-uḍiiʔ	'radio announcer (m.)'
			m-uḍyiʔ-at	m-uḍiiʔ-a	'radio announcer (f.)'
iḍwaaʔ-at	ʔiḍaaʔ-a	'lighting'	→ ʔaḍwaʔ-a	ʔaḍaaʔ	'he lit'
m-asyir-at	m-asiir-a	'march'	→ sayar-a	saar	'he walked'
m-aʒyiʔ	m-aʒiiʔ	'coming'	→ ʒayaʔ-tu	ʒiʔ-t	'I came'
sawaq-a	saaq	'he drove'	→ swuq, suwq	suuq	'drive (imp.) (dial.), market'
s-t-aqyal-a	s-t-aqaal	'he resigned'	→ s-t-aqyil	s-t-aqiil	'resign (imp.)'
s-t-aryaḥ-a	s-t-araaḥ	'he rested'	→ m-ur-t-ayaḥ	m-ur-t-aah	'rested'
			s-t-aryih	s-t-ariih	'rest (imp.)'
ṭayar-a	ṭaar	'he flew'	→ ṭiyr, ṭyir	ṭiir	'bird, fly (imp.)' (dial.)
				bi y-ṭiir	'it is flying' (dial.)
y-amwut-u	y-amuut	'he dies'	→ mawat-a	maat	'he died'
y-aṭyir-u	y-aṭiir	'he flies'	→ ṭayr, ṭyir	ṭiir	'bird, fly (imp.)' (dial.)
y-awzin-u	y-azin	'he weighs'	→ m-iwzaan	m-iizaan	'scales'
aḍwaaq-a	ʔaḍaaq	'he made sb. taste'	→ ḍawq, ḍwuq	ḍuuq	'taste, taste (imp.)' (dial.)
y-afyiḍ-u	y-afiiḍ	'it overflows'	→ fayaaḍ-a	faaḍ	'it overflowed'
b. siyr-at	siir-a	'biography'	→ sayar-a	saar	'he walked, adjusted'
y-abyit-u	y-abiit	'he spends the night'	→ bayt	beet	'house' (dial.)
c. y-uṭwiʔ-u	y-uṭiiʔ	'he obeys'	→	y-ṭuuʔ	nonword
y-awqiy-u	y-aqii	'he protects'	→	ʔiiqaaʔi	nonword

The reasoning behind our analysis of covert [−M, +T] resurfacing parallels that behind our analysis of covert [+M, +T] resurfacing. It can be illustrated by means of the first error in (8a). The output *m-uḍiiʔ* exhibits the usual characteristics of weak roots. First, its stem displays only two phonetic consonants, which suggests that its vowel hides the third consonant characteristic of Arabic stems. Second, its template is *m-uCCiC*, just like the one in *m-untiz* 'producer' or *m-ušrif* 'supervisor'. It follows from both observations that the long [ii] in error *m-uḍiiʔ* should be attributed to the spreading of /i/ onto the templatic position of the preceding /y/ or to the vocalization of this glide (i.e., *m-uḍyiʔ* → *m-uḍiiʔ*). Since, as we will show in section 4.1, both /yi/ and /wi/ can surface as [ii] (cf. /m-uḍyiʔ/ → *m-uḍiiʔ* 'radio announcer' and /m-uxwif/ → *m-uxiif* 'scaring'), the identity of the underlying glide cannot be deduced from the output stem alone, but its presence and position can. The output stem alone reveals that this is a hollow root. To identify the segmental nature of this glide, we also need to examine related words.

3.3 Other Errors on Glides

The new corpus also contains substitution and deletion errors. We will show that inaudible glides (presented in (9) and (10)) and audible nonglides (presented in (11)) are again subject to the same error types. We interpret these errors as being compatible with our claim that ZT's errors operate on URs rather than surface forms. However, we do not invoke them as evidence for the root in

Arabic morphology. Models that do not appeal to the root can account for these errors equally well.

Examples of substitution errors are given in (9). In these errors, the underlying glides are replaced with either another glide or a glottal stop. The roots of the targets share only two consonants with the roots of the outputs. The errors in (9b) also involve metathesis.

(9) Substitution of glides

Root of target	Target		Output		
a. žwd	žaad	'he was good'	→	žayad	nonword
bqy	baqaaʔ	'staying'	→	baqaw	nonword
b. wkr	wakr	'nest, abode'	→	karaʔ	nonword
wfd	y-afid	'he arrives'	→	fadiy	nonword
ryš	riiš-a	'feather'	→	šaraaš-a ⁶	nonword
žyl	žiil	'generation'	→	(/y-awžil-u/ →) y-ažil	'he is afraid'

The second group of errors, shown in (10), seems to involve the deletion of the underlying glide. The target root becomes biconsonantal and behaves as is standardly assumed: either the second consonant or both consonants are doubled to satisfy the template (McCarthy 1981:396, Lowenstamm and ElMhammedi 1995:130). The errors in (10b) also involve metathesis. The glide can undergo deletion or substitution regardless of whether it is in the onset or coda position.

(10) Deletion of glides

Root of target	Target		Root of output	Output	
a. žwd	žaad	'he was good'	→	žd	žadd 'grandfather, he worked hard'
šwb	ʔašaab	'he hit a target'	→	šb	šabb 'he poured'
žwd	ʔižaad-a	'excelling'	→	žd	žadd-a 'grandmother, he worked hard'
ʔyš	ʔiīš-a	'living, life'	→	ʔš	ʔiīšš 'nest' (dial.)
šyʔ	ʔišaaʔ-a	'rumor'	→	šʔ	šuʔaaʔ 'ray'
wšf	y-ašif	'he describes'	→	šf	šaff 'row'
žfw	žafaaʔ	'roughness'	→	žf	žafaaf 'drought'
zwl	ʔazaal	'he took sth. off'	→	zl	zalaazil 'earthquakes'
wfd	y-afid	'he arrives'	→	fd	fadd nonword
fyd	s-t-afaad	'he benefited'	→	fd	fadd nonword
b. dyf	ʔaḏaaf	'he added'	→	fḏ	fiḏḏ nonword
				faḏḏ	'he dispersed'
ryh	riih	'wind'	→	hr	ħariir 'silk'
bky	bukaaʔ	'crying'	→	kb	kabb 'he poured out'

⁶ We consider this error a case of substitution of alveopalatal [ʃ] for the palatal segment [y] rather than a case of deletion, because ZT's deletion errors typically lead to spreading (or copying) of C₂ to the right. The pattern of this particular error—namely, C₁C₂C₁—is an unusual example of spreading (or copying).

The errors in (11) show that glides and high-sonority nonglide consonants are treated alike. The substitutions of nonglides in (11a) and deletions of nonglides in (11b) parallel the substitutions of glides in (9) and deletions of glides in (10), respectively.

(11) Substitution and deletion of nonglides

	Root of target	Target		Root of output	Output	
a.	wḏh	wuḏuuḥ	‘clarity’	→ wḏʔ	wuḏuuʔ	‘ablution’
	nbḏ	nabḏ	‘beat’	→ xbḏ	xabiḏ	nonword
	ndm	nadam	‘regret’	→ bdm	badam	nonword
b.	nšf	m-un-tašaf	‘half’	→ šf	šaff	‘row’
	nḏl	naḏl	‘mean’	→ ḏl	ḏull	‘humiliation’
	nqš	naqš	‘lack’	→ qš	qaššaaš-a	‘scissors’ (dial.)
	nsl	nasl	‘progeny’	→ sl	sulaal-a	‘descendants’
	šnf	šinḏ	‘type’	→ šf	šaff	‘row’
	xsʔ	xaasiʔ	‘outcast’	→ xs	xasiis	‘mean’
	žzʔ	žuzʔ	‘part’	→ žz	žizz	nonword
	nžm	nažm-a	‘star’	→ mž	mižmiž	nonword

4 Alternative Explanations for Glide Resurfacing

The evidence for the resurfacing of glides that we just reviewed reveals that ZT’s errors treat silent glides just as they do audible nonglides. We take this to show that these errors operate on underlying roots, since silent glides are only present underlyingly. We see a convergence between our aphasic evidence for the presence of glides in the URs of Arabic weak roots and evidence obtained recently in two priming experiments with normal adult Arabic and Hebrew speakers. In priming experiments on Arabic words based on weak roots, Boudelaa and Marslen-Wilson (2004) show that a word based on a weak root containing a silent glide facilitates access to another word containing the same root with an audible glide. For example, (/w-t-ifaaq/ →) ?ittifaaq ‘agreement’ primes *waafaq* ‘he agreed’ in the same way that (/k-t-itaab/ →) ?iktitaab ‘subscription’ primes *kaatab* ‘he corresponded’, where priming—according to these authors—is mediated by the root morphemes \sqrt{wfq} and \sqrt{ktb} , respectively. They also report that priming is found even in the absence of shared meaning, so that (/w-t-ižaah/ →) ?ittižaah ‘destination’ primes *waažah* ‘he confronted’, where the prime and the target share $\sqrt{wžh}$. In both cases, these authors interpret the priming effect as evidence for (a) the existence of consonantal roots in Arabic and (b) the presence of glides in weak roots. Velan et al. (2005) reach similar conclusions from masked-priming experiments in Hebrew. Our study concurs with these results: ZT’s errors reveal access to the silent glides of weak roots just as priming does in these two studies.

In what follows, we articulate two alternative explanations for the glide resurfacing observed in ZT’s errors. First, the resurfacing of silent glides could be an artifact of Arabic spelling. For instance, ZT could have pronounced *m-adiin* ‘indebted’ as nonword *daniy* (with a [y] instead of [w]; see (4d)) because the written stimulus ⟨mdyn⟩ contains the grapheme ⟨y⟩. This orthographic

explanation is evaluated in section 4.1. Second, the resurfacing of silent /w/ in, for example, *s-t-aqaam* ‘he stood straight’ → error *waʔiim* in (4a) and *ʔaḏaaʔ* ‘he lit’ → error *ḏawʔ* ‘light’ in (6a), could be attributed to the fact that the target and the output—or some intermediate form leading to the output—share the same meaning and/or belong to the same morphological paradigm, rather than being attributed to access to word-internal structure. We evaluate this alternative explanation in section 4.2.

4.1 *Is Glide Resurfacing Due to Arabic Spelling?*

The main reason why spelling cannot cause the resurfacing of silent glides is that Arabic spelling is almost entirely phonetic.⁷ If a glide is absent from the PR of a stimulus, it is also absent from its written form, and vice versa. It stands to reason that a glide that is absent graphemically cannot cause spelling-based errors. This reasoning applies to the glide resurfacing observed in both [+M, +T] and [−M, +T] errors, be they overt or covert. To illustrate, consider the [+M, +T] resurfacing in the errors *s-t-aqaam* ⟨stqʔm⟩ → *waʔiim* ⟨wqym⟩ in (4a) and *ʔaḏaaʔ* ⟨ʔḏʔf⟩ → *faddʔ* ⟨fdʔ⟩ in (4e). The written forms of these targets lack the graphemes ⟨w⟩ and ⟨y⟩ altogether and therefore cannot provoke the resurfacing of [w] and [y]. Only in two [+M, +T] resurfacing errors can the influence of spelling not be ruled out: *m-adiin* ⟨mdyn⟩ → *daniy* ⟨dny⟩ and *m-uṣiib-a* ⟨mṣyb-t⟩ → *ṣabiy* ⟨sby⟩. Spelling cannot explain [−M, +T] resurfacing errors either since in only one error was the resurfacing glide present in the spelling of the target: *tuul* ⟨twl⟩ → *ṭawiiil* ⟨ṭwyl⟩. We now show that two other factors make the case against spelling even stronger in its details than it already is in the general form just presented.

First, our previous arguments against a graphemic explanation of ZT’s metatheses (PBI 2000: 616–618) apply *mutatis mutandis* to the new corpus. One such argument mentioned that ZT never metathesized either the consonantal graphemes representing long vowels (called *matres lectionis*, or ‘mothers of reading’) or the consonantal graphemes representing affixal consonants, though he sometimes metathesized the same graphemes when they transcribed root consonants. For example, he never metathesized ⟨w⟩ and ⟨y⟩ in errors such as *m-aḏhuud* ⟨mḏhwd⟩ ‘effort’ → *m-aḏduuh* ⟨mḏdwh⟩ nonword and *xanaaziir* ⟨xnʔzyr⟩ ‘pigs’ → *xazaaniir* ⟨xzʔnyr⟩ nonword. If ZT had metathesized graphemes, he would have metathesized them all, but instead his errors singled out root consonants and left out all other graphemes.

The second argument against a graphemic explanation of ZT’s errors comes from the fact that phonological rules specific to Arabic glides make underlying glides irretrievable from surface forms, be they phonetic or graphemic. (For discussion of Arabic weak roots, see Brame 1970, Chekayri and Scheer 1996, 2004, Åkesson 2001:270–376, Chekayri 2001, 2006, and Rosenthal 2006.) In the columns in (12), recall that prepausal forms lack the final suffixal vowel and hence

⁷ An exception is the definite article /al/, written ⟨ʔl⟩. Although in speech its liquid consonant totally assimilates to a following coronal consonant (e.g., /al-ṭaalib/ → [ʔaṭṭaalib] ‘the student’), its written form is always ⟨ʔl⟩: ⟨ʔlʔlb⟩.

(13) Glide-specific rules of deletion and substitution

UR	PR	UR	PR	Pattern as in		
a. aya	→ aa	ṭayar-a	ṭaar	‘he flew’	daxal-a	‘he entered’
ayu	→ aa	ṭayub-a	ṭaab	‘it is well’	kabur-a	‘he grew up’
uyi	→ ii	buyiʔ-a	biiʔ	‘it was sold’	kutib-a	‘it was written’
b. awa	→ aa	mawat-a	maat	‘he died’	katab-a	‘he wrote’
awu	→ aa	ṭawul-a	ṭaal	‘he grew tall’	kabur-a	‘he grew up’
uwi	→ ii	quwil-a	qiiil	‘it was said’	kutib-a	‘it was written’
y-awC	→ y-aC	y-awṣif-u	y-aṣif	‘he describes’	y-aḍrib-u	‘he hits’
c. y	→ ʔ	saayir	saaʔir	‘walking’	kaatib	‘writing’
w	→ ʔ	faawiz	faaʔiz	‘winning’	kaatib	‘writing’
d. y	→ ʔ	yabaaʔ	yabaaʔ	‘stupidity’	malaak	‘angel’
w	→ ʔ	duʔaaw	duʔaaʔ	‘prayer’	ṣuraax	‘shouting’

Here too, the written form of the word is a transcription of its PR. For instance, the spelling of the forms in (13c) transcribes the phonetic glottal stop but not the glides that underlie it (/faawiz/ → [faaʔiz] ⟨fʔʔz⟩ and /saayir/ → [saaʔir] ⟨sʔʔr⟩), and the same is true for the forms in (13d). Yet ZT’s forms display glide resurfacing in comparable words listed in (6a) (e.g., *ʔaḍaaʔ* → *ḍawʔ*) and (7) (e.g., *ṭaaʔir-a* → *ṭayyaar-a*). In still other errors, the spelling even fails to lead ZT astray regarding the segmental nature of the underlying glide. For instance, in the second example in (6a), the underlying /w/ of target *m-udiiʔ* ⟨mḍyʔ⟩ resurfaces in the error *ḍawʔ* despite the presence of the grapheme ⟨y⟩ in the target. If ZT’s errors were based on spelling, ⟨y⟩ would lead to the resurfacing of [y] instead of [w].

We conclude that ZT’s production errors displaying resurfacing of silent glides cannot be attributed to (misinterpretations of) Arabic orthography.

4.2 Is Glide Resurfacing Due to Paradigmatic Relations?

Let us now consider the possible role of paradigmatic relations in glide resurfacing in ZT’s errors. One could maintain that ZT produces either outputs that are lexically—that is, morphologically and/or semantically—related to the target, or outputs that are altered forms of intermediate words that are lexically related to the target. This reasoning would garner support from the fact that morphological errors, semantic errors, and visual-then-semantic errors are characteristic of ZT’s deficit (see section 2).

Before we assess this alternative analysis, let us give a classification of ZT’s errors that are relevant to the present discussion. First, in the present corpus, ZT’s metatheses yield outputs that are either words or nonwords. When the metathesized form coincided with an existing word of Arabic, the output was never morphologically or semantically related to the target. Let us call this situation [−F, −S], where *F* stands for *shared form or morphological structure* and *S* for *shared semantics* (as in (14a)). Similarly, the output of a template selection error can be either a word or a nonword. However, when it coincides with an existing word, it can be either both

morphologically and semantically related to the target or only morphologically related to it. Let us refer to these situations as [+F, +S] and [+F, -S], respectively (as in (14b)). All of these possibilities are summarized and illustrated in (14).

(14) A classification of ZT's errors according to the type of output

Error	Output	Example
a. [+M, +T]	1. word [-F, -S] 2. nonword	qaaʕ 'bottom' → waaqiʕ 'reality' s-t-aqaam 'he stood straight' → waʕiim
b. [-M, +T]	1. i. word [+F, +S] ii. word [+F, -S] 2. nonword	ʔaḏaaʔ 'he lit' → ḏawʔ 'light' m-uḏaaʔ 'added' → ḏayyif 'offer food to sb.' ʔaʒaab 'he answered' → ʔaʒwuba

Let us then assume, for argument's sake, a strictly word-based view of morphology where morphemes play no role, and where words are fully listed in the lexicon and grouped into morphological paradigms or families (e.g., Stump 2001, Blevins 2003). Within this perspective, ZT's errors may be explained as follows. Upon seeing a word, ZT activates its paradigm, scans the list of (possibly all) the morphological and semantic relatives this paradigm contains, and wrongly *selects* one of them to produce one of three types of error. First, he may leave the word unchanged and yield a [-M, +T] error where the output is a morphologically and semantically related word, as in *ʔaḏaaʔ* 'he lit' → *ḏawʔ* 'light' (i.e., [+F, +S], as in (6a) and (7)). Second, he may produce a morphologically related but semantically distant word, as in *m-uḏaaʔ* 'added' → *ḏayyif* 'offer food to sb.' (i.e., [+F, -S], as in (6b) and (8b)). Third, he may err on the selected word and produce a [-M, +T] error where the output is a nonword, as in (6c) *ʔaʒaab* 'he answered' → *ʔaʒwuba*, which is clearly a mispronunciation of *ʔaʒwib-a* 'answers'.

When presented with a word, ZT may also produce a [+M, +T] error where the output can again be either an existing word or a nonword. For example, in reading *xafaaʔ* 'secrecy' as *xaayif* 'scared', he may have browsed through the list of related words. Among these, he may have wrongly selected (*/xaafiy/* → *xaafii* 'secret, unknown', over which he then performed a metathesis error yielding *xaayif* 'scared' (i.e., [-F, -S]). In the same vein, when reading *s-t-aqaam* 'he stood straight', ZT may have retrieved *qawiim* 'straight' from the paradigm of the target and then metathesized its root consonants to produce (*/waqiim/* → *waʕiim* nonword).

The analysis outlined so far would then account for all cases of glide resurfacing seen in template selection errors where the output and the target are both semantically and morphologically related, that is, [+F, +S] in (6a), (7), and (8a). It would also account for cases where the target and the output share no meaning, that is, [+F, -S] in (6b) and (8b). Obviously, an explanation based solely on semantic relatedness would explain [+F, +S] errors but would fail to account for [+F, -S] cases since in none of them is the output semantically related to the target.

Both the semantic relatedness analysis and the more general paradigmatic analysis can explain a subclass of nonword outputs, namely, those that can be treated as simple phonological errors on a word that is lexically related to the target (e.g., [+M, +T] (4a) *s-t-aqaam* 'he stood straight' → error *waʕiim* nonword, possibly via *qawiim* 'straight', and [-M, +T] (6c) *ʔaʒaab* 'he an-

swered' → error *ʔaʒwuba* nonword, probably via *ʔaʒwib-a* 'answers'). Both analyses can also explain the [+M, +T] error in (4b), *xafaaʔ* 'secrecy' → *xaayif* 'scared', where the output might be the metathesized form of *xaafiy* 'secret, unknown', a word that is clearly lexically related to the target.

However, neither type of intraparadigmatic analysis can explain any word or nonword output where there is no existing word that is lexically related to the target to mediate between target and output. Thus, at least the errors in (4c) and (4i) would remain unexplained under either analysis, as the targets do not have related forms with overt glides that could be metathesized to yield the observed errors. An anonymous reviewer suggests that this problem may be solved by invoking interparadigmatic comparison. Since new forms can be coined through analogy, metatheses such as *qaaf* 'bottom' → error *waaqif* 'reality' (4c) could involve misselection of a template from a paradigm different from that of the target word, to which the metathesized root consonants would subsequently be mapped. In the example at hand, the alleged intermediate form *qaawif* (triggered by *qaaf*) could be built by analogy with the pair *xaaf* 'he was scared' and *xaayif* (< /xaawif/) 'scared', although *qaawif* itself does not exist. However, this scenario is possible only within a model that allows access to the root \sqrt{qw} with the correct labial glide. In fact, in the presence of pairs such as *saar* 'he walked' – *saaʔir* (< /saayir/) 'walking', the unattested error *yaaqif* would be just as likely as attested *waaqif*. We thus conclude that analogy alone cannot explain these errors and that ZT must be guided by the extracted root. Crucially, it is that very access to underlying roots that is unavailable within a strictly word-based morphology.

It could be objected that, in a few metathesis errors, ZT may infer the resurfacing glide, not from the underlying root but from the members of the paradigm that display that glide. For example, in *m-adiin* 'indebted' → *daniy* nonword (4d), he could retrieve the glide from *dayn* 'debt', *duyuun* 'debts', *m-adyuun-iyy-a* 'debt (of a country)'. Alternatively, one could suggest that such errors involve template misselection and glide insertion. For example, in *m-adiin* → *daniy*, ZT could wrongly select the *CaCiC* template, map the two consonants of the stem (/d/ and /n/) from left to right onto this template, and then insert [y] to fill the empty *C*-slot. A major empirical problem with both analyses, however, comes from the allomorphic variations that characterize weak roots: both glides are often found in the same paradigm. For example, *s-t-aqaam* 'he stood straight' belongs to the same paradigm as *qiyaam* 'standing (straight)', *quyyam* 'standing (straight) (pl.)' (which display [y]), in addition to *qawiim* 'straight', *qawwam-a* 'he straightened', *ta-qwiim* 'straightening', *quwwam* 'standing (straight) (pl.)' (which display [w]), and *m-us-t-aqiim* 'straight' and *y-aquum* 'he stands (straight)' (which display neither glide). Random selection of one of the two glides from the allomorphs of this paradigm or random insertion should yield random resurfacing of [y] and [w] in aphasic errors, but this is not what we observe. ZT's errors always pick the glide that linguistic analysis would see as underlying. This is explained under our analysis since we claim that ZT's errors access URs, but random selection among the list of allomorphs or random insertion would leave the systematicity in glide resurfacing unexplained.

In addition to the above, neither a paradigmatic representation nor a semantic approach can account for ZT's errors on nonword targets since these do not belong to morphological families,

nor do they occupy nodes in semantic networks. In (15), we present unpublished examples of nonwords taken from our 1997 corpus. These errors show that ZT extracts and metathesizes even the roots of isolated nonwords (possibly by means of a process such as Bat-El's (1986) root extraction). These errors are possible only within a model of morphological representation that allows automatic segregation between the root and the template, that is, the kind of model we advocate. If these metathesis errors operated on surface representations unaided by some form of root extraction, one would expect vowels to be involved as well, but they are not.

(15) Errors on nonwords

Root of target	Target		Root of output	Output	
ʔsx	ʔasax	nonword	→	ʔxs	ʔaxas nonword
ywl	yaawali	nonword	→	wyl	waayali nonword
nlm	nalām	nonword	→	nml	namal nonword
ržš	ražaš	nonword	→	žrš	žaraš nonword

Crucially, the paradigmatic and semantic alternatives fail to account for any of ZT's metathesis errors, including the ones reported in PBI 2000, because such errors distinguish root consonants from both vowels and nonroot consonants of the word. The burden is therefore on word-based approaches to explain why only root consonants are targeted by these errors and why this happens in Arabic but not in French. We therefore contend that a morphological explanation based on the root morpheme is preferable since it can explain all of ZT's errors without running into the problems of the surface-oriented paradigmatic and semantic approaches. We also believe that all models that do not recognize the morphemic status of the consonantal root—some of which were listed in section 1—will have to adopt some version of these paradigmatic and semantic approaches and consequently will face the same empirical difficulties.

Before we conclude this discussion, let us point out that we do not deny the role that paradigmatic information plays in the construction of grammars. A child acquiring Arabic does not extract roots and build multitiered morphological representations right away. Rather, the child starts to automatically decompose words morphologically only after acquiring enough words that form a paradigm. Only then do consonantal roots and templates emerge as organizing units in the mental lexicon and shape the analysis and representation of all words—even isolated ones—acquired subsequently.

We also believe that a paradigmatic view of the mental lexicon is compatible with morpheme-based approaches. We suggest, however, that paradigms are more relevant to the architecture of the lexicon than to the representation of word structure. In our view, a paradigm is not a mere list of words sharing form and meaning with no reference to morphemes, as in the approaches taken by Blevins (2001, 2003) and Stump (2001). Instead, it is a structured set of words that, in Arabic, share the same consonantal root (except for rare cases of suppletion). Crucially, this unit is the morpheme that binds together all the words of the paradigm and, as such, governs lexical access to and between them. This view is supported by our data from aphasia, where errors are systematically governed by the consonantal roots, and by priming experiments in Arabic, which

argue that the root is a processing unit (see Boudelaa and Marslen-Wilson 2004). In a mature grammar, this root-based representation characterizes the lexical entries of native and borrowed words alike and is automatically assigned by speakers to novel words. A process of root extraction must then be allowed to apply automatically when processing a given word and building its morphological structure. Root extraction is used during language acquisition to build multitiered morphological representations of the words in the mental lexicon and continues to be used later to assign such a structure to lexical innovations (e.g., *ʔaflaam* ‘films’ from English/French *film*, *sayyiv* ‘he saved’ from English *save*, *šabaatir* ‘chapters’ from English *chapter*, *sallib* ‘he slept’ from English *sleep*, *takaasi* ‘taxi’ from English/French *taxi*), including nonwords. This process accounts for ZT’s metatheses on nonword targets, like those given in (15).

In the following section, we show that root extraction is just as active in Arabic hypocoristic formation as it is in novel words and nonwords. We will argue that it is guided by form and is insensitive to meaning.

5 On the Apparent Failure of Silent Glides to Resurface in Arabic Hypocoristics

We now turn to data that have been claimed to run counter to our prediction that the silent glides of roots should resurface when mapped to suitable patterns. The evidence comes from Arabic hypocoristics derived from proper names (Davis and Zawaydeh 1999, 2001, henceforth D&Z; Zawaydeh and Davis 1999). From here on, we use *name* to refer to personal proper names, and *word* to refer to any word that is not a proper name.

5.1 On the Internal Structure of Arabic Names

Various studies—such as Mester 1990 and Poser 1990 on Japanese, Kahn 1976, Kager 1993, and Benua 1995 on English, and Plénat 1984, 1999 and Scullen 1993 on French—have shown that hypocoristics are based on the surface forms of names. They do not refer to any potential morphological or semantic structure. This also seems to be true in Semitic, even though speakers, name lexicographers, and even linguists typically consider that Semitic names have meaning. Thus, the Amharic hypocoristics described in Beyene 1989 are formed by adding one of several possible suffixes to the prosodically circumscribed initial *CVC(C)* sequence (underlined in (16)) of the input name. (On the notion of prosodic circumscription, see McCarthy and Prince 1995: 340.) The Modern Hebrew hypocoristics discussed in Bat-El 2005 are similar to those of Amharic.

(16) Name	Hypocoristics	Gloss
hirut	<u>hiriš</u>	
mə-čal	<u>məčiš</u> , <u>məče</u> , <u>məču</u>	‘patience’
sənnay-it	<u>sənniš</u> , <u>sənniyye</u>	‘beauty’ (in Ge‘ez)
təsfaye	<u>təsfīš</u> , <u>təsfīyye</u> , <u>təsfu</u> , <u>təsfinnət</u>	‘my hope’

Like speakers of other Semitic languages, Amharic speakers assume that their names have meaning. For instance, they will readily state that the male name *məčal* is coined after, or even

is, the word *mā-ĉal* ‘patience’. Though we will show that this cannot be true literally, we include in (16) both the morphological division (in the leftmost column) and the gloss (in the rightmost column) of the homophonous words to show that, even if we equate homophonous names and words, Amharic hypocoristics are insensitive to both morphology and meaning. As we will show next, D&Z make a significant contribution by showing that Arabic hypocoristic formation is different in that it treats names as if they had the morphological structure of their word homophones.

Some modern Arabic dialects apply the template *CaCCuuC* to some names to create hypocoristics expressing endearment. When a quadriconsonantal name is involved, each consonant fills one of the four *C*-positions, as in *maryam* → *maryuum*. Medial gemination is observed with triconsonantal names, as in *basma* → *bassuum*. Biconsonantal names behave either like *diima* → *damduum* or *dadal* → *dalduull/dalluul* (D&Z 1999:90).⁹ D&Z (2001) show that the input to this hypocoristic template undergoes morphological decomposition since the mapping strips off affixes and epenthetic *ʔ*, all of which are underlined in the names in (17).

(17) Name	Hypocoristic
<u>ʔ</u> ib- <u>t</u> -isaam	bassuum
<u>m</u> -uhammad	hammuud
salm- <u>aan</u>	salluum

D&Z (2001) conclude that these hypocoristics are based on the root of the input name rather than on a structureless segmental string. This property makes Arabic *CaCCuuC* hypocoristics different from the hypocoristics of other languages. However, D&Z argue that the extracted root is not the traditional lexical root of Arabic but an *output root*, a new morphological unit that shares elements of both lexical roots and surface stems. D&Z define the output root as the string of nonaffixal and nonepenthetic consonants that are realized phonetically within the stem.¹⁰ We will notate output roots $\sqrt{[CCC]}$ to distinguish them from the usual lexical roots \sqrt{CCC} . Ratcliffe (2004:85) offers an alternative analysis that does away with the language-specific notion of output root. In his view, Arabic *CaCCuuC* hypocoristics are formed by applying *sonority stripping*, a form of prosodic circumscription that extracts syllabic troughs from surface stems and makes no reference to lexical roots. Crucially, though, sonority stripping is guided by ‘constancy’—that is, sensitivity to recurrent phonetic strings that share ‘some element of reference’ (p. 77). This morphosemantic guide allows sonority stripping to preserve only the nonaffixal and nonepenthetic consonants of the surface stem. Because both analyses appeal to morphological structure, we

⁹ D&Z (1999:84) and Zawaydeh and Davis (1999:134) regard the hypocoristic template of *maryuum* and *bassuum* as different from the hypocoristic template(s) of *dalduul* and *dalluul* in that the latter also include(s) a reduplicative morpheme. We agree—at least as far as *dalduul* is concerned—since we have noted that speakers seldom produce reduplicated hypocoristics when presented with a nonreduplicated model. The number of *CaCCuuC* templates involved has no bearing on the present discussion of roots.

¹⁰ “[H]ypocoristic formation is sensitive to root consonants, but only as they appear in the full name” (D&Z 2001: 518).

believe that D&Z's and Ratcliffe's analyses are notational variants distinguished only by how language-specific their mechanisms are.

All but three of the hypocoristics cited by D&Z (1999, 2001) and Zawaydeh and Davis (1999) are, in fact, equally compatible with lexical and output roots. For instance, lexical and output roots coincide in the female name *ʔib-t-isaam*: their segmental makeup is *bsm* in both cases. This triconsonantal sequence is the *lexical root* \sqrt{bsm} (also present in *bas̄m-a* 'smile (f.)'), but *bsm* also happens to be the consonantal sequence, or *output root*, that is left after epenthetic *ʔ* and infixes *-t-* have been stripped off. If the two kinds of root coincide, what then is the justification for the new concept of output root?

D&Z (2001) base their argument on one triconsonantal name and two biconsonantal names. They argue that the silent underlying glides present in the URs of these three names fail to resurface in their corresponding hypocoristics. The triconsonantal name is *ʕayda*, whose hypocoristic is *ʕayyuud*, instead of the output **ʕawwuud* D&Z (2001:517) would expect under their analysis of this name as including the lexical root $\sqrt{ʕwd}$ 'RETURN' of the participle *ʕayda* 'the returning one (f.)' (a dialectal form they assume to be derived as follows: */ʕaawid-at/* → *ʕaayida* → *ʕaayda* → *ʕayda*). The two biconsonantal names are *diima* and *mufiida*. The hypocoristic of *diima* is *dam-duum* (D&Z 1999:90), rather than the output **dawwuum* D&Z (2001:517) would expect since they view this name as being based on \sqrt{dwm} 'CONTINUE', a lexical root at work in the nouns *diim-a* 'continuous rain with no thunder or lightning' and *dawaam* 'continuity'. Likewise, the hypocoristic of *mufiida* is *fadfuud* (D&Z 1999:90), instead of the form **ʕayyuud* D&Z (2001:517) would expect on the assumption that this name includes the lexical root \sqrt{fyd} 'BENEFIT', involved in the adjectives *m-ufiid-a* 'useful (f.)' and *ʔafyad* 'more/most beneficial'.

D&Z (2001:518) perceive a formal similarity between the absence of overt glide resurfacing in these three hypocoristics and the absence of overt glide resurfacing we note in PBI 2000:615, fn. 10, in ZT's metathesis errors. D&Z suggest that both empirical gaps would be explained if the inputs of hypocoristics and ZT's errors were output roots (i.e., $\sqrt{[ʕyd]}$ for the name *ʕayda* and $\sqrt{[mt]}$ for the word *maat*) rather than lexical roots (i.e., $\sqrt{ʕwd}$ and \sqrt{mwt} , respectively). Ratcliffe (2004) also aims to explain these gaps but, as mentioned earlier, he uses the mechanism of sonority stripping guided by morphosemantic 'constancy' instead of the notion of output root to capture the observed sensitivity to morphological structure in both hypocoristics and ZT's errors.

At this stage of the present article, it is already clear that output roots could not possibly account for the gap in ZT's errors since this gap has now been filled: our new corpus does display overt [+M, +T] resurfacing, as in */qawaʕ/* → *qaaʕ* → error *waaqiʕ* (4c). Such errors are incompatible with D&Z's (2001) analysis since the resurfacing glide is absent from the target's output root. Indeed, we showed earlier that all errors exhibiting glide resurfacing are incompatible with this and other surface-based analyses. This includes Ratcliffe's (2004) analysis, whose recourse to constancy can identify—and hence leave out—epenthetic and affixal consonants in a stem but cannot explain metathesis errors such as *s-t-aqaam* → *waʔiim* in (4a) and *m-afaad* → *fadiy* in (4g), where the resurfacing glides arise from targets that contain neither glides nor the low-sonority vowels *ii* and *uu* (possibly interpretable as *iy* and *uw* in Ratcliffe's analysis).

Moreover, section 3.2 documented template misselections in ZT's errors that are the formal counterparts of *CaCCuuC* hypocoristics, but with the added twist that these errors, unlike

D&Z's hypocoristics, *do* display overt [−M, +T] resurfacing, as in (*ʔadwaʔ* → *ʔadaaʔ* → error *dawʔ* in (6a). We argued that [+M, +T] resurfacing (section 3.2.1) and [−M, +T] resurfacing (section 3.2.2) errors show that the inputs of ZT's errors consist of lexical roots rather than D&Z's output roots or Ratcliffe's (2004) sonority troughs.

Since (a) operations on lexical roots are attested in Semitic (e.g., in both corpora of ZT's errors), (b) operations on whole words are needed independently (e.g., in cases of prosodic circumscription and pure affixation; see Idrissi 2001:121), and (c) root extraction is a necessary step in processing and derivation (as we concluded in section 4), the pursuit of analytical parsimony prompts us to ask whether the additional concept of output root is needed to account for the apparent failure of glide resurfacing in D&Z's (2001) hypocoristics. In the following section, we argue that the specifics of names already provide the tools needed to account for hypocoristic formation in Arabic without the need to introduce the concept of output root.

5.2 What's in a Name?

D&Z's (2001) expectation that the names *ʔayda*, *diima*, and *mufiida* should exhibit overt glide resurfacing rests on the crucial assumption that homophonous pairs of names and words share both meaning and structure, that is, that name = word. For example, it is only when the name *ʔayda* is equated with the word *ʔayd-a* 'the returning one (f.)' and its UR /ʔaawid-at/ that one can say that the name has a silent /w/ that should resurface when mapped onto the hypocoristic *CaCCuuC* pattern. This equation is made explicitly by D&Z (2001:517).¹¹ Similarly, the hypocoristics *damduum* and *fadfuud* only pose a problem for glide resurfacing when their corresponding names are assumed to be based on the lexical roots \sqrt{dwm} and \sqrt{fyd} . Without equating the name *diima* and the word *diim-a* 'continuous rain with no thunder or lightning', on the one hand, and the name *mufiida* and the word *m-ufiid-a* 'useful (f.)', on the other hand, there would be no expectation that these names include a silent /w/ and a silent /y/, respectively. Is it in fact reasonable to think that some or all speakers equate homophonous names and words? In section 5.2.1, we examine the semantic side of this question and in section 5.2.2, its morphological side.

5.2.1 The Semantics of Names Insights into whether names have the meaning of their word homophones can be sought in the work of philosophers and semanticists, neuropsychological behavioral data, language variation and change, and intuitions of language users. Below we examine all these sources of data and conclude that names are different from words.

5.2.1.1 The View from Philosophy and Semantics Following the influential work of John Stuart Mill, most contemporary philosophers and semanticists consider that the meaning of a name consists mostly in reference and little sense (see Saeed 1997:28 on this Fregean distinction). While words have type reference and point to categories, names are indexicals, have token reference, and point to unique individuals (see Sorrentino 2001, Jackendoff 2002:239). As for the sense of a name, it is limited to one's personal knowledge of the particular person bearing this name, that is, what is called *identity-specific semantic knowledge* by Bruce and Young (1986:306) or *person*

¹¹ "[T]he name [ʔayda], grammatically, is a participle (feminine) form of the verb and would have the underlying representation /ʔaawida/" (D&Z 2001:517).

identity node by Valentine, Brennen, and Brédart (1996:190). In other words, the properties one associates with an individual named *John* (e.g., occupation, ethnic origin, physical and personality traits, address, phone number) do not extend to other bearers of this name (Kripke 1972:309, Bach 1987:135, McCulloch 1989:21, Kleiber 1995:13).

Because the meanings of homophonous names and words are logically distinct, no synchronic *internal* evidence can show that the connection between a name and a word extends beyond phonetic coincidence. This is because any name can refer to any individual irrespective of his or her actual attributes: Mr. *Hassan* [hasan] (an Arabic male name homophonous with the adjective meaning ‘handsome’) and Mrs. *Young* need not be handsome or young. The names *Hassan* and *Young* refer to the particular individuals assigned these names, whereas the adjectives *hasan* and *young* only refer to individuals displaying the properties described by these adjectives. Gardiner (1954:49) argues that even those names that are coined after existing words (e.g., *Hassan* and *Young*) are meaningless. It follows that the meaning of the female name *ʕayda* is limited to (a) its token reference (i.e., knowing who bears this name) and (b) the extralinguistic (i.e., connotative) sense consisting in whatever biographical information the speaker knows about individuals he or she happens to call by that name and the possible connotations of gender, age, social class, nationality, ethnicity, or religion. Because women called *ʕayda* are no more involved in the activity of returning than anybody else, neither the meaning nor the silent glide of the lexical root $\sqrt{\text{ʕwd}}$ (glossed as ‘RETURN’ by D&Z) can pertain to this name.

5.2.1.2 The View from Neurolinguistics Influential studies by Semenza and Zettin (1988, 1989) mark the emergence of a neurolinguistic literature dedicated to the finding that brain-damaged speakers may forget a name such as *Baker* while they have no problem retrieving the homophonous word *baker* (proper name anomia), or the reverse (common name anomia). These deficits, referred to collectively as the *Baker-baker paradox*, have been summarized in Cohen and Burke 1993 and documented in numerous case studies, such as McKenna and Warrington 1978, Luchelli and De Renzi 1992, Valentine et al. 1993, Fery, Vincent, and Brédart 1995, Semenza 1997, and Saetti et al. 1999. Most of these neurolinguistic studies explain this dissociation by appealing to the studies of philosophers, discussed in the preceding section, which hold that names lack the meaning of their word homophones.

These two types of anomia suggest that homophonous name-word pairs are processed by neurally and functionally distinct components of the semantic system (Müller and Kutas 1996, Lyons, Hanley, and Kay 2002:33). Neuropsychologically, then, it is not the case that *Baker* = *baker* and, hence, that name = word. Neurolinguistic data therefore corroborate the conclusion of philosophers and semanticists that names must be different from words. We now turn to synchronic and diachronic facts leading to the same conclusion.

5.2.1.3 The View from Language Variation and Change The pronunciation of a given name in Arabic can vary, while the form of its word homophone is always stable. For instance, the word [ʕayš-a] ‘alive (f.)’ (dial.) has a constant form, while the pronunciation of the name *Aysha* will range from [ʕayša] to [ʕəyša], [ʕiīša], [ʕaaša], or even (MSA) [ʕaaʔiša]. More instances of names drifting away from homophonous words are given in (18). Our examples are taken from Emirati

Arabic (18a) and Moroccan Arabic (18b–c). The names in (18c) have the structure of a possessor + possessee noun phrase, but their lack of meaning obscures their original internal structure and prompts speakers to treat them as mere sequences of sounds. This explains the loss of some segments in the name forms.

(18)	MSA word form	Dialectal name forms	MSA word form	Dialectal name forms
a.	ʔaali	ʔaali, ʔali, ʔili, iʔli, ʔli	saʔiid	saʔiid, saʔid, sʔid, siʔid
	ħiṣṣ-a	ħiṣṣa, haṣṣa, ħuṣṣa, ħiṣṣa	fahd	fahd, fahad, fahəd, fəhəd
	ʔaaʔid-a	ʔaaʔida, ʔaayda, ʔayda, ʔiida	xaliif-a	xaliifa, xalifa, xliifa, xilifa
	m-uniir-a	muniira, mnira	ʒumʔ-a	ʒumʔa, ʒumʔa, ʒimʔa
	suhayl	suhayl, suhil, shil, ishil	ʔawaḍ	ʔawaḍ, ʔwaḍ, ʔuwaḍ, iʔwaḍ
	m-uhsin	muhsin, mihsin, mihsin		
b.	faaʔim-a	faaʔima, faʔima, faʔma, faʔima, faʔna	m-ubaarak	mubaarak, mbarək, əmbark, bbarək
c.	ʔabdu	ʔabduʔlah, ʔabduʔla,	ʔabdu	ʔabdulqadir, ʔabdalaqadər,
	al-ʔaah	ʔabdaʔla, ʔəbdəʔla, ʔbəlla	al-qadir	ʔəbqadər, ʔəqadər
	ʔabdu	ʔabdussalam, ʔabdissalam,		
	as-salaam	ʔəbslam, ʔəslam		

In Moroccan Arabic, some names are homophonous with simple definite noun phrases: for example, *l-məxtar* ‘the chosen one’, *l-məhdi* ‘the guided one’, and *l-kaml-a* ‘the perfect one (f.)’. While the phrases always display the definite article, their homophonous names can lose it (even though a name is, by definition, definite since it refers to a known individual). Thus, the name forms *lməxtar*, *lməhdiy*, and *lkamla* coexist with *məxtar*, *məhdiy*, and *kamla*, but the homophonous phrases do not.

Just as we find variation affecting names but not homophonous words, so too do we find instances of language change affecting words but not their homophonous names. For example, the name-word pairs in (19) are still homophonous in MSA, but their corresponding Moroccan Arabic dialectal name-word pairs have drifted apart. The dialectal word forms underwent short vowel deletion, but the dialectal name forms did not.

(19)	MSA name-word form	Moroccan Arabic dialectal word form	Moroccan Arabic dialectal name form	Word gloss	
	ʔaziiz	ʔziz	ʔaziz	*ʔziz	‘dear’
	ħakiim	ħkim	ħakim	*ħkim	‘wise, doctor’
	rabiʔ-a	rbiʔ(-a)	rabiʔa	*rbiʔa	‘grass’
	rafiiq	rfiq	rafiq	*rfiq	‘companion’
	ħabiib-a	ħbiba	ħabiba	*ħbiba	‘dear (f.)’
	kariim	krim	karim	*krim	‘generous’
	ʒamiil	ʒmil	ʒamil	*ʒmil	‘handsome’

To conclude, evidence from language variation and change confirms that names are isolates that are linguistically dissociated from words. Originally homophonous name-word pairs can drift

apart because the lack of semantic load in names makes them linguistic isolates, while words must evolve consistently with the other members of their paradigms.

5.2.1.4 The View from Native Intuitions We noted in section 5.2.1.1 that plain logic shows that (for example) *Baker* and *baker* bear no semantic relationship to each other, in section 5.2.1.2 that neuropsychology shows that the two words are accessed differently, and in section 5.2.1.3 that they behave differently both synchronically and diachronically. Do native speakers consider that *Baker* = *baker* anyway? D&Z (2001) claim that they do precisely that. For instance, D&Z expect the overt resurfacing of /w/ in the hypocoristic of the name *ʕayda* because they equate what they assume to be its lexical root, $\sqrt{\text{ʕwd}}$, with that of the homophonous word *ʕayd-a* ‘the returning one (f.)’ (dial.), itself related to *ʕaad-a* ‘he returned’ and *ʕawd-a* ‘returning’. The authors of some Arabic name dictionaries do intuit that *ʕayda* shares the root $\sqrt{\text{ʕwd}}$ of *ʕaad-a* ‘he returned’ (Baker 2003:362), but there are other name lexicographers who link this name to the homophonous word *ʕayd-a* ‘visiting or nursing (the sick) (f.)’, containing the root $\sqrt{\text{ʕyd}}$ of *ʕiyaad-a* ‘visiting (the sick), clinic’ (Al-Khazraji 1976:433, Talaas and ‘uday 1985:213, Naaʕiif 1988:261), or even to *ʕayd-a* ‘celebrating (a religious feast) (f.)’, sharing the root $\sqrt{\text{ʕyd}}$ of *ʕiyd* ‘feast’ (Tamer 2004:50). The latter two interpretations—which also rely on homophony and which are as plausible as any since they are readily made by some Arabic speakers—would avoid the problem posed by the apparent lack of overt resurfacing in *ʕayyuud*: /w/ does not surface in this hypocoristic because the lexical root of the word from which *ʕayda* is coined actually *has* an underlying /y/ for these speakers.

Because, to match names and words, a speaker can only rely on homophony, names are like inkblot tests; they have no intrinsic meaning but one is free to discern a meaning anyway. The name *Rose* may invoke nothing to one English speaker, a flower to another, and the past tense of *rise* to a third. It may even invoke the color pink to a fourth speaker who is familiar with French (where *rose* also means ‘pink’) or the word for ‘rice’ to a fifth speaker who masters Arabic (where [rʊz, rʊzz] means ‘rice’), since reactions to crosslinguistic homophony have long been documented (e.g., Haas 1951, Leslau 1959). There being no right or wrong answer to the question ‘‘What does this name mean to you?,’’ individual speakers are free to hazard creative or educated guesses.

Interestingly, this exercise in free association is widespread in the Arab world, as revealed by a common Arabic expression: *ʔism ʕalaa m-usammaa* ‘the name suits the named one’ (literally ‘name on named’). Historical anecdotes abound of metalinguistic reactions to the connotations of names (Ibn Al-Zubair and Badawi 1991:22ff., Sublet 1991). Some hadiths report that the prophet Mohammed favored people and places that bore names evoking positive connotations, and that he even renamed people whose names had negative connotations (Geoffroy and Geoffroy 2000:23–26). We claim, however, that this exercise in free association, based as it is on homophony or received wisdom, cannot be the linchpin of a synchronic analysis of hypocoristic formation representing the grammar of a speech community. There are several reasons for this.

First, it is still the case that Mr. *Hassan* need not be handsome. Second, Arabic speakers will perceive or process this name differently: some may link it to ‘handsome’, some to ‘good’

(as in ‘good work’), and possibly some to nothing. Third, even if all Arabic speakers were etymologically gifted, the assumption that hypocoristic formation decomposes names by relying on meaning cannot be true since clearly senseless and borrowed names also form *CaCCuuC* hypocoristics, as in *Maryam* → *maryuum*, *Lauren* → *larruun*, and *Angela* → *nažžuul* (Zawaydeh and Davis 1999:117, 136). The fourth reason is that it is actually easy to find Arabic names whose meaning is not readily available, even though speakers form hypocoristics from these names as well. The evidence for this is fourfold. First, some names are homophonous with words unknown to most native speakers, such as *laylaa* ‘wine, alcohol or its intoxicating effect’ and *diim-a* ‘continuous rain with no thunder or lightning’ (whose lack of overt glide resurfacing in unattested **dayyuum* earned it a place as one of the three problematic hypocoristics invoked by D&Z).¹² Second, some names sound different enough from possible word matches that even name dictionaries can only venture possible links; for example, *nihaad* is not homophonous with any word of Arabic, but Baker (2003:377) relates it to *nahd* ‘elevated piece of ground, female breasts, lion’. Third, some names clearly owe their alleged glosses to folk etymology. For instance, *dyaana* is glossed as the Roman goddess of hunting in Talaas and ‘uday 1985:121 and Naašijif 1988:241, but it is also, more creatively, derived from *diin* ‘religion, belief’ (\sqrt{dyn}) in Al-Arna’out 1989: 113 and even from \sqrt{dyn} ‘LEND’ (see *dayn* ‘debt’) in D&Z 2001:517. Fourth, some names are always listed without glosses, for example, *bilal*, *maawiya*, *širin*, *šahrzaad*, and *sonya*.

5.2.1.5 A Unified Linguistic Account Knowing a word entails knowing (at least) four types of specification: its form (phonological field), distribution (syntactic field), structure (morphological field), and meaning, that is, reference and sense (semantic field). We suggest that personal names have all of these fields but that their semantic field is deficient: it has space for reference and extralinguistic (i.e., connotative) sense but not for linguistic (i.e., definitional) sense. This representation accounts for the philosophers’ and semanticists’ views commented upon in section 5.2.1.1 and the neurolinguistic facts shown in section 5.2.1.2. Since the lexical specifications of homophonous names and words are different, they cannot share the same lexical entries and must be interpreted (section 5.2.1.1), processed (section 5.2.1.2), and perceived (section 5.2.1.4) differently. It also stands to reason that they evolve separately (section 5.2.1.3).¹³

Allerton (1987:72) and Brennen (2000:143) posit that even when a name evokes a sense to a speaker at first, the sense of the homophonous word becomes less salient and less readily accessible as the name comes to be used by this person more as an indexical referring to an individual than as a word bearing sense. We agree with this scenario but think that linguistic sense is never present in the name: it is the novelty of the homophony that gives some speakers

¹² It has indeed been our experience that many speakers are incapable of quoting the meanings of the very names they claim to have meaning, as with the names *lužayn* ‘silver’, *zaynab* ‘beautiful fragrant plant’, *ʔarwa* ‘female mountain goats’, *hayfaaʔ* ‘slender, delicate’.

¹³ Even if a homophonous name-word pair shared one lexical entry, the name and the word would be linked to different structures and meanings, which is a notational variant of having two lexical entries.

the illusion that a name shares the sense of a homophonous word. As that novelty wears off, so does the incorrect feeling that the name may have had sense in the first place (whether it is to the person naming a child or to the person first exposed to a name). Even if, because of cultural reinforcement, some speakers keep the link between homophonous name and word active, such a link would remain extralinguistic and could neither become linguistic nor be valid across a community for the simple reason that anyone can treat homophony as he or she pleases, since it is governed by shared surface phonology rather than by shared abstract attributes such as meaning. It follows that no sense-sensitive hypocoristic rule can be valid across speakers.

If not sense, then, what causes the affix stripping in Arabic *CaCCuuC* hypocoristics? We will argue below that Arabic names can (but need not) be assigned a morphological structure—also on a speaker-specific basis—and that this is what hypocoristics can be sensitive to (though this is again up to the individual speaker). Evidence for this comes from hypocoristic formation and a set of aphasic errors. We predict that, because speakers assign morphological structure to names solely on the basis of their surface form, some names may be assigned different structures simply because their surface form allows for more than one analysis. Let us now assess this prediction.

5.2.2 The Morphology of Names We suggest that the affix stripping at work in Arabic hypocoristics is guided by form alone. In addition to linguistic evidence (such as names retaining morphological structure after the meaning of the original word is lost; see J. Anderson 2003), there is recent psycholinguistic evidence that morphemic division can emerge without recourse to sense. Longtin (2003) and Longtin, Segui, and Hallé (2003) compile such evidence from priming experiments in French showing facilitation effects between semantically unrelated but morphologically related words (e.g., *département* ‘department’ and *départ* ‘departure’), but these facilitation effects are known to be especially clear and consistent in Semitic. Studies on Arabic (e.g., Boudelaa and Marslen-Wilson 2000) and on Hebrew (e.g., Frost, Deutsch, and Forster 1997, Deutsch, Frost, and Forster 1998, Frost et al. 2000) report cross-modal priming effects between homophonous but semantically unrelated roots in Arabic and Hebrew but not in English. The current psycholinguistic consensus is that Semitic languages—possibly because of their strong constraints on possible word patterns—have morphologies that are rich enough to prompt speakers to extract roots in the absence of semantic cues, even in names and isolated words (Plaut and Gonnerman 2000: 479).

To test these claims, we conducted a follow-up experiment in 2004 in which ZT was presented with a list of names in a reading-aloud task. To avoid uncertainty about which member of a homophonous name-word pair ZT might have erred on, in (20) we report only errors on names that do not coincide with any word of Arabic (as far as we can reasonably state from our elicitations). Epenthetic consonants are underlined in the target column. The [−M, +T] errors in (20a) are instances where ZT possibly extracts the root from a name and produces a word based on the same root. One exception to this is the last item in (20a), which could be a case of affix stripping, a common error in ZT’s performance. (20b) presents [−M, +T] errors in which the output is a word but can also be a name. (20c) lists [−M, +T] errors where the output can only be a name. The [+M, +T] errors in (20d) combine metathesis and template misselection.

(20) Errors revealing morphological structure in names

Target name	Output	Output gloss	Target name	Output	Output gloss
a. <u>ʔ</u> alṭaaḥ	→ laṭaf	'be soft'	m-uṭṭaṣim	→ ʔiṣaaḥ	'strap, thong', name
luṭṭii	→ laṭaf	'be soft'	<u>ʔ</u> ahmad	→ ḥamad	'thank, praise', name
firaas	→ faras	'horse'	c. lubaab-a	→ liblib-a	name
šams-a	→ šams	'sun'	ʔumar	→ ʔammaar	name
b. <u>ʔ</u> anwar	→ nuur	'light', name	ʔaaliy-a	→ ʔaliy	name
rabiiʔ-a	→ rabiiʔ	'spring', name	ḥamd-aan	→ <u>ʔ</u> ahmad	name
m-ahdiy	→ haadiy	'guiding', name	d. ḥassaan	→ ḥanas	nonword
nuṣm-aan	→ naṣiim	'paradise', name	dayaanaa	→ duny-aa	'universe', name
ʔadiil-a	→ ʔaadil	'fair, just', name	sufy-aan	→ sayf	'sword', name

These aphasic errors on names and D&Z's (2001) hypocoristics both show that affixal and epenthetic consonants are treated differently from root consonants in names, and hence that names undergo morphological decomposition. The arguments presented in sections 5.2.1.1–5.2.1.3 have, we believe, established that the morphological decomposition of names, if it happens at all, cannot be guided by sense. This suggests that—as in the priming experiments we just cited—the extraction of the root is guided by the prevalence of a rich morphology that imposes a polymorphic analysis on all names and all words. It remains to be determined whether homophonous name-word pairs, such as the name *ʔibtisaam* and the word *ʔib-t-isaam* 'smiling', share the same lexical root (sense being encoded in the word itself, not in the root, as in Larcher 1995) or have distinct but homophonous lexical roots that ZT's errors and Arabic hypocoristics simply treat as equivalent.

Since names are semantic isolates whose morphological analysis can only depend on their surface form, their lexical roots are likely to be as close to the surface as possible, which is exactly the generalization that D&Z's output roots were meant to capture in the first place. Under the view that names lack sense, the simplest possible lexical roots of the names *ʔayda*, *diima*, and *mufiida* will be $\sqrt{ʔyd}$, \sqrt{dm} , and \sqrt{fd} , respectively. When mapped to the template *CaCCuuC*, these lexical roots will yield the correct hypocoristics *ʔayyuud*, *damduum*, and *fadfuud*. As soon as sense is no longer imposed upon names, these three hypocoristics cease to be problematic. We conclude that output roots turn out to be an unnecessary addition to the array of linguistic units required for analyzing Arabic word structure.

Another crucial difference between our analysis, on the one hand, and D&Z's and Ratcliffe's analyses, on the other hand, is that we claim that speakers do not simply operate on those phonetic consonants that are nonaffixal and nonepenthetic. Rather, we claim that speakers—being unguided by sense—will either (a) posit roots that are surface true or (b) posit more abstract roots when attempting to undo the effects of the glide-specific rules presented in section 4.1. Recall that, in our analysis, the UR and the morphological structure assigned to names are up to individual speakers. No speaker (and no linguist) can speak for the community when it comes to the analysis of names since we are dealing with extralinguistic competence unguided by sense. Because of

the rich allomorphic variations exhibited by weak roots, the analysis will vary across names and across speakers. For instance, [ii] may stand for /ii/, which is the zero hypothesis, but also for /iy/, /yi/, /yu/, /uy/, /wi/, or /iw/ (see (12)). Our own elicitations from students and colleagues in the United Arab Emirates, Kuwait, and Saudi Arabia coincide with D&Z's results. However, they also bring forth four alternative forms crucially revealing that some speakers posit an abstract UR. All of the *CaCCuuC* hypocoristics we present in (21)–(24) come from our investigations; they are all distinct from the *CaCCuuC* hypocoristics documented by D&Z (1999, 2001) and Zawaydeh and Davis (1999).¹⁴

We first consider hypocoristics that conform to D&Z's results. The examples in (21) show that the morphological decomposition is a solid empirical effect extending beyond the data presented by D&Z in their three articles. Epenthetic consonants are underlined>.

(21)	Name	Hypocoristic	Name	Hypocoristic
a.	yazan	yazzuun	sayf	sayyuuf
	nansi (Nancy)	nannuus, nassuus	šamma	šammuum
b.	ʔahlaam	ħalluum	ʔafraah	farruuh
	ʔanfaal	naffuul	ʔasʔad	saʔʔuud
	ʔašraf	šarruuf	ʔabraar	barruur
c.	m-ahammad	ħammuum	m-šabbah	šabbuuh
	m-ašaaʔil	šaʔʔuul	m-ubaarak	barruuk
d.	ʔaḏaar-iy	ʔaḏduur	sind-iyy-a	sannuud
	zaky-iyy-a	zakkuu	badr-iyy-a	badduur
	xalf-aan	xalluuf		
e.	ʔawaatʔif	ʔaʔtuuf	lawaaħiḏ	lahħuuḏ
	ħawaazin	ħazzuum		
f.	bašaayir	baššuur	ʔašaayil	ʔaššuum
	banaayir	bannuur	šamaayil	šammuum
	maḏaayil	maḏuul		
g.	ʔal-yaazy-a	yazzuum		
h.	šaym-aaʔ	šayuum	ħasn-aaʔ	ħassuum
	hayf-aaʔ	hayyuuf	lamy-aaʔ	lammuuf
	mayḏ-aaʔ	mayyuḏ	zahr-aaʔ	zahhuur
	nažl-aaʔ	nažžuum		
i.	ʔum-ay-m-a	ʔammuum	buḏ-ay-n-a	baḏuun
	kl-ay-ḏəm	kaluun	suh-ay-l-a	sahuul
	zul-ay-x-a	zalluum	luž-ay-n	lažžuum
j.	z-ay-nab	zannuum	f-ay-šal	faššuum
	h-ay-dar	hadduur		

The names in (21a) lack epenthetic and affixal consonants altogether; hence, all of their consonants are treated as root consonants and preserved. Those in (21b–d) do not appear in D&Z's three

¹⁴ Like D&Z, we omit the *-a*, *-e*, *-i* suffixes that are sometimes added to some of the hypocoristics we collected (e.g., *ʔammun-a*, *nažžuum-e*, *fahhuud-i*, the last suffix standing for the first person singular possessive).

articles, but their epenthetic (b), prefixal (c), or suffixal (d) consonants appear there in other names. The remaining examples introduce nonroot consonants that do not appear in D&Z's data. They are epenthetic consonants (21e–f), prefixal consonants (21g), suffixal consonants (21h), and the diminutive infix morpheme *-ay-* in its modern position (21i) and (what is possibly) its archaic position (21j).¹⁵ (The diminutive infix is arguably more of a vocalic pattern than an infix.) All of these examples comply with D&Z's generalizations.¹⁶ We now turn to those hypocoristics that behave otherwise.

In each example in (22), a nonroot consonant is preserved in the hypocoristic pattern in the way only root consonants should be.

(22)	Name	Hypocoristic	Name	Hypocoristic
a.	/asmaay/ ʔasmaaʔ ʔamaanii ʔaryam	ʔassuum ʔammuun ʔaryuum	ʔayman ʔawaahir	ʔaymuun, ʔammuun ʔawhuur
b.	m-ufiid-a m-iiʔaad ʔal-yaazy-a	maffuud maʔʔuud lazzuuy	m-uniir(-a), m-anaar m-anaal	mannuur mannuul
c.	sult-aan sind-iyy-a šamm-ah saar-ah	saltuun sanduuy šammuuḥ sarruuḥ	ʔadn-aan naʔa-at yaad-ah	ʔadnuun naʔžuun yadduuḥ

These new data show that speakers are actually free to decompose names thoroughly, partially, or not at all, as befits lexical items whose morphological analysis is conducted in the absence of semantic information. The epenthetic consonants (22a), prefixal consonants (22b), and suffixal consonants (22c) of these names are treated as root consonants here, whereas they were treated as nonroot consonants in (21) and in D&Z's hypocoristics.¹⁷ There are even doublets or quasi

¹⁵ According to Fleisch (1983:99), the rare *-ay-* pattern (or infix) in (21j) indicates both diminutives and augmentatives. For him, *faysal* is the augmentative of 'judge' and *haydar* is the diminutive of 'pebble'. This *-ay-* is no longer productive in the first syllable, but some speakers clearly still treat it as affixal in the hypocoristics of (21j).

¹⁶ All these alternative hypocoristic forms differ from D&Z's (2001) results, most likely for two reasons. First, all of D&Z's consultants were from Amman, Jordan. Most of our consultants were from the United Arab Emirates and Kuwait, though a few of them were from Saudi Arabia, Oman, Egypt, Syria, and Jordan. Second, D&Z's (1999:85) data collection was based on multiple choice: "For each name, speakers were given one or more choices of possible hypocoristic forms, and were asked to circle any that they thought were appropriate for the name. If none of the listed hypocoristics seemed appropriate, speakers were asked to write in one that they considered suitable for the name." In our own elicitations, six name-hypocoristic pairs were presented as examples to our consultants, after which they were simply asked to come up with their own hypocoristics for other names they could think of. This difference in methodology is likely to have influenced the results in that we provided less guidance.

¹⁷ Such cases abound in Arabic. Idrissi (2001:107ff.) proposes a process of affixation of prefixal and epenthetic material to the root that creates complex roots. He shows that this incorporation is frequent in Arabic (and Berber) morphology. It can be seen in prefixed trilateral nouns selecting the broken plural pattern of quadrilateral nouns, such as *m-adras-a* 'school' – *madaaris* 'schools', on a par with quadrilateral *θaʔlab* 'fox' – *θaʔaalib* 'foxes'. It can also be seen in prefixed trilateral stems serving as the derivational input of quadrilateral verbs, such as *m-adras-a* 'school' → *ta-madras-a* 'he attended school', on a par with quadrilateral *ta-dahraʔ-a* 'he rolled (reflexive)'. A similar phenomenon is

doublets where the same prefix or name can be treated either way. For instance, the epenthetic glottal stop can be left out or not: *ʔašraf* → *šarruuf* in (21a) but *ʔayman* → *ʔaymuun* in (22a), even though the two names share the same pattern. Note the total freedom of analysis and irrelevance of sense revealed by the alternative hypocoristic form *ʔammuun*: the glide of the name *ʔayman* is ignored to the benefit of the glottal stop even though the glide belongs to the “accepted” root \sqrt{ymn} and the glottal stop is supposed to be epenthetic. Epenthetic *w* can also be treated either way: *ʔawaatīf* → *ʔaʔuuf* in (21e) versus *ʔawaahir* → *ʔawhuur* in (22a). There is a similar choice for prefixes: *m-ufiid-a* → *fadfuud* in D&Z 1999:90 versus *m-ufiid-a* → *maffuud* in (22b), and *ʔal-yaazy-a* → *yazzuuy* in (21g) versus *ʔal-yaazy-a* → *lazzuuy* in (22b). Likewise, suffixes can be either omitted or incorporated: *xalf-aan* → *xalluuf* in (21d) versus *sult-aan* → *salʔuun* in (22c). We have not come across hypocoristics treating the diminutive morpheme *-ay-* as part of the root (to parallel its exclusion from the hypocoristics in (21i–j)), but we expect a wider empirical study to uncover such data. All the data in (22) are incompatible with D&Z’s output roots and Ratcliffe’s sonority stripping since both approaches exclude epenthetic and affixal consonants.

We have just documented cases where nonroot consonants are incorporated into *CaCCuuC* hypocoristics, but we have also found instances where silent root consonants are posited and resurface in such forms.

(23)	Name	Hypocoristic	Name	Hypocoristic	Name	Hypocoristic
a.	raami	rammuuy	ʔali	ʔalluuy	šaadi	šaadduuy
	faadi	fadduuy	haadi	hadduuy	zaki	zakkuuy
b.	riima	rammuuy	muuza	mazzuuy	huda	hadduuw, hadduuy
	ʔula	ʔalluuy	hiba	habbuuy	haala	halluuy
	hala	halluuy	rana	rannuuy	huda	hadduuy
	hila	halluuy	šamma	šammuuy	lama	lammuuy
	ḏuḥa	ḏahhuuy	maha	mahhuuy	muna	mannuuy
	suha	sahhuuy	nada	nadduuy	nuha	nahhuuy
	riḏa	raḏḏuuy	rula	ralluuy	saara	sarruuy
	saža	sažžuuy	yaada	yadduuy		
c.	riima	rayyuum	diima	dayyuum		
d.	nuuf	nawwuuf	nuura	nawwuuf		

None of the hypocoristics in (23) are compatible with output roots; the observed overt glide resurfacing proves that some speakers posit abstract URs that go beyond the phonetic makeup of the source names. Some consultants exhibited overt glide resurfacing with most [i]-final names, as shown in (23a). This suggests that some speakers analyze the final vowel [i] as including /y/,

found in Classical Arabic diminutivized plurals such as *ʔuṣayḥaab* ‘friends (diminutive)’: the epenthetic glottal stop is extracted from the surface form of *ʔaṣḥaab* ‘friends’ along with the consonants of the root $\sqrt{ṣḥb}$. Within a word-based approach, Hammond (1988:254) treats such correspondences as output-to-output segmental transfer.

possibly by analogy with colloquial *nasi* ‘he who forgot’ (MSA /naasiy/ → *naasii* in (12a)).¹⁸ Likewise, some consultants exhibited the same overt glide resurfacing with some [a]-final names, as in (23b). It appears that these speakers also analyze these names as /y/-final, by analogy with /ramay-a/ → (prepausal) /ramay/ → *ramaa* ‘he threw’ in (12a). They are not guided by the URs of the homophonous words, since some of these words actually end with /w/: the word *rida* ‘acceptance, agreement, blessing’ is homophonous with the name *rida* but may be said to involve the root \sqrt{rdw} (see *riḍwaan* ‘blessings’). Only one *a*-final name (*hud-a* → *hadduw*, *hadduy*) is also treated as possibly ending in /w/, possibly by analogy with /danaw-a/ → (prepausal) /danaw/ → *danaa* ‘he came near’ in (12b). The observed preference for a final /y/ over a final /w/ may be due to insufficient data or, more likely, to a constraint (pointed out by D&Z (2001: 517, fn. 4)) leading to the avoidance of combinations of [uu] and [w].¹⁹ It is not due to any statistical predominance of /y/-final verb roots since an analysis of Chekayri and Scheer’s (2004) database reveals that 51% of Arabic glide-final roots end in /w/ while 49% end in /y/. We also see in (23c) that the names *riima* and (by now familiar) *diima* lead to the alternative forms *rayyuum* and *dayyuum* in addition to the forms *ramruum* and *damduum* reported by D&Z (1999: 84, 90) and the alternative *rammuuy* listed in (23a). The alternative forms *rayyuum* and *dayyuum* seem to be due to analyzing these URs as posited /riym-a/ and /diym-a/, by analogy with /hiyl-at/ → *hiil-a* ‘trick’ in (12a), whereas D&Z’s *ramruum* and *damduum* arise from the posited URs /riim-a/ and /diim-a/ that are more transparently faithful to the PR. These hypocoristics do not treat these two names as based on the lexical roots \sqrt{rym} and \sqrt{dwm} of their homophonous words. We expect this since our analysis does not equate homophonous names and words. Finally, (23d) shows that *nuuf* and *nuura* yield *nawwuuf* and *nawwuur*. These data again show that these hypocoristics are not built on the output roots $\sqrt{[nf]}$ and $\sqrt{[nr]}$. They also show that speakers are free to posit URs; in this case, they do so by analogy with /suwd/ → [suud] ‘black’ in (12b).

In conclusion, the data in (23) cannot be explained by means of D&Z’s output roots. On the other hand, Ratcliffe’s (2004) analysis—based as it is on sonority stripping—could account

¹⁸ One might wonder why these *CaCCuy* hypocoristics do not turn into *CaCCii* along the lines of /m-armuuy/ → *marmii* ‘thrown’. Two explanations suggest themselves. First, this could simply be due to the lack of productivity of glide-specific assimilation rules, already pointed out in footnote 8. Second, it may be that the absence of semantic networks in names makes UR-to-PR faithfulness requirements stronger on hypocoristics than they are on words.

¹⁹ We find this constraint to be strong over word-final *uw#* sequences. Evidence for it comes from the ways in which names with root-final /w/ undergo substitution when /w/ should appear as [uw] in the corresponding hypocoristics.

(i) Name	Hypocoristic	
ʔarwa	ʔarruuy	(*ʔarruuyw)
fadwa	fadduuš	(*fadduuw)
marwa	marruuš	(*marruuyw)
manwa	mannuun	(*mannuuyw; example from D&Z 1999:92)

We find this constraint to be much weaker or even nonexistent over word-medial *wuu* sequences, since the hypocoristics *nawwuur* and *nawwuuf* are acceptable to many speakers.

for (23c–d) by extracting glides from the long high vowels. It could also extract *y* from the word-final *i* in (23a) provided sonority stripping is made to apply to the MSA version of the names (which have *ii* in all cases). The data in (23b) remain unexplained in Ratcliffe’s approach as it now stands.

Neither D&Z’s output roots nor Ratcliffe’s sonority stripping can account for the four cases in (24).

(24)	Name	Hypocoristic	Name	Hypocoristic
a.	ʕayša, ʕiiša	ʕayyuuš, ʕawwuuš	šayxa, šiixa	šayyuux, šawwuux
b.	safaaʔ	saffuuy	wafaaʔ	waffuuy

The hypocoristic forms *ʕawwuuš* and *šawwuux* are not predicted under either analysis because, for D&Z, the input names do not include a [w] and, for Ratcliffe, the input names include neither a [w] nor a [uu]. Both hypocoristic forms show that speakers can go against surface forms and are free to posit any UR as long as it conforms to the rules in (12): the [ii] of *ʕiiša* and *šiixa* can be derived from a UR that includes /y/ (12a) as well as one that includes /w/ (12b). Likewise, our view of hypocoristic formation as unguided by sense predicts that some speakers can see an analogy between the word-medial [ay] of *ʕayša* and *šayxa* and the word-medial [ay] of both *xayfa* ‘scared, f.’ (dial.) (√*xwf*) and *ħayr-a* ‘confused, f.’ (dial.) (√*ħyr*). Our analysis therefore explains the variation observed in these four hypocoristic forms. Similarly, the two hypocoristics in (24b) show that speakers can go against the phonetic presence of a nonepenthetic and nonaffixal [ʔ] to posit a /y/ in accordance with rule (13d). They do not seem to posit a /w/ because the hypocoristic forms that would result from it (**saffuuw*, **waffuuw*) would violate the constraint against *uuw#* mentioned in footnote 19.

In this section, we have shown that speakers are free to venture personal guesses about what the URs of names may be. When mapping names onto the *CaCCuuC* hypocoristic pattern, speakers may proceed in one of the following ways. First, they may decompose names in a way that leaves out affixal and epenthetic material. Second, they may simply incorporate this material in a new root (see Idrissi 2001:107ff., for similar cases in Arabic verbal and nominal morphology). Third, they may assign a root to the name on the basis of the quality and position of its full vowels. This confirms that there is no equation between the meaning and structure of homophonous names and words and that the input to hypocoristic formation in Arabic is a consonantal root that is extracted from the surface form of the name, extraction being guided by morphophonological regularities rather than by morphosemantic knowledge. What is more, the freedom of the abstract analysis exhibited by the hypocoristics in (22)–(24) is incompatible with analyses based on phonetic strings (even after epenthetic and affixal consonants have been excluded). The abstractness inherent in our analysis allows us to account for the observed array of data—both hypocoristics and aphasic errors. By contrast, we believe that surface-based analyses, such as those of D&Z (2001) and Ratcliffe (2004), cannot do so because their essence is to be bound to phonetic information.

6 Conclusion

This article has pursued our research program from the point where PBI 2000 left it. We had earlier argued that ZT's aphasic errors treated the URs of Arabic and French as being of different morphemic natures. The consonants of Arabic roots were frequently metathesized while those of French roots were not. We think this empirical effect is still intractable for models of morphology that do not recognize the existence of morphemes in general and consonantal roots in particular. In the research reported here, we pursued this line of investigation by testing ZT on words based on weak roots, that is, words whose URs have traditionally been viewed as containing glides. These glides are silent in some words and audible in others. We tested ZT on words in which these glides were silent and found that they resurfaced in some errors. We argued that this demonstrates that his errors operate on underlying root morphemes rather than on fully formed words (or paradigms) or even surface strings of consonants. We extended this study to hypocoristic formation and concluded that it too shows evidence of operations on underlying root morphemes, even though ZT's errors involved meaningful words while hypocoristic formation operates on senseless names. We now turn to the implications of our findings.

We showed that, in Arabic, words and even nonwords are automatically decomposed into consonantal roots and syllabic patterns, even in the absence of related words and semantic cues. This is done through a process of root extraction that also applies to names, whether native or borrowed. The consonantal root then emerges as an independent lexical unit that can be used to form simple words in the input-to-output fashion illustrated in the first part of (25), as in the combination of \sqrt{ktb} and *CaaCiC* to form *kaatib* 'writer, writing'. More complex words may be formed in an output-to-output fashion from such words, as in the second part of (25), by means of apophony and/or mapping of a stem onto a template, as in *kaatib* 'writer' \rightarrow *kuttaab* 'writers' (see Idrissi 1997:133), or by mere affixation, as in *kaatib* 'writing' \rightarrow *kaatib-uun* 'writing (pl.)'.

(25) root \rightarrow word 1 \rightarrow word 2

We suggest that the first part of (25) is to be privileged unless there are specific reasons to opt for the second part, a division of labor that defines a rich area of investigation. Examples of mixed approaches are expounded in Bolozky 1999 and Arad 2003 for Hebrew, Idrissi 2001 for Arabic and Berber, and S. Rose 2003 for Ethiopian Semitic.

Surface-based approaches dispensing with lexical roots altogether must account for the external evidence discussed here. They also face at least two other challenges, one posed by the source word and the other by abstract root segments. It has often been pointed out (e.g., in Idrissi 2001, Prunet 2006:45, and references therein) that attempting to do away with Semitic roots requires the often arbitrary—and sometimes impossible—choice of an input (word 1), an output (word 2), and a direction (word 1 \rightarrow word 2). There are also numerous arguments for abstract root segments in Semitic that appear to be intractable for surface-based approaches (e.g., in Brame 1972 for Maltese Arabic, and in Marcos 1974, Bender and Fulass 1978, Voigt 1981, Podolsky 1991, S. Rose 1992, Lowenstamm 1996, Prunet 1996a,b, 1998, Banksira 2000, and Chamora and Hetzron 2000 for Ethiopian Semitic). These studies document various violations of the biunique-

ness condition—that is, instances where URs and PRs cannot be uniquely recovered from each other (Idsardi 2006)—in the segmental makeup of Semitic roots.

The other implication of our study is that phonology must allow for abstract representations. In this respect, our work joins a rich tradition in generative phonology. We believe that morphemes, just like phonemes (see Sapir 1933), are mental, cognitive units, and as such can only be abstract and need not—and, strictly speaking, cannot—be isomorphic with their allomorphs. We also concur with recent studies such as Scheer 2004 on phonological representations, LaCharité and Paradis 2005 on borrowings, and Y. Rose 2003 on the acquisition of phonology, which all point to the inadequacies of models that put the burden of analysis solely on surface forms.

Our attempt to find evidence for the abstract nature of Arabic roots led us to examine new aphasic errors. It also led us to explore hypocoristics, to understand the lack of glide resurfacing they have been claimed to display. The results of our empirical investigations of aphasic errors and hypocoristics bear out our predictions. It would be fruitful at this stage to extend the types of evidence discussed here and elsewhere to studying the templates of Arabic, which are even less understood than its roots.

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