Roots in syntax

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There are only two ingredients of language: roots and formal features.

Contents

A very brief history of roots

From

the idealised common denominator of individual words that were understood to be *diachronically* related,

To

grammatical elements that participate in the combinatorial process (and somehow relate to concepts).

Aronoff (1994, 40):"a root is what remains after all the morphology has been wrung out of a form".

The DM approach to roots has been shaped by Marantz's (1997) work (Harley and Noyer 1999; 2000):

a. Acategorial (i.e., category-neutral) but syntactically active;
b. Meaningful;
c. Phonologically identified.

Roots as acategorial syntactic objects

How roots are categorised

Free roots, 'roots by themselves', are category-less or 'acategorial' (Acquaviva 2009; 2014b):

(1) Roots are (i) acategorial and (ii) must be assigned a category (noun, verb, etc.) by grammar, as (iii) they cannot stand within a structure unless categorised.

aka Embick and Marantz's (2008, 6) *Categorization Assumption*.

This assumption contains an implied premiss: free roots cannot be used as elements of grammar *because* they are acategorial – but see also (Adger 2013, 29).

Two ways in which the categorisation requirement is understood.

I. Roots are categorised *by their functional superstructure*, without the need of a dedicated categorising head (Alexiadou 2001; Borer 2003; 2005; 2013; 2014a; De Belder 2011; Adger 2013; De Belder and van Craenenbroeck 2015 and elsewhere).
II. Roots are categorised *by specialised categorisers*: little *n* (a nominaliser), little *v* (a verbaliser), and little *a* (an adjectiviser) (Marantz 1996; 1997; Harley and Noyer 2000; Lowenstamm 2008; Embick and Marantz 2008; Embick 2012; Harley 2014; Acedo–Matellán and Mateu 2014 and elsewhere).

Roots are special

Roots have been treated as special primitives since the earlier days of DM (Harley and Noyer 1999; 2000), in ways that go well beyond questions of categorisation.

(2) *Some possible generalisations on why roots are special*
   a. Roots neither are formal features themselves (like [number] or [Q]), nor are they composed of formal features like functional heads are;
   b. Roots are not *just* pure forms, i.e. they are not Vocabulary Items – but see Borer (2005; 2013; 2014b);
   c. Roots behave as units that (are used to) denote, denotation being a par excellence language-external function (Chomsky 1995).

Condensing:

(3) Roots are not (composed of) formal features; roots fetch denotations.

The 'fetch denotations' part: a grammatical structure that involves no roots at all is limited to encoding only those "notions that are grammatically encoded", which are of course limited in number (Kayne 2008; Cinque 2013). Such rootless structures are made up exclusively of formal features and typically surface as expressions like 'This is her', 'I got that', 'It is here' and so on (cf. Emonds 1985, chap. 4; van Riemsdijk 1998; Haider 2001; Schütze 2001; Panagiotidis 2003; Harley 2005).

(4) The grammar's ability to include roots within the structures it builds enables the Language Faculty to manipulate concepts *beyond those encoded by formal features*.

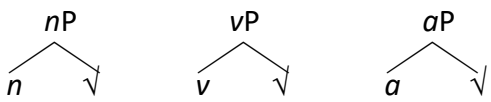
Ultimately, the availability of roots entails that we can use language to 'refer' to the world (Acquaviva and Panagiotidis 2012; Borer 2014b, 356–58; Panagiotidis 2014a, 290).

Ok, roots are special. Why *must* they be categorised? Two answers under minimalist assumptions:

I. Roots cannot be *interpreted* at the interfaces unless they are categorised, as in Panagiotidis (2011), echoing Arad (2003, 741, 747; 2005).
II. Categorisation renders roots *visible* at the onset of a derivational process, possibly making them labelable (Mitrović 2018; Nóbrega and Panagiotidis 2020, 228–36 for a treatment of compounds based on this assumption).

Merging and projecting roots

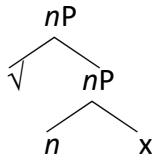
The most common assumption about the placement of a root in a syntactic structure: roots are merged as complements of category heads.



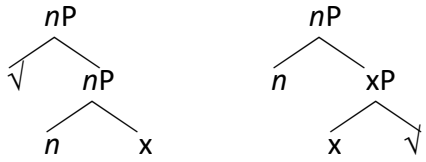
This extensively held idea has been debated, primarily due to two reasons:

(5) We need different merging sites for roots, either
  (i) To secure locality, in order to account for allomorphy (Marantz 2013) or for the assignment of non-compositional readings (Nóbrega and Panagiotidis 2020; Nóbrega 2021), or
  (ii) To capture interpretive differences, mostly in the verbal domain (Embick 2004; 2010; Alexiadou and Anagnostopoulou 2013; Alexiadou, Anagnostopoulou, and Schäfer 2015).

In the context of (i) above, it is argued that roots are merged as *adjuncts* of category heads, thus avoiding their being sent to the interfaces without relevant syntactic material.



In the context of (ii) above, *both* structural configurations are assumed to be possible (Alexiadou and Lohndal 2017b for an extensive review of possible structural configurations for roots).



A related claim:

(6) Roots do not take complements and they do not project their own phrases.

The arguments for (6) are manifold and grounded both theoretically (see e.g. Borer 2003; 2009; Acquaviva 2009), and empirically.

In any case, if roots lack any functional information then they lack any syntactic properties of their own; hence they depend on merging with categorising material in order to be integrated into an argument structure.

Roots are meaningless

Marantz (1996): roots are something like *placeholders*. This idea evolved into an account of roots as semantically impoverished (Arad 2003; 2005) – more on that below.

Two decades into the 21st century, few in a generative framework would argue that the conceptual content of roots (if any) is relevant to the syntactic computations – with notable exceptions including Rappaport-Hovav and Levin (1998; 2010), Rappaport-Hovav (2014 et seq.).

Here we will adopt a more radical idea, after Borer (2005; 2009; 2013; 2014a) and Acquaviva (2009; 2014a; 2014b): there is hardly *any* conceptual content in roots.

Radical emptiness?

Word families, groups of words derived from the same root, often may share a common conceptual core, cf. Hale and Keyser (1993; 2002); Rappaport-Hovav and Levin (1998; 2010); Levin and Rappaport-Hovav (2005).

e.g. *butter* the noun and *butter* the verb, a triplet like *red*, *redness*, *redden*.

Two points:

I. Roots derive *word* families, not *semantic fields* (cf. Panagiotidis 2014a, 295–97; 2020).
II. We must distinguish between those words in a 'word family' directly derived from the root and those derived from an *already categorised* noun, verb, or adjective (Arad 2003; pace Harley and Haugen 2007; Borer 2014a, 140–41).

(7) The Greek root NOM

Derived from the noun nóm-os *'law'*

nom-ik-os	'legal$_1$, juristic'
nom-im-os	'legal$_2$, lawful'
para-nom-os	'illegal, outlawed'
nom-o-thet-	'legislate'

Derived directly from the root NOM

nom-ós	'prefecture'
nom-í	'distribution', 'grazing'
ypo-nom-os	'sewer'
astr-o-nom-ia	'astronomy'
nom-iz-	'think, believe'
nom-iz-ma	'coin', 'currency'

Still, in many word families we cannot fail to notice an affinity between the denotations of their members.

This is precisely the intuition behind Arad's *Multiple Contextual Meaning* (Arad 2005, 65): an uncategorised root contains the 'common semantic denominator' of the words (directly) derived from it (Arad 2005, 4–6, 55–59, 271–74).

An example: the by now celebrated Hebrew root QLT (Arad 2005, 97):

(8) The Hebrew root QLT

Nouns:
- miqlat ('shelter')
- maqlet ('receiver')
- taqlit ('record')
- qaletet ('cassette')
- qelet ('input')

Verbs:
- qalat ('absorb', 'receive')
- hiqlit ('record')

Still, 'word families' like the one in (7) have cast serious doubt on the feasibility of a root encoding some sort of a denotational core, no matter how abstract or how (exasperatingly) vague.

The idea that roots are completely devoid of any semantic content: alluded to in Aronoff (2007), advanced in Acquaviva (2009; 2014b), Borer (2005; 2009; 2013; 2014a), De Belder (2011), Panagiotidis (2011; 2014a; 2014b), Acquaviva and Panagiotidis (2012), Harley (2014).

In this body of work the 'small word' approach to roots is radically rejected. Roots are reconceived as indeed something special even beyond the description in (3): they are typically recast as *indices*.

A spectrum of content?

Saab (2016) and Alexiadou and Lohndal (2017a) attempt to strike a compromise between the radical emptiness of roots and the more traditional approach to them as small words: *content spectra / scales*. Consider Saab (2016):

(9) Content continuum for roots

DOG	QLT	NOM-	-MIT
Very concrete			*Totally vague*

Somewhere In the middle of such a scale one would find roots like QLT: roots that either (i) bear a shadow of content, associated with a vague 'common denominator', or (ii) are "polysemous in isolation", until they are categorised (Levinson 2007; Marantz 2013), as discussed in Section 0.

Alexiadou and Lohndal (2017a), like Saab (2016), build on such a scale/continuum to draw a correlation between the conceptual concreteness and the morphological boundedness of a root:

(10) A content-boundedness correlation for roots

DOG	QLT	NOM-	-MIT
Very concrete			*Totally vague*
Free root			*Bound root*

There are of course at least two serious issues with this assumed correlation:

I. Is this indeed a universally valid correlation?
II. *Architecture of the FL*: why would the 'amount' and type of denotation an uncategorised root would correlate with its morphological behaviour?

Even if the correlation in Saab (2016) and Alexiadou and Lohndal (2017a) is not valid, it still captures a descriptive generalisation:

(11) Root *productivity*, not morphological boundedness, seems to be linked with how contentful the root *appears* to be.

Morphologically bound roots, like MIT, are usually more productive and they seem to possess 'less content' than free roots, like DOG, which tend to be less productive and to pass as the most denotationally concrete ones.

Consider a case of diachronic opening up of or 'diminishing' of 'root content' once a root gradually becomes more productive: the Greek root ZAXAR (Panagiotidis 2014a, 300–301):

(12) More than just sugar

zaxar-i	'sugar'
zaxar-en-ios	'made of sugar' (not necessarily 'sweet')
zaxar-o	'diabetes', 'blood sugar'
zaxar-ux-o	'dulce de leche' (a substantivised adjective: 'having sugar')
zaxar-on-	'crystallize (for edibles)', 'leer at something (transitive)', 'get in the mood' (intransitive)'

By now the root ZAXAR looks more like QLT in (8), possessing a much vaguer 'content'.

(13) The illusion of semantic concreteness of a root is created in cases when very few words are *directly* derived from it.

Polysemy?

A somehow popular alternative both to radical contentless and to Arad's Multiple Contextual Meaning: *root allosemy* (Marantz 2000; Levinson 2007; Marantz 2013).

Allosemy in general is defined as the semantic version of allomorphy: the availability of "special meanings in particular contexts" (Marantz 1997).

At least two serious issues in the whole idea of root allosemy.

First, allosemy is not regulated by a set of context-sensitive ordered rules: allosemes are inserted wherever they are inserted.

Second, the purported alloseme is not always selected locally.

In order to bypass this second problem Marantz (2013, 108–12) posits "an alloseme of the little *v* head that is semantically null" for cases of "apparent deverbal derivation, built on stems with phonologically overt verbalizing morphology". Such deverbal derivations involve "a meaning for the root that is not built on the meaning of the embedded verb" (ibid. 106).

Such "semantically null" categorisers might do the trick in the Japanese and Greek cases Marantz reviews (see also Anagnostopoulou and Samioti 2014), but not e.g. in the case of roots like NOM in (7):

(14) [$_{vP}$ nom-íz-] → 'think'
[$_{nP}$ [$_{vP}$ nom-iz-] ma] → 'coin'

Suppose that in *nom-iz-ma*, the *-iz-* form does not realise the semantically contentful *v* head of *nom-iz-* ('think') but a "semantically null" variant. Accordingly, for the purposes of interpretation *nom-iz-ma* would be *a direct nominalisation* of the root NOM, and *nom-iz-ma* should mean something like 'law' or 'edict'. This is hardly the case.

Roots are not their forms

One of the residues of the 19th century take on roots:

"The hopeless confusion about how lexical / morphological atoms relate to conceptual substance" (Paolo Acquaviva, p.c.).

More specifically: the confusion between *roots as syntactic objects* and *the exponence of roots* – unless one explicitly believes a root is "a unit which is fundamentally phonological in nature […] terminals which have nothing but phonological properties" (Borer 2014b, 356).

This confusion survives partially because of the older DM thesis that roots are privileged in that their phonological features are inserted early, but see Galani (2005), Siddiqi (2006), Haugen (2009), and Harley (2014).

Late Insertion for everything, including roots

Siddiqi (2006, chap. 3) applies to roots all morphological principles that DM avails itself to for the insertion of forms into functional nodes, doing away with the need for readjustment rules. For instance (example from ibid., p. 60):

(15) *The root √SPEAK and its forms (Vocabulary Items, not ordered)*

Vocabulary Entry for *speak*
√SPEAK → *speak* /spik/
[v]

Vocabulary Entry for *speech*
√SPEAK → *speech* /spitS/
[n]

Vocabulary Entry for *spoke*
√SPEAK → *spoke* /spowk/
[v]
[past]

Haugen (2009) takes the divorce between roots and their VIs one step further:

> for f-nodes, the spell-out is deterministic, being required by the features presented by syntax (e.g. tense or aspect). VI's must compete and the one that matches the most features is what gets inserted (as per the Elsewhere Principle). Conversely, the spell-out of l-nodes is non-deterministic. Hence, multiple VI's may be licensed for a given set of features. This follows from the notion that encyclopedic information attached to roots is irrelevant to the syntax" (ibid. 250-251).

This passage is independently interesting in that it links the non-deterministic nature of VI insertion into root (*l*-)nodes with the absence of formal features in precisely these nodes.

Harley (2014) provides empirical arguments for Late Insertion for root VIs from Hiaki / Yaqui and other languages where root suppletion is extensive.

Verbs displaying genuine root suppletion are not necessarily high-frequency 'bleached' verbs, of the likes of *do-did* and *go-went* (selected from ibid. 234):

(16) *Hiaki root suppletion*

weama ~ rehte	'wander.SG ~ wander.PL'
kivake ~ kiime	'enter.SG ~ enter.PL'
vo'e ~ to'e	'lie.SG ~ lie.PL'
weye ~ kaate	'walk.SG ~ walk.PL';
mea ~ sua	'kill.SGOBJ ~ kill.PLOBJ'

Data like these are complemented by the those collected in Veselinova's (2006) survey of suppletion in 193 languages, with genuine suppletion patterns for verbs e.g. meaning ' fall.in.water', 'swim', 'bet', 'make.netbag' (conditioned by number) or 'hear', 'drink', beat' (conditioned by Aspect).

Roots are not 'something like stems'

Even among those who take roots to be featureless formal objects, along the lines of (3), some of "the hopeless confusion" between a root and its form(s) remains (also discussed in Adger 2013, chap. 2).

Acedo-Matellán and Real-Puigdollers (2019) apply the idea in De Belder (2011), Lowenstamm (2014) and Acedo-Matellán and Real-Puigdollers (2014) that roots and derivational affixes are indistinguishable from each other, namely: derivational affixes are also *always* roots.

This kind of blanket approach blurs the distinction in Haugen between *featureless* terminals (roots) and terminals with *features* (which include some derivational affixes).

Roots as indices

What is a conceptually desirable – or even "virtually necessary" – alternative

i) to the older DM roots-as-small-words approach and
ii) to the borerian roots-as-forms account?

Recall that we must capture all three of the current hypotheses based on the empirical work on roots:

1. the contentlessness of acategorial roots before they are merged,
2. the non-projection of roots and
3. Late Insertion of the forms associated with roots.

Roots are *indices* i.e. roots are akin to addresses (Acquaviva 2009; 2014b; Harley 2014).

What roots are: unique identifiers

Roots, not their forms, are indices. Pfau (2009, 90) was the first to work with this idea in order to explain certain processing errors. Within the domain of grammatical theory, here is how Acquaviva (2009, 15) originally forms his proposal on roots as indices:

> The minimal units of interpretation are those that define a semantic type, and these are not roots, but core nouns and verbs. Roots are smaller; in this sense, they have no meaning by themselves but co-occur with category-assigning heads to form interpretable typed grammatical entities. But how does *dog* differ from *cat*, then, if both have the structure [root+*n*]?
>
> My answer is that the root DOG acts as an index that makes the noun dog different from nouns based on other roots. In the abstract syntactic representation before Vocabulary insertion, roots have the function of differential indices. They do not mean anything by themselves, but act as name-tags which define identity and difference.

The idea is straightforward, once we divorce our thinking from that 19th century bias. Hence, roots are actually indices / conceptual addresses, a term that belongs to Boeckx (2010, 28), going back to Pietroski (2018).

These indices are completely devoid of formal features (Embick 2015) or, rather, of *all* features (Acquaviva 2009).

Their featurelessness makes them indeed equivalent to empty sets, as diagnosed by De Belder (2011), but only as far as features are concerned, formal or other.

Their featurelessness can also be made to derive their syntactic inertia: they do not project (*what label would featureless objects project?*), a fact that renders fluid their insertion in the structure, recall Section 0.

Moreover, the featurelessness of roots makes their categorisation obligatory.

Harley (2014, 242) floated (and popularised) the idea that these *formal* indices be notated numerically, i.e. as $\sqrt{}_{322}$, $\sqrt{}_{77}$, $\sqrt{}_{683}$ and so on.

But what *are* these indices? What are roots *made of*?

"UG-extraneous elements […] essentially 'imported' into the syntactic derivation" (Panagiotidis 2014a, 290).

We can possibly follow Richard Larson (p.c., reported in Panagiotidis 2014b, 425) in thinking of their existence as the result of "the hijacking of the successor function by the Faculty of Language". This would make roots abstract indices "differentiated from each other by means of natural number" (ibid.).

What roots uniquely identify: "words" (or "lexemes")

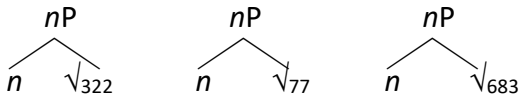
Hence

(17) Roots in a derivation act as *abstract differential indices*.

Roots are the only syntax-internal criterion of lexical identity (Acquaviva 2009; 2014b; Acquaviva and Panagiotidis 2012; Panagiotidis 2014a; 2014b).

Roots enable language to encode a wide range of concepts, well beyond those encoded by features, roots being "a syntax-internal criterion of lexical identity, so that two otherwise identical syntactic constructions count as different formal objects if they differ in the root, and as identical (that is, tokens of the same type) if the root is the same" (Acquaviva and Panagiotidis 2012, 11).

(18) *Same structure, different roots*



Different roots, i.e. different indices, enable the same simplex syntactic structure – say, an idealised *n*P consisting of nothing but a root and a categoriser *n* in this basic case – to be associated with different concepts (cf. Panagiotidis 2020).

How do we detect roots? Beyond just grammar

How are roots-as-indices detected by learners and/or linguists?

The answer is easy in languages like English and even more so in Semitic, with its triconsonantal roots: "A root is what remains after all the morphology has been wrung out of a form" (Aronoff 1994, 40).

However things are more complex in synthetic languages like Greek (Ralli 1988; 2003).

Consider again the form *nom-* in Greek (Panagiotidis 2014a, 295)

I

nóm-os	nom-ik-ós	nóm-im-os	nom-o-thet-ó	pará-nom-os
'law'	'legal$_1$, juristic'	'legal$_2$'	'legislate'	'illegal'

II

nom-ós	nom-ḯ	ypó-nom-os	asty-nom-ia	astro-nom-ia
‘prefecture’	‘usufruct’, ‘grazing’	‘sewer’	‘police’	‘astronomy’

Historically, I-list words derive from a root yielding words about law and rules, whereas II-list words derive from a root yielding words about distribution and sharing.

How many *nom*- roots are there in Modern Greek? What are the criteria?

- Not meaning: what is the relation between grazing and prefecture? Isn’t police and astronomy closer to law than sewers?
- Form then? Would this entail that there is *a single root* deriving all the above words? Is there not such a thing as root homophony? What about root suppletion (Harley 2014)?

The decision must be a principled one.

These principles must be of a fundamental character and UG-external, while making reference to both grammatical structure and morphological exponence: after all *root identification is where grammatical acquisition meets word learning*.

Principle I: Form

Same form → same root

This is a really simple learning principle. Recall that we cannot rely on meaning, anyway (Arad 2003; Borer 2009; Acquaviva and Panagiotidis 2012; Harley 2014).

Of course it is not enough. Consider the duo *kori* (‘daughter’) and *kori* (‘pupil’), one of many homophonous pairs and triplets in Modern Greek (Panagiotidis 2014b, 419). Both words are feminine nouns and have identical exponents of the various ϕ-feature combinations throughout their respective paradigms: they are indistinguishable in form and they mark identical features.

If they are both derived from the same root, root as the syntactic criterion of lexical identity fails. Hence, we do need *root homophony*:

kor-i	kor-i
KOR_1-fem.sg.nom	KOR_2-fem.sg.nom
‘daughter’	‘eye pupil’

This now forces us to posit

Principle II: Morphosyntax

Same form in same morphosyntactic environment → different roots

'Morphosyntactic environment' means both the morphosyntactic features and the structure *and* its exponence. Some examples illustrating this.

Different homophonous roots:

kom-a	*kom-a*	*kom-a*	*neuter, singular, non-oblique case*
party	*comma*	*coma*	
lir-a	*lir-a*		feminine, singular, non-oblique case
pound	*lyre*		
fil-o	*fil-o*		*neuter, singular, non-oblique case*
leaf	*sex*		

Identical root (as per Principle I): *nom-* and in the verbs like

kur-ev-	'shear', 'give a haircut'
kur-az-	'tire'
kur-ar-	'treat as a patient'

Identical *v* heads but different exponents (Spyropoulos, Revithiadou, and Panagiotidis 2015; Panagiotidis, Spyropoulos, and Revithiadou 2017).

Principle III: Suppletion

Complementary distribution → root suppletion

No accident root suppletion is much more common with verbs – besides the well-known *oeil-yeux* in French (Veselinova 2006; Harley 2014).

Detecting complementary distribution can be done a la Yang (2016). Hence:

Superprinciple: Time

All principles apply once and on the existent 'lexicon'.

Hence the interesting cases of

ayel-i	*ayelad-a*	
'pack, flock'	'cow'	
Xrist-os	*xris-ma*	*xri(z)-o*
'Christ'	'anointment, nomination'	'anoint, nominate'

The word cow is learned *before* packs and flocks; the word Christ (and some of the words derived from it) is encountered before learned terms about anointing and nominating. Therefore, *ayelad-* and *xrist-* are most roots in their own right.

Primitives such as roots are identified via the interaction of simple learning principles that make reference to both grammatical structures and language-specific forms.

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