The roots of language

Mark Aronoff

Stony Brook University

1   Introduction

In this article, I will try to cast light from several angles on the term *root* as it is used in current morphological theory and on the various notions that the term embodies. I will contrast two very different broad types of morphological theories that traffic in roots, which I will term *root-based* and *lexeme-based* theories. In root-based theories, morphological structure is built up from meaningful simplex roots. In lexeme-based theories, the starting point of morphological structure is lexemes, which are meaningful but need not be simplex; in this type of theory, roots may be part of morphological structure, but they play a less central role and their relation to meaning is more complex.

From a very general point of view, the major difference between the two lies in esthetics. Root-based theories value reduction and perfection highly, both as analytical strategies and as esthetic desiderata. For these theories, it is highly desirable on esthetics grounds that the basic lexical elements of language be simplex signs. Lexeme-based theories give both these considerations much less privileged places in both theory and practice, so that it does not much matter whether the

ultimate units of language are simplex signs or not. The apparent fact that simplex

signs do not occupy a place of honor is interesting, but not surprising.

As exemplars of the two types of treatments of roots, I have chosen to

contrast distributed morphology, because it is the most widely discussed root-based

theory, with my own work, especially as exemplified in Aronoff (1994). Distributed

morphology has been around for some twenty years in a variety of slightly different

incarnations. I will try to confine myself to the version presented in Halle and

Marantz (1993), the locus classicus of the theory, but much of what I have to say

applies more broadly.

My prejudices are well known, so it should not be surprising that I come

down on the side of lexeme-based theories.   My goal, though, is not simply to

excoriate root-base morphology, but to understand its motivation and sources. In

the first part of this article, I will explore how roots have been treated in modern

linguistics, from both perspectives.   In the second part, which is more substantive in

many ways, I will take a longer perspective and look at the development of the

treatment of roots in the grammatical traditions surrounding the two languages

where roots have figured most prominently: Arabic and Hebrew. I began

researching this question under the assumption that the origins of the grammatical

theory of roots lay in the Arabic tradition, but I have concluded that it is not obvious

that the root as we understand it today was isolated as a distinct entity by the early

Arabic grammarians. Instead, it is only in the tradition of Hebrew grammar (itself a

somewhat late historical offshoot of Arabic grammar) that we can conclude

unequivocally that the root assumed the theoretical role that most linguists have

assigned to it. In the last part of the article, I will look at the evidence for roots in modern-day Semitic languages from more empirically oriented approaches: neurolinguistics, experimental psycholinguistics, and first language acquisition. I will show that this evidence comes down on the side of lexeme-based theories of morphological roots.

Overall, my aim is to show that roots are real linguistic entities but that there is no point in assuming that all instances of a given root have the same meaning in any language, that roots are semantically invariant. Roots are part of the autonomous morphological system of a language and what is special about Arabic and Hebrew are the obligatory templates for verbs, not the roots. Overall, this conclusion should not be surprising.

The idea that roots are semantically invariant is old and grows out of a grammatical tradition whose object of study was, in the eyes of its practitioners, the sacred language of the first known divinely-inspired book, the Old Testament and even more specifically the Pentateuch. It should not be surprising that students of such a language might want to treat it as a perfect system. This tradition persisted into the nineteenth century in such fanciful ideas as those of Fabre D'Olivet (1815-1816), who believed that not only Biblical Hebrew roots but the Hebrew letters themselves had invariant meanings, a view that greatly influenced Benjamin Lee Whorf's work on inner meaning. What should surprise us is the persistence of such beliefs when considering the languages of humans rather than God.

2   Controversies

The discussion of roots has generated as much heat as it has light over the last twenty years. But hot debate among grammarians is nothing new. William Chomsky, in his book on David Kimḥi's grammar of Hebrew, tells the following story about a pair of medieval grammarians:

> The versatile and brilliant statesman, soldier, and poet, Samuel ha-Nagid (11th century) found time amidst his multifarious duties and occupations to engage in verbal clashes on grammatical issues with the profound grammarian Ibn Janah and to write, according to Ibn Ezra's testimony, twenty-two books of "supreme quality" (v'eyn lm'alah mimenu) on Hebrew grammar. . . The grammatical controversy between Ibn Janah and Samuel ha-Nagid is recounted at some length in the writings of some of the medieval Hebrew grammarians. Samuel ha-Nagid apparently aroused by Ibn Janah's criticism of some of the views of his teacher, Yehudah Hayyuj, sent a messenger from Granada to Saragossa, the place of Ibn Janah's residence, charged with the task of challenging Ibn Janah to a verbal duel on certain grammatical issues and of exposing publicly the "fallacy" of his theories. On his arrival in Saragossa, the messenger stayed at the home of a communal leader in that city, named Abu Soleiman ben Taraka, a friend of Ibn Janah. A public reception was arranged in honor of the visitor, to which Ibn Janah was invited. The latter, without suspecting the chief purpose of the gathering, accepted

the invitation. During the reception, the visitor began to inveigle Ibn

Janah gradually and subtly into a discussion. Some of the questions

raised by him were readily disposed of and adequately answered by

Ibn Janah. But others followed, and Ibn Janah, unprepared for this

barrage of questions, was befuddled, and he promised to reply at

some future time. He did so and sent his reply to the visitor. The

latter, however, superciliously remarked that it would be wiser for

Ibn Janah to withhold his reply until the Nagid's book was published,

where he would find even more serious criticisms leveled against him.

This Ibn Janah refused to do. He issued his reply in book form and

called it *Kitab at-Taswiya*. After the publication of the Nagid's attack

on him Ibn Janah retorted with a violent counter-attack in a book,

which he called *Kitab al-Tashwir*. Ibn Janah was very proud of this

book, and he frequently referred to it in glowing terms, but,

unfortunately, only a fragment of it is now extant. (Chomsky 1952 xv

– xvii).

Similar tales are told about the Arabic grammarians from a much earlier time.

Kūfa and Baṣra are two cities in Southern Iraq founded by early Muslims,

acknowledged to have been the intellectual centers of early Islam. The city names

came to represent two schools of Arabic grammar, with the Kūfan school being in

the minority. The two schools differed on, among other matters, whether the

maṣdar verbal noun was the *ʔaṣl* (base) of the verb or vice-versa. The battle raged

for centuries, though the Baṣrans are generally acknowledged to have won in the end.

Plus ça change, plus, c'est la même chose. The battle between DM'ers and their opponents has raged with equal ferocity over the last two decades.   Here is a small sample of the invective in Marantz 1997:

This paper brings the reader the following news: Lexicalism is dead, deceased, demised, no more, passed on… The underlying suspicion was wrong and the leading idea didn't work out. This failure is not generally known because no one listens to morphologists. Everyone who has worked on the issues of domains — what are the domains for "lexical phonological rules", what are the domains of "special meanings", what are the domains of apparently special structure/meaning correspondences — knows that these domains don't coincide in the "word" and in fact don't correlate (exactly) with each other. But the people that work on word-sized domains are morphologists, and when morphologists talk, linguists nap. (p. 202)

Marantz's opponents are more polite, but no less damning. Here are a few samples from Williams (2007):

These awkwardnesses all stem from the idea that idiomatic meanings can all be fixed on the "roots" that occur in the idiom, and not on the idiom itself; and that stems from the decision that the lexicon(s) in DM do not list any derived forms, and that in turn stems from the decision that morphemes are the sole units of insertion. (p. 360)

As DM stands, all applications of the Pāṇinian principle which are not morpheme vs. morpheme contests must be recast as one or another kind of rule of special allomorphy, turning gold into clay. (p. 364)

There is no reason to accept any part of Marantz's analysis of nominalization. (p. 367)

3   Roots in modern morphological theory

3.1   Roots and the intellectual sources of DM

Meaningful roots are central to DM. Marantz (1997) proclaims that "Things with special meanings are roots" (p. 212 – 213). The source of DM's insistence on the centrality of roots lies in the linguistic ideas of Roman Jakobson. Jakobson was a staunch reductionist who was strongly influenced by the successes of physics in the early 20th century and believed that linguistics consisted mainly of removing the surface variance of languages to reveal the underlying invariance. Jakobson admired Baudouin de Courtenay and Kruszewski for their work on invariance, which he often argued to be the main source of modern synchronic linguistics.[1] Jakobson applied this esthetic of invariance most fully and famously to his analysis of Russian nominal cases, in which the various meanings and uses of each case were reduced to a single abstract meaning (Jakobson 1971a).

Classic generative phonology was most centrally an attempt to apply a radical version of Jakobsonian invariance to sound systems. Its goal was to reduce the linguistic signifiers of a language to an underlying level at which there was a one-to-

one correspondence between the forms and meanings of simple signs. The DM notion of the root is a direct outgrowth of this Jakobsonian vision of languages: lexical items should be reduced to roots and each root should have a single form and a single meaning at some underlying level.

I have found no mention of roots in Chomsky and Halle 1968 (SPE), the great masterwork of classic generative phonology, not surprising, since SPE makes no theoretical distinction between morphology (where roots reside) and syntax. The internal structure of a word like *theatr-ical-ity* is not provided by morphology but by syntax, in the form of a bracketed phrase structure tree to which the rules of phonology apply cyclically, with the cycles determined by the tree structure. There is implicit morphology distinct from syntax in SPE, though. The affixes in this same word *theatricality*, for example, are provided with internal morphological structure: *ic+al* and *i+ty*. In a footnote, the analysis of *i+ty* is said to be "well motivated on morphological grounds" (p. 33), based on the existence of the noun-forming affix –*ty* and such sets as *sanctity-sanctify-sanctitude* and *clarity-clarify*, although it is noted in the next footnote that this analysis of *ity* is not required by the phonology.

SPE makes use of the term and notion *stem*. For example, the *dox* of *orthodox* and the *graph* of *photograph* are labeled as stems and given their own (initial) cycle. Elsewhere, in particular in the analysis of Latinate verbs of the form "prefix-stem" such as *permit*, *transfer*, and *compel*, the authors do not give the stem its own cycle, marking this particular construction by the famous = boundary (which is identified formally as neither a formative boundary nor a word boundary). In conclusion, nowhere that I can find does SPE use the term *root*; and though *stem* occurs in SPE it

seems to be used by and large for bound stems, and apparently those without much semantic content.

The DM distinction between a list of roots and a list of words can be traced directly to Halle (1973). Halle uses the term *root* on the second page of this article, noting that "the list [of morphemes] must include not only verbal, nominal, and adjectival roots but also affixes of various sorts" (p. 4). One of the main points of this article is to provide an account for the fact that not all possible words actually occur, and those that do occur are often idiosyncratic in form or meaning. Halle encodes these idiosyncrasies by means of a dictionary that he characterizes as a filter:

> I propose that idiosyncrasies of the type just illustrated be listed in a
> special filter through which the words have to pass after they have
> been generated by the word formation rules. The special information
> given in the filter under each entry is then added to the
> representation of the word. In the case of semantic idiosyncrasies
> such as those exemplified by the special meaning of nouns like *recital*
> and *transmittal* the filter would supply the appropriate indications
> about their semantics. In the case of phonological idiosyncrasies like
> those exhibited by nouns like *obesity*, the filter would supply the
> information that the noun in question is not subject to the Trisyllabic
> Shortening Rule, or, more formally, would supply the noun with the
> feature [- Trisyllabic Shorten-ing Rule]. Finally, "gaps" in the
> dictionary . . . would be accounted for by providing the "missing"

words with the rule feature [- Lexical Insertion]. In other words, the

fact that English lacks the nouns *derival* and *arrivation* would be

reflected in the grammar by marking these words, which would be

generated by the word formation rules, as not being subject to lexical

insertion and therefore incapable of appearing in any actual sentence

of the language, in spite of the fact that they are neither semantically

nor syntactically or phonologically anomalous. (Halle 1973, p. 5)

In other words, I am proposing that the list of morphemes together

with the rules of word formation define the set of potential words of

the language. It is the filter and the information that is contained

therein which turn this larger set into the smaller subset of actual

words. This set of actually occurring words will be called the

dictionary of the language. (Halle 1973, p. 6)

Lexical insertion, within this framework, selects fully inflected words from

this dictionary.[2] Researchers outside DM have not pursued the idea that the

dictionary is a filter, because it is difficult to understand what Halle meant by the

term *filter*. Are the dictionary entries the words that make it through the "exception

filter" or the ones that remain behind, are filtered out? The filter cannot be uniform

in texture in any sense, as normal filters are, because it singles out the words that

actually occur, which presumably comprise some sort of list. Furthermore, the filter

provides some of these words, at least, with additional information that the rules of

word formation do not provide.   Overall, the relation among the dictionary, the

filter, and the morphemes is not at all clear in this framework, which is admittedly not meant to be more than a prolegomenon.

DM makes use of another traditional term, *morpheme*, albeit in a very untraditional way. For DM, morphemes are not signs, sound/meaning pairs, but rather "terminal elements of the trees [that] consist of complexes of grammatical features", which "are supplied with phonological features only after Vocabulary insertion at M[orphological]S[tructure] (Halle and Marantz 1993, p. 114). In other words, what they call morphemes are what most others call morphosyntactic features or properties or values and what the call Vocabulary insertion (or "the addition of phonological material" (p. 131) is what others call morphological realization.[3] But Vocabulary insertion does more: "In addition to phonological features, Vocabulary insertion supplies morphological features that signal idiosyncratic properties of specific Vocabulary items" (p. 136).

Nowhere do Halle and Marantz discuss the term *root* in their 1993 paper. As far as I can tell, roots are introduced into DM by Marantz (1997), who "explodes the Lexicon and includes a number of distributed, non-computational lists as Lexicon-replacements" (p. 203). The first list of three, which he calls the "narrow lexicon" "contains the atomic roots of the language and the atomic bundles of grammatical features" (p. 203). The second list is the Vocabulary of Halle and Marantz, i.e. morphological realization or spell-out. The third list is Halle's dictionary redux under another name: "Encyclopedia – the list of special meanings. The Encyclopedia lists the special meanings of particular roots, relative to the syntactic context of the

roots, within local domains" (204) and includes not only words but also all idiomatic expressions. In short, it is a Bloomfieldian lexicon of idiosyncratic complex items.

I won't speculate as to why DM plays so fast and loose with traditional terminology, here conflating *dictionary* and *encyclopedia,* elsewhere *morpheme* and morphosyntactic feature value. The problem in this instance is that there is a well-established dichotomy in lexicology between the two terms at issue here, which is lost by calling one the other: a **dictionary** is a list of words: a dictionary definition contains only what is necessary to distinguish one word from another; while an **encyclopedia** is about concepts and things: its entries contains all that there is to know about the entity named in each.   Contrast the *Oxford English Dictionary* of 1928 with the *Encyclopedia Britannica* of 1911. The first sought to include everything there was to know about the words of English. The other sought to include everything there was to know about everything besides the words of English. The DM Encyclopedia is not an encyclopedia, but instead a dictionary, in fact a direct descendant of Halle's dictionary, a Bloomfield lexicon of 'idioms', irregular entities, including words and phrases. But within a theory that wishes to give words no special place, there can be no dictionary of words, and so the former dictionary is now called an encyclopedia, even though it is not one, or at least this is the only explanation I can provide for the peculiar use of terminology here.

Which brings us back to roots.   Roots in DM are mysterious objects. They have no phonological form, at least not at first, since they only receive form at the point of Vocabulary insertion and they are also subject to readjustment rules, but they do bear meaning: "Things with special meanings are roots" (Marantz 1997, p.

212 – 213). As Williams notes (2007), for DM'ers, it is not the case that what DM calls idioms have idiosyncratic meaning, but rather that the roots have idiosyncratic meanings in the context of individual expressions (idioms). DM roots are apparently not just abstract meaning bearing elements, but rather the only true bearers of lexical meaning. In a way, they are like lexemes, except for being simplex (Aronoff 1994). And, as Williams argues, it is this claim about simplex roots bearing meaning that brings DM to grief.

But why make such a claim, especially when the existence of the "Encyclopedia" makes the claim empirically empty, given that roots can have "special contextual meanings" (p. 213)? The answer is that DM is a last-ditch attempt to preserve the vision of Jakobsonian invariance of elementary signs in the form of roots. From a signifier point of view, DM abandons this invariance to Vocabulary insertion, but it apparently cannot go so far as to abandon the signified side and so resorts to the artifice of supplying roots with abstract meanings that are then somehow molded in context by means of the Encyclopedia. The upshot is that DM roots, in truth, have neither constant form nor constant meaning.

3.2   Roots within lexeme-based morphology

On May 29, 2011, Simon Winchester published a piece in *The New York Times* on the three "most complex" verbs in the English language: *set, put,* and *run*. The last has now assumed top position as the verb in the *Oxford English Dictionary* with the most senses: 645 according to the official OED count. I will not attempt to prove that

none of these 645 can be reduced to any other one, but consider just a few, listed in

(1):

   a) He ran the table

   b) The trains run between Jerusalem and Tel Aviv (ambiguous)

   c) Run a bath

   d) Run before the wind (of a sailboat)

   e) Overrun

   f) Run over

   g) Run a seam

   h) Run up a bill vs. run up a hill

   i) Run someone through with a sword

Within a lexeme-based theory, each of the however many distinct senses of

run we finally decide there are is a separate lexeme with its own meaning. And here

is where the concept of root becomes useful. All these distinct senses share the same

three idiosyncratic forms: *run, ran, run* (the last two forming the past tense and past

participle). Within a lexeme-based theory, we say that all three share a single

abstract root √RUN. √RUN does not have a constant sense, because it occurs in all

these distinct lexemes; nor does it have a constant form. But all these lexemes share

this single root, because they all vary in the same way under the same

morphological conditions. Within lexeme-based theory, then, a root is a purely

abstract morphological entity, a morphome. I suspect that the same is true in DM.

This analysis extends to all highly frequent irregular root/lexemes in all

languages, which show the same consistent irregularity across multiple senses. In

(2), I have provided a list of the most common English irregular verbs in rank frequency order:

2) BE, HAVE, DO, SAY, GET, MAKE, GO, KNOW, TAKE, SEE, COME, THINK, GIVE, FIND, TELL, FEEL, LEAVE

Just like √RUN, all of these verbs are highly polysemous and not one of them has a regularized analog. We therefore say in a lexeme-based theory that each of these irregular verbs is a root that occurs in a large number of homophonous lexemes. We can also now understand how polysemy and homophony apply within such a theory: the roots are polysemous (inasmuch as they each occur in many lexemes), but the lexemes are homophonous (inasmuch as they share a single root).

4   The origins of roots in Semitic grammatical study

I will now explore the historical origins the idea of roots through a brief survey of the earliest works on Semitic morphology and of the received tradition that has persisted to this day in both the Arabic and Hebrew grammatical traditions. My goal is to understand what the traditional views of Semitic morphology were, how they have developed up to the current time, and to then use these views, in the final section of this article, as an aid to understanding what Semitic verb morphology is really like. The main conclusion of this section will be that Arabic grammar operated on roots but did not recognize them as a special category separate from other "bases". The isolation of the root as a distinct concept began in early Hebrew grammar shortly after the turn of the millennium and hundreds of years after the establishment of the Arabic tradition.

4.1 Arabic dictionaries

The first significant linguistic work on Arabic was a dictionary, *Kitāb al-ʕayn* 'the book of ʕayn', by al-Khalīl ibn ʔAhmad al Basrī (718 – 791 CE), who lived in the century following the founding of Islam. Al-Khālil used an Indian-style order for the letters of the Arabic alphabet, starting at the letter representing the farthest point back in the vocal tract, which is pharyngeal ʕayn, and ending at the furthest point forward, which is aleph. Al-Khalīl aimed at a comprehensive Arabic lexicon, though he never got past the first letter, hence the title of the book. His method was to put into one entry all words with the same root. He then grouped together all occurring roots that are permutations of the same set of consonants. So, all k-t-b words are grouped together, but then this root is grouped with all occurring permutations of these three consonants. The fact that the dictionary was organized around roots, as were all subsequent dictionaries of Arabic and other Semitic languages, is a *prima facie* argument for the value of roots in describing Semitic languages. The fact that roots sharing the same consonants were grouped together, regardless of order, is an indication that al-Khālil was concerned largely with form.

Homophonous roots were grouped together in one entry, as in the following partial entry for ʕ-sh-q from al-Azhari's (d. 981) *Tahdhīb*, a later lexicon in the same tradition:

Abūl-Abbās Aḥmad ibn Yahyā was asked whether love or passion is more praiseworthy. He said: "love, because passion includes a degree of exaggeration". Ibn-al 'Aʕrābī said "ʕushuq are the men who trim the sets of sweet smelling plants; when said of a camel, ʕushuq means one

that keeps to its mate and does not desire any other". He said: "ʕashaq

is the lablab-tree; the singular is ʕashaqa". He said: "ʕashaq is also the

arak-tree. An ʕashiq 'lover' is called thus because he withers from the

intensity of his passion in the same way as the ʕashaqa 'lablab-tree'

when it is cut." (Tahdhīb I, p. 170, from Versteegh 1997, p. 30)

Dictionaries of Arabic ever since have been arranged by the forms of roots,

not their meanings. All senses of a given root are listed together. The Wehr/Cowan

Dictionary of Modern Written Arabic (1971) lists the numbered senses listed in (3),

among others, under the verb entry *najada* for the root *njd* (where verb measures

are in bold). Essentially synonymous definitions are separated by commas;

semicolons separate the major senses.   Nouns derived from the same root are listed

in (4.)

3) **I:** to, help, aid, assist, support; to sweat, perspire;

   II: to furnish, upholster; to comb, card, tease (cotton);

   III: to travel in the highlands (of Arabia);

   X: to ask for help, seek aid; to take liberties, make bold

4) highland, upland, tableland, plateau; help, aid, succor; emergency, crisis,

   trouble, difficulty, distress, calamity; courage bravery, intrepidity,

   undauntedness; sword belt; upholsterer; upholsterer's trade; upholstery

   work; upholstery

Cowell (2005) remarks about Arabic dictionaries in general:

Words with the same root commonly have related meanings . . .

There are countless exceptions however. In Arabic

dictionaries, for instance, which are alphabetized by roots –

not by bases as Western dictionaries are – "homonymous roots"

are sometimes entered separately . . . This policy has never

been consistently carried out, however; the more usual type of

entry is the purely "formal" roots, whose sub-entries may

include words of various word-families, arranged without

regard to meaning.

It is often difficult, if not impossible, to decide without

arbitrariness whether two words with the same (formal) root

have "related meanings" or not. The use of etymology to

resolve some of these difficulties only makes the concept of

'root' still more ambiguous. (Cowell 2005, p. 36 – 38)

4.2   The influence of The Greek grammatical tradition on Arabic grammar

Versteegh (1977) has demonstrated that the Greek grammatical tradition is a major

source for Arabic grammar, to some extent indirectly through Syriac, the Aramaic

language in which many of the writings of the early Church fathers were composed,

at a time when early Christians and early Muslims lived side by side. Some of his

strongest evidence comes from terminology, where we can sometimes see a direct

chain from Greek through Syriac to Arabic and even further to Hebrew. The terms

for verbs with two arguments, for example, are remarkably similar in meaning in all

these traditions, as well as in Latin grammar. All are calques on the Greek word meaning 'going across', as shown in (5):

5) Greek   diabas   'going across'

     Latin   transitivus   'going across, passing over'

     Syriac   mʃannya:ni: 'moved away'

     Arabic   muta'addi   'crossing'

     Hebrew   yoceʔ   'going out'

     Hebrew   mitʕabber   'crossing over'

Versteegh provides more extensive evidence for the intellectual continuity among the Greek, Syriac, and Arabic grammatical traditions, which I cannot rehearse here. But his claim makes eminent sense, given other well-known continuities between the Greek and Islamic intellectual tradition.

4.3   The Arabic morphological tradition

Sībawayhi (Abū Bišr ʿAmr ibn ʿUṯmān ibn Qanbar Sībawayhi) is generally considered to be the author of the first book on Arabic grammar. He studied Arabic grammar in Basra, at about the time that al-Khalīl was writing his dictionary in the same city, and died about 796 CE, soon after al-Khalīl. He wrote one book, known as *Kitāb Sībawayhi*, often called simply *The Kitāb*, a grammar of Bedouin Arabic, which is generally regarded as the founding work of Classical Arabic grammar.[4] He often refers to al-Khālil. All subsequent traditional grammars of Arabic fall within the template of the Kitāb.

The *Kitāb* and subsequent traditional Arabic grammars are divided into two parts. The first part is devoted to syntax: parts of speech (noun, verb, particle) and their distribution, and includes inflection. The second part is devoted to the forms of words: morphology and morphophonology. The coverage of morphology is exhaustive. According to Carter (2004, p. 100), within this tradition "The word is formed from a combination of its roots consonants (called *ʔaṣl*, lit. 'trunk or base', hence 'radical') and the pattern (*wazn*, lit. 'measure' or *bināʔ*, lit. 'structure, building'), in which those consonants are embedded." Each *bināʔ* gets its name from the third person masculine past tense form of the verb in that *bināʔ,* using the root f-ʕ-l, e.g. faʕala.

In traditional Arabic morphology, however, derivation does not operates directly from the consonantal root, as it does in traditional Hebrew grammar, but *de mot à mot* 'from word to word' (Bohas 1984). This type of word-based derivation makes sense if we assume the influence of the Greek and Syriac grammatical traditions, which were strictly word-and-paradigm and admitted of no morphemes. Thus, one word form is said to be the *ʔaṣl* of another, as follows:[5]

The maṣdar is the initial form of the verb

The maṣdar is the *ʔaṣl* of the past form of the verb

The past form of the verb is the *ʔaṣl* of the present

The present form is the *ʔaṣl* of the imperative

In short, traditional Arabic morphology is not root-based in the modern sense. Each form in a derivation was regarded as the base (*ʔaṣl*) of the next and there was no distinct term for the consonantal root as opposed to other bases. Yes, dictionaries

from the start were organized around consonantal roots, but homophonous roots with different senses were never systematically distinguished.

4.4   The Hebrew morphological tradition

The first grammarians of Hebrew lived in the Golden Age of Jewish culture in Arab Iberia, Al-Andalus, from about the 10th to the 12th centuries, centered around Cordoba. The earliest Hebrew grammarians were clearly influenced greatly by the Arabic grammatical tradition. Hebrew grammar as we know it was later codified by the members of the Kimḥi family, who lived in Provence, much further north. The *Michlol* of David Kimḥi (1160-1235) (Chomsky 1952) is the best known of their works. Kimḥi also wrote a dictionary, called *Sefer Hashorashim* 'the book of roots'. Traditional Hebrew grammar after Kimḥi largely lost contact with Arabic grammar, due in part to the fall of Muslim Andalusia to the Christians in 1236. Later Hebrew grammarians consequently had little knowledge of Arabic or the Arabic grammatical tradition.

Traditional Hebrew morphology is resolutely root-based. The names of the radicals are identical to those used in Arabic grammar, the three letters p, ʕ, l from the verb 'do, work', demonstrating clearly the Arabic origins of the tradition. But a special term *ʃɔrɛʃ* 'root' is used in Hebrew grammar to mean **only** the consonantal root of a verb or noun, which may consist of two, three, or four radicals.[6] There is no equivalent term in Arabic grammar and no Hebrew term equivalent to the Arabic *ʔaṣl* 'base, source', which has a much wider use, as we saw in the last section.

It is likely that the Western grammatical term *root* is a calque of the Hebrew grammatical term. Of the four earliest citations of the English word *root* in this

sense in OED, three refer to Hebrew. Furthermore, only Hebrew grammar, not

Arabic grammar, had a distinct term that referred just to the root, and Western

Christian grammarians had little or no contact with the Arabic tradition, although

some did know Hebrew well because of the sacred nature of the Old Testament. The

Old Testament books of the King James Bible, for example, were translated directly

from the Hebrew original.

In traditional Hebrew grammar, words are not derived from one another in

the word-and-paradigm manner used in Arabic grammar and its precursors.

Instead, words are derived by putting a root into a *binyan* 'structure' for verbs and a

miʃkal 'weight' for nouns.[7] Hebrew grammar traditionally recognizes seven verb

binyanim in which roots can occur and a larger number of noun *miʃkalim*. Each

binyan is said to have a meaning or syntactic function. The meanings of the *miʃkalim*

are not given as large a role. The term used for binyan in traditional Western

grammars of Hebrew (e.g. Gesenius/Kautzch/Cooley 1910) is *conjugation*. One

binyan is termed *qal* 'simple'. It is equivalent to the *bināʔ aṣliyya* 'root structure' of

Arabic grammar and is similarly not named by its form. All others have names

corresponding to the third person singular past tense, as in Arabic, called the *ground*

form by Gesenius/Kautzch/Cooley (cf. German *Grundform*).

In traditional Hebrew grammar, a binyan is not a pattern or template, terms

that have been used recently. The literal translation is 'structure' but *conjugation* is

used in English, because binyanim are treated like conjugations in traditional

Hebrew grammar, with full paradigms provided for each. For some binyanim it is

possible to argue that there is one pattern/template or ground form or principal

part. For other binyanim, most prominently *qal* and *nifʔal*, there are at least two principal parts in the paradigm. For *qal*, there are also subconjugations, mostly vowel-driven, similar in spirit to the subconjugations of the Latin third conjugation, with and without the theme vowel *i.*

4.5   Form and meaning in Hebrew morphology

In traditional Hebrew morphology, each roots is said to have a constant meaning and each binyan is said to embody a constant syntactic type, defined largely in terms of argument structure. The meaning of an uninflected verb (lexeme) is composed of the meaning of its root and the syntactic type of its binyan. In fact, little of this is cashed out in practice. Consider first the binyan system. First, the syntactic types of only three of the seven binyanim are reliable. *Puʕal* and *hofʕal* are more or less restricted to being passives of *piʕel* and *hifʕil* respectively, and have always been fairly marginal. Of the five major binyanim, *hitpaʕʕel* is the only truly reliable one, being almost always reflexive. Of the remaining four, *Hifʕil* is the most reliable, being usually causative, while *piʕʕel* is frequently 'intensive', not a structural type (though see the discussion of Doron below) and is also used with all quadriliteral verbs, regardless of meaning, a usage that is clearly driven by phonological factors. *Qal* embodies no syntactic type (it is basic). *Nifʕal* is usually intransitive but sometimes the passive of *qal,* which surprisingly has no regular passive, though it is the most common binyan. Overall, there are many verbs whose binyan must be listed lexically. For example, *hitpaʕʕel* verbs include *hitpallel* 'pray', *histakel* 'look' and *hiʃtameʃ* 'use'. Berman (1978, ch.3) provides a summary of the nuances of the binyan system in Modern Israeli Hebrew. Her conclusion is that the traditional

treatment is incompatible with the facts of Hebrew. Instead, "each binyan can be said to have certain salient or 'unmarked' properties" (ibid. p. 93), with many verb senses listed lexically.

Much less reliable are the roots. No root occurs in every binyan, let alone every nominal mishkal. And, as I have discussed at length elsewhere (Aronoff 2007), many roots have quite distinct senses when they occur in different binyanim. Overall, Hebrew roots are very similar to English strong verb roots. None may be quite so polysemous as *run*, but what unites all the uses of a given root is its participation in the morphology of the language, not its semantics.

Hebrew (and all Semitic languages) has what are called weak roots, which are completely analogous to the strong verbs of Germanic. As I demonstrated at length in Aronoff 2007, these verb roots, like the Germanic strong verbs of English, can be placed into subclasses, according to their alternations. For example, there is a class of roots that we may call *missing n-initial*. The members of this class consist of a subset of the roots whose initial consonant is /n/, along with several roots whose initial consonant is /j/, and one with initial /l/. These form an inflectional class because they all lose their initial root consonant under certain circumstances, while regular roots with these same initial consonants do not. Semantics is irrelevant, just as it is with Germanic strong verbs in English.

All Semitic languages investigated to date, except to some extent for Maltese (Hoberman and Aronoff 2003), exhibit almost exceptionless root-and-binyan verbal morphology, just as with any other system of verb conjugations (e.g. Latin). Roots and binyanim are morphological entities first and foremost. The difference in the

obligatoriness of patterns between verbs and nouns may lie in the fact that verbs are inflected in all Semitic languages, while nouns are not always. Overall, though, neither the verb roots nor the binyanim have constant meaning in any Semitic language so far investigated, despite or perhaps because of the robustness of the inflectional patterns.

4.6   A modern analysis: Doron on Israeli Hebrew binyanim

Doron 2003 makes an excellent case for the semantic value of the 'derived' binyanim in Israeli Hebrew (those other than *qal*). But Doron admits that many individual verbs are idiosyncratic. Overall, her analysis supports a theory in which certain binyanim may be used productively as part of the derivational morphology of the language, while simultaneously serving as inflectional classes:

> All the meaning contrasts discussed above are achieved by the pairing
>
> of equi-rooted verbs [two or more verbs with the same root]. On the
>
> other hand, when a single verb is derived from a root, i.e. when the
>
> verb is not paired with another equi-rooted verb, then the
>
> contribution of the template is more erratic. Even then, a lot of
>
> systematicity can be shown to exist if one also takes into account equi-
>
> rooted nouns and adjectives. But when no contrast whatsoever is
>
> expressed by the choice of morphology, then, as often as not, the
>
> template is arbitrary. For example, verbs such as *listen*, *climb*, or *urge*,
>
> are not semantically causative, despite their derivation by the
>
> causative template; neither do *perfume, end,* or *disperse* necessarily

denote actions, despite their derivation by the intensive template.   (P. 23)

The semantics of the templates only reveals itself when the choice of template is paradigmatic rather than idiosyncratic.   (pp. 24-25).

It is well known that derivational morphology allows a certain amount of deviation from compositional meaning. . . .Many intensive verbs are associated with rich encyclopedic knowledge. . . .Crucially, templates can be specified to have marked features in the environment of certain roots. . . Therefore, idiosyncratic verb have listed templates. The templates of these verbs are completely uninformative -- that is, the form/meaning correspondence is rendered as opaque as in the more familiar languages with poorer morphology. (p. 38)

Doron's account is very similar to that of Cowell (2005) for Syrian Arabic, where a change in binyan is treated as a form of derivational morphology or word formation: each derivational process has a syntactic and semantic effect that is expressed through a change in binyan, but the binyanim have no constant meaning outside their use in derivational morphology. This type of account fits easily into any framework that distinguishes degrees of productivity in derivational morphology, e.g. Aronoff 1976. The idea that assignment to conjugation class can be part of derivational morphology is discussed in detail in Aronoff 1994, for both Israeli Hebrew and other languages, especially Latin. For example, the Latin

intensive verb is formed by taking the past participle stem of a verb, e.g. *canere-* 'sing', whose past participle stem is *cant-*, and using it to form a verb of the first (-a:) conjugation: *cantare*. The desiderative verb suffix *ur-*, by contrast, forms verbs of the fourth (-i:) conjugation (as in *e:suri:re*) from *e:dere* 'eat'. Just like Latin conjugations, Hebrew (and Arabic) binyanim have no predictable meaning except when used to form new words. This is what lies behind Doron's observation about verbs that are "not paired with another equi-rooted verb" being idiosyncratic. A root that occurs in only one word is a type of *hapax legomenon*, for which no meaning can be reliably assigned outside that one word. Doron frames her account in terms of DM. But in fact, nothing in Doron's account particularly supports DM over other theories and there is much in it that quite directly supports the observation that binyanim are inflectional classes that have been co-opted for purposes of derivational morphology, which goes as far back as at least Kuryłowicz (1962).

5   Findings from outside pure linguistic analysis

In this section, I will review very briefly findings on Semitic roots from allied fields: child language acquisition, aphasiology, and experimental psycholinguistics. Despite claims to the contrary, the overwhelming weight of evidence favors the sort of position that I am advocating here: Semitic roots are primarily morphological in nature. Whether they have constant meaning or not is unimportant.

5.1 Evidence from child language acquisition

The leaders in the study of native acquisition of Hebrew and Arabic are Ruth Berman and Dorit Ravid. Berman and Ravid agree that "Hebrew-speaking children can perform consonantal root extraction from as young as age three both in interpreting and producing novel verbs based on familiar nouns and adjectives" and that the novel verbs that they produce conform to the standard morphological patterns. (Berman 2003, p. 274). Ravid (2003) concludes: "Developmental studies indicate that the basic ability to manipulate nonlinear structures emerges early on in Hebrew speakers." (p. 303). By kindergarten, "young Palestinian Arabic speakers were easily able to identify pairs of words related through the root, and also to provide another word from the same root." (p. 306-307)

5.2 Evidence from aphasia

Prunet, Béland, and Idrissi 2000 present a case study of a French-Arabic bilingual aphasic who showed root-sensitive metathesis in Arabic but no similar behavior for French. They conclude that "Arabic roots can be accessed as independent morphological units" (610). Prunet et al suggest that this finding supports a "morpheme-based theory that forms words by combining roots and templates" (609). Goral 2001 surveys a number of case studies of aphasia in Hebrew speakers (including one covered by Prunet et al.). She concludes that " these two abstract morphemes [roots and patterns] have a psychological reality for Hebrew speakers" (309).

5.3 Psycholinguistic evidence

In the last twenty years, there have been many psycholinguistic studies on Hebrew root and pattern morphology, using a variety of experimental paradigms: Feldman, Frost, and Penini, Frost, Forster and Deutsch 1997, Deutsch, Frost, Rayner and Pollatsek , Goral and Obler 2003, Shimron 2003, Berent and Shimron 2003, Velan, Frost, Deutsch, and Plaut 2005, Frost Bick, Frost, and Goelman 2010. Prunet 2006 presents a valuable overview of work on Semitic languages more broadly. The overall conclusion to all this work is best expressed in the words of Joseph Shimron 'the sensitivity to the roots is not necessarily affected by their meanings. Rather, the root as a morpheme has an independent effect unconstrained by semantic mediation" (Shimron 2003, p. 20). This conclusion applies equally well to the findings from child language acquisition and aphasia: speakers of Semitic languages are very sensitive to roots, but there is no evidence that these roots have constant meaning, only that they play an important in the morphology of these languages.

6   Conclusion

6.1 Semitic roots
        Roots are real linguistic entities, but there is no value in assuming that all instances of a given root have the same meaning. Roots are instead most centrally part of the autonomous morphological system of a language and they play as robust a role in the morphology of a language like English or Latin as they do in Hebrew or Arabic.

What is special about Arabic and Hebrew is less the roots than the complex ways in which these roots interact with the obligatory syllabic templates that undergird the conjugation system of verbs. There is also the large role that the conjugations themselves play in derivation, apart from affixation. In most languages, conjugations are distinguished from one another by having different affix patterns. In Semitic languages, they are also distinguished by complex syllabic templates, reminiscent of the ablaut patterns of Germanic languages, but much stricter in form, as Kuryłowicz notes: "The Sem[itic] ablaut is an essential ingredient of the morphological structure of the verb" (1973, p. 43).

It is time now to close the circle. I started off by comparing the role of the root in two quite distinct types of theories, one in which roots have constant meanings, of which DM is the modern archetype, and one in which roots play a purely morphological role, need not have constant meanings, and often don't. I then searched for the historical origins of the theory in which roots are meaningful by definition. Although I had previously long believed that these origins lay in Arabic grammar, I have become convinced that the grammatical tradition in which roots first played the fundamental role that we find in modern theories was that of the Medieval Hebrew grammarians.

Behind this search, though, lies a more fundamental issue. The idea that roots and other morphemes have constant meaning has been axiomatic in modern linguistics ever since the term morpheme was first coined by Baudouin de Courtenay (1895). Modern generative phonology, beginning with McCarthy (1981), adopted traditional Hebrew morphology almost wholesale. And though McCarthy's

phonological analysis did not depend at all on Semitic roots having a constant

meaning, the notion has not really been questioned in the theoretical literature.

Meanwhile, though, another group of linguists began to work about a half

century ago on descriptions of the morphology of Semitic languages unfettered by

traditional notions, notably structuralists like Cowell (2005) working on Arabic

dialects and the group of Israeli linguists who deliberately approached Modern

Israeli Hebrew with an open mind rather than from the point of view of traditional

Hebrew grammar, including Shlomo Ariel, Aaron Bar-Adon, Haim Blanc, Ruth

Berman, Shmuel Bolozky, Uzi Ornan, and Ora Schwartzwald. What they and their

successors discovered was that the root and binyan system of these languages was

more honored in the breach than in the observance, that it constituted a system of

partial regularities rather than the perfect universe that had been depicted in

traditional grammar, what Berman (1978, p. 100) calls a "compromise view . . . most

appropriate to the semi-productive nature of the *binyan* system in contemporary

Hebrew." Others, notably Waltke and O'Connor (1990), have extended similar

observations to Biblical Hebrew, where the binyanim are more regular, but still not

nearly as systematic as the received tradition would lead one to expect.

In other words, if one looks at Semitic root and binyan systems as they

actually function within real languages, rather than through the lens of a tradition

that dates back a millennium, they turn out to manifest the sort of partial and

default regularities characteristic of complex morphological systems that have

become familiar to morphologists over the last forty years, rather that the invariant

system so dearly desired by theoreticians since Baudouin de Courtenay.   But we

should not despair, because in these forty years we have developed an arsenal of tools meant precisely to attack these partial regularities in very precise ways as a network of ordered defaults (Aronoff 1994, Brown and Hippisley 2011). Yes, Semitic morphology is unusual, but it is not outside the universe of morphological systems that have occupied morphologists' attention of late. Furthermore, although roots are central to Semitic morphology, the roots of Semitic are in many ways completely analogous to those of English inasmuch as their most interesting properties are purely morphological and have nothing to do with meaning, except insofar as they are realized through a lexeme.

6.2   Roots, morphemes, morphomes, and lexical categories

The most remarkable property of roots in any language is their formal stalwartness in the face of semantic variation. As I noted above, English irregular verbs like *run* always have the same irregular forms, no matter how wide the variation in meaning across senses. The same is true of suppletive Latin roots like *fer* and the weak roots of Hebrew. Much less remarked but more remarkable is the fact that this formal unity in the face of semantic variation is not a special property of irregular roots or roots in general; it is the hallmark of morphological units of every kind, including those that show no variation in form at all. Consider English derivational suffixes, like *–er*, *-ic*, and *–y*. If we peruse a reverse alphabetical dictionary and consider the meanings of all words ending in any one of these suffixes, it quickly becomes apparent that there is tremendous variation in the set. But their form remains constant, so much so that this formal constancy is never noticed. English

derivational suffixes differ greatly from one another in productivity, as derivational

affixes do in any language, and these differences are correlated closely with what I

have called elsewhere *semantic coherence* (Aronoff 1976), the extent to which the

meaning of any given word in a suffix is predictable (Baayen 1992, Plag 1999, Bauer

2001).   Where they do not differ is in what we might call *formal coherence*.

Between the most productive affixes such as *–ness* and the least productive like *–th*

there is no difference in formal coherence, despite the gulf in semantic coherence.

The constant heart of linguistic morphology is the form of word and this extends to

roots as it does to all morphological elements. Even Alec Marantz seems now to

agree, at least if I interpret one of his recent statements correctly:

> This view of the relation between roots and lexical categories is
>
> generally consistent with the insights of "lexeme-based"
>
> morphological theories such as Aronoff's (2001) [sic]. The word root
>
> plays an important role in an Aronoff-style theory as well as the
>
> present one, capturing facts associated with families of words sharing
>
> the same root. However, the meaning contribution of a root is never
>
> independently realized within this version of Distributed Morphology,
>
> since the objects of interpretation are the phases, not the roots. A root
>
> with a category-determining head corresponds to the lexeme of
>
> Aronoff's system, and such a constituent can have a particular
>
> meaning, a variety of uses, and a history, as Aronoff makes clear.
>
> Marantz (n.d., pp. 5-6)

REFERENCES

Aronoff, Mark (1976). *Word Formation in Generative Grammar.* Cambridge, MA: MIT
     Press.

Aronoff, Mark (1994). *Morphology by Itself: Stems and Inflectional Classes*.
     Cambridge, MA: MIT Press.

Aronoff, Mark (2007). In the beginning was the word. *Language* 83. 803 – 830.

Baayen, Harald (1992). Quantitative aspects of morphological productivity.
     Yearbook of Morphology 1991. 109 – 149.

Baudouin de Courtenay, Jan (1895). Versuch einer Theorie phonetischer
     Alternationen: Ein Kapitel aus der Psychophonetik, Strassburg/Crakow.

Bauer, Laurie (2001). *Morphological Productivity*. Cambridge: Cambridge University
     Press.

Bentin, Shlomo, and Laurie B. Feldman (1990). The contribution of morphological
     and semantic relatedness to repetition priming at short and long lags:
     Evidence from Hebrew. *Quarterly Journal of Experimental Psychology* 42A.
     693-711.

Berent, Iris, and Joseph Shimron (2003). What is a root? Evidence from the
     obligatory contour principle. In Shimron, ed. 201 – 222.

Berman, Ruth Aronson (1978). *Modern Hebrew Structures*. Tel Aviv: University

    Publishing Projects.

Bick, Atira S., Gadi Goelman, and Ram Frost (2008). Neural correlates of

    morphological processing in Hebrew. *Journal of Cognitive Neuroscience* 20.

    406 – 420.

Bick, Atira S., Gadi Goelman, and Ram Frost (2011). Hebrew brain vs. English brain:

    Language modulates the way it is processed. *Journal of Cognitive*

    Neuroscience 23. 2260 – 2270.

Bick Atira S., Ram Frost, and Gadi Goelman (2010). Imaging implicit morphological

    processing. Evidence from Hebrew. *Journal of Cognitive Neuroscience* 22.

    1955 – 1969.

Brown, Dunstan, and Andrew Hippisley (2011). *Network Morphology: A Defaults*

    Based Theory of Word Structure. Cambridge; Cambridge University Press.

Chomsky, Noam, and Morris Halle (1968). *The Sound Pattern of English.* New York:

    Harper and Row.

Chomsky, William (1952). *David Kimḥi's Hebrew Grammar (Mikhlol).* New York:
    Bloch.

Cowan, J Milton, ed. (1971). *The Hans Wehr Dictionary of Modern Standard Arabic.*

    Wiesbaden: Harrasowitz.

Cowell, Mark W. (2005). *A Reference Grammar of Syrian Arabic.* Washington, DC:

    Georgetown University Press.

Deutsch, Avital, Ram Frost, Alexander Pollatsek, & Keith Rayner (2000). Early

morphological effects in word recognition in Hebrew: Evidence from parafoveal preview benefit. *Language and Cognitive Processes* 15. 487-506.

Doron, Edit (2003). Agency and voice: The semantics of the Semitic templates. *Natural Language Semantics* 11. 1-67.

Fabre d'Olivet, Antoine (1931). La langue hébraïque restituée. Edition augmentée d'un complément inédit rédigé en 1823 sous le titre de Théodoxie universelle, examens de la cosmogonie contenue dans le premier livre du Sepher de Moïse, appelé Beraeshith et réproduit en fac-simile sur le manuscrit de l'auteur. Paris: Dorbon-Ainé.

Feldman, L.B., and Shlomo Bentin, (1994). Morphological analysis of disrupted morphemes: Evidence from Hebrew. *Quarterly Journal of Experimental Psychology* 47A. 407-435.

Feldman, Laurie Beth, Ram Frost, and Tamar Pnini (1995). Decomposing words into their constituent morphemes: Evidence from English and Hebrew. Journal of Experimental Psychology: Learning, Memory, and Cognition 21. 947 – 960.

Frost, Ram, Kenneth Forster, and Avital Deutsch (1997). What can we learn from the morphology of Hebrew? A masked-priming investigation of morphological representation. Journal of Experimental Psychology: Learning, Memory, and Cognition 23. 829 – 856.

Georges Bohas. 1984. Études des theories des grammairiens arabes. 1: morphologie et phonologie. Damascus: Institut Français de Damas.

Goral, Mira (2001). Aphasia in Hebrew speakers. *Journal of Neurolinguistics* 14. 297
– 312.

Goral, Mira, and Lorraine K. Obler (2003). Root-morpheme processing during word
recognition in Hebrew speakers across the adult life span. In Shimron, ed.
223 – 242.

Halle, Morris (1973). Prolegomena to a theory of word formation. *Linguistic Inquiry*
4. 3 – 16.

Halle, Morris, and Alec Marantz. Distributed morphology and the pieces of inflection.
In Kenneth Hale and Samuel Jay Keyser, eds. *The View from Building 20.*
Cambridge, MA: MIT Press. 111 – 176.

Jakobson, Roman (1971a). Beitrag zur algemeinen Kazuslehre: Gesamtbedeutungen
der Russischen Kasus. In *Selected Writings: Word and Language,* vol. 2. 32 –
71. The Hague: Mouton.

Jakobson, Roman (1971b). The Kazan school of Polish linguistics and its place in the
international development of phonology. In *Selected Writings: Word and
Language,* vol. 2. 394 – 428. The Hague: Mouton.

Kruszewski, Mikołaj (1993). *Writings in General Linguistics: On Sound Alternation.
An Outline of Linguistic Science.* Amsterdam:John Benjamins.

Kuryłowicz, Jerzy (1962). L'aphophonie en sémitique. The Hague: Mouton.

Kuryłowicz, Jerzy (1973). Studies in Semitic Grammar and Metrics. London: Curzon
Press.

Marantz, Alec (1997). No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. *Proceedings of the 21st Annual Penn Linguistics Colloquium: Penn Working Papers in Linguistics* 4: 2, ed. Alexis Dimitriadis et al. 201-225.

Marantz, Alec (n.d.). Phases and words. Available at https://files.nyu.edu/ma988/public/marantz_publications.html.

McCarthy, John J. (1981) A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12. 373–418.

Plag, Ingo (1999). *Morphological Productivity*. Berlin: Mouton de Gruyter.

Prunet, Jean-François (2006). External evidence and the Semitic root. *Morphology* 16.41 – 67.

Shimron, Joseph (2003). Semitic languages: are they really root-based. In Shimron, ed. 1 – 28.

Shimron, Joseph, ed. (2003). *Language Processing and Acquisition in Languages of Semitic, Root-based, Morphology.* Amsterdam: John Benjamins.

Stankiewicz, Edward, ed. (1973). *A Baudouin de Courtenay Anthology*. Bloomington: Indiana University Press.

Velan, Hadas, Ram Frost, Avital Deutsch, and David Plaut (2005). The processing of root morphemes in Hebrew: Contrasting localist and distributed accounts. *Language and Cognitive Processes* 20. 169 – 206.

Versteegh, C. H. M. (1977). *Greek Elements in Arabic Linguistic Thinking*. Leiden: E. J. Brill.

Waltke, Bruce, and Michael O'Connor (1990). Biblical Hebrew Grammar. Winona Lake: Eisenbrauns.

Williams, Edwin. 2007. Dumping lexicalism. In Gillian Ramchand and Charles Reiss, eds. *The Oxford Handbook of Linguistic Interfaces*. Oxford: Oxford University Press. 353-381.

[1] They coined the term *morpheme*, among many others, and were the first to use

phoneme in something like its standard sense. Stankiewicz (1972) is an anthology of

Baudouin de Courtenay's work, with some discussion of Kruszewski's influence on

his teacher. Kruszewski's work is anthologized in English in Kruszewksi (1993).

See Jakobson (1971b) for an assessment of the contributions of both.

[2] Halle notes, incidentally, that "certain words presuppose the existence of other

words" (p. 13), a harbinger of lexeme-based theories of morphology.

[3] It is not clear to me whether DM Vocabulary insertion differs at all from

morphological realization rules or constraints. Both match phonological material

with morphosyntactic information. DM allows for the morphology to manipulate

the syntactic tree in various ways and even add structure before reaching MS, but

there is nothing to prevent other theories from doing the same if they like.

[4] Earlier grammarians whose work has been lost or was never written down may

have influenced Sībawayhi.

[5] Here *ʔaṣl* might best be interpreted as 'base' or 'source'. Recall that the direction of

derivations between the *masdar* and the verb was a major aspect of the war

between the Basrans and the Kufans.

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[6] The word *ʃɔrɛʃ* in the sense 'root of a plant' is attested in Deuteronomy, which was probably composed about the seventh century BCE and the word has since been in continuous use in various related senses.

[7] This term is clearly related to the Arabic term *bināʔ* and the two concepts are very similar. Compare also Arabic *wazn* 'weight, measure', used interchangeably with *wazn*, to *miʃkal*.