Towards a (minimalist) Theory of Features and the role of semantic features.[i]

ABSTRACT: This paper reviews the bibliography on a (yet to come) Theory of Features, establishes its desiderata, and posits some theoretical and methodological prerequisites for it. It then goes on to make suggestions on how such a Theory should be compiled and also proposes some fundamental tenets on which it should be founded. These tenets are centred around the idea that purely semantic features do not exist and that formal features are Saussurean signs abstractly encoding a limited number of archaic concepts. Speculations on the correct formalism for features, on how to assemble a reliable repertory of features, and on how they build functional heads are offered.

KEYWORDS: feature, concept, semantic feature, formal feature, sign, functional head, interface, derivational affix

1. Features as interface instructions: formal features

During his presentation at the Abralin 'The Minimalist Program: Achievements and Challenges' online event on 6 July 2020, Marcel den Dikken admits what everyone working in the field seems to already know, namely that "the Minimalist Program doesn't have currently a theory of features".

Similar observations are already in place in Adger and Harbour (2008), in their review of the history of attempts to come up with a theory of formal features. Adger and Harbour

dedicate some space to Muysken and van Riemsdijk (1986), who in turn lay down the fundamental desiderata of an explanatory Theory of Features:

(1) "[H]ow many are there?", "what are they?", "how do they distribute over syntactic structures?"

Unlike what would be sufficient in grammatical frameworks merely seeking to describe the workings of the syntactic mechanism, a minimalist theory of features would have to be founded upon plausible biolinguistic assumptions. A first fundamental assumption would be that features in general be conceived as "instructions to the interfaces" (Chomsky 1995). Following the 'virtually conceptually necessary' hypothesis that there are two interfaces, one with the Articulatory-Perceptual (A-P) systems and one with the Conceptual-Intentional (C-I) ones, a sort of division of labour is established. Hence, as in Zeijlstra (2008), *phonological* features would be instructions to the interface between the combinatorial system of language and the A-P systems and *semantic* and (interpretable versions of) *formal* features would be instructions to the interface between the combinatorial system of language and the C-I systems.[1]

[1] The "interpretable versions of" caveat is necessary also because this definition de facto excludes Case features (at least in their conception in Chomsky 2001; and pace Pesetsky and Torrego 2001; 2004; Manzini and Savoia 2011, chaps. 7 and 8) and grammatical gender features (Kramer 2015; Panagiotidis 2018) from among formal features, as they probably possess no interpretable versions and/or their values are not readable at the relevant interface; e.g. the [feminine] value of the gender feature in the Italian noun *casa* ('house') is not an interface instruction to in any coherent way.

Consequently, beginning to address the 'how many' question in (1), we will have to ensure that any features posited will abide by no less than expectations of psychological reality: features posited will have to be instructions to the interfaces. Still, this requirement seems to be hardly obvious in practice, as in generative research features are often conceived as mere diacritics (as 'flags') for particular structural relations and/or operations (e.g. a feature [wh] for wh-movement, or index features used in classic accounts of Binding).

The features-as-flags practice is however incompatible with the features-as-instructions requirement. More concretely, the likes of SLASH, Strong, EDGE, Brody's * Spell-Out feature, or Merchant's E (for ellipsis) features should all be removed from the picture, unless they could be independently motivated as instructions to the C-I interface. Interestingly all the above purported features would affect the *externalisation* of a syntactic structure in the sense that they would regulate what is silent, and what is pronounced and where; hence such features would be relevant at the A-P interface.[2] This in turn would make them phonological features, which is implausible in our current understanding of Phonology. If features like SLASH, Strong, EDGE, *, E etc. are to be understood as formal features, they should then be somehow interpreted at the C-I interface, which does not seem to be the case. Therefore,

(2) Non-phonological features must be motivated as instructions to the C-I interface.

Generally speaking, "independently motivated as instructions to the interface" is a condition to be necessarily satisfied before positing a feature. True, the membership and organisation of the actual feature inventories would be open to empirical discoveries, to second thoughts

[2] For recent takes on externalisation: Berwick and Chomsky (2017) Chomsky (2020).

on the appropriate taxonomies, and to similar considerations – a matter to which I will return in Section 5.2.

Thus, on the one hand the theory will have to be built on the psychological reality of features and on their being motivated as interface instructions, as opposed to them solely triggering grammar internal operations such as (external) Merge, or to them flagging dependencies, such as co-indexing. On the other hand, in order for said theory to be coherent, our approach to features will have to be in unwavering consideration of their role in grammatical relations and operations.

We therefore begin with syntactic or, more aptly, *formal* features. The rationale for putting formal features first would go like this: we expect formal features *both* to reflect some sort of concept (in the broadest sense) relevant to the C-I interface *and* to play a role in grammatical computation (in the narrow sense). So, indispensably:

(3) Formal features must be motivated as involved in grammatical operations and representations in the narrow sense.

The statements in (2) and in (3) taken together amount to an understanding that we cannot motivate a formal feature as a potential trigger of a grammatical relation and/or operation *unless it functions as an instruction to the C-I interface*.

Illustrating: a purported feature [X] can be construed as an instruction to the C-I interface (e.g. animacy) *and* it plays a role in grammatical computation: [X] is a good candidate for a formal feature. On the contrary, a feature [Y] could be posited to play a role in grammatical computation (e.g. motivate Internal Merge) but cannot be construed as an instruction relevant to the C-I interface: [Y] is not a good candidate for a formal feature. Finally, a

feature [Z] could be understood to encode instructions for the C-I systems but at the same time it is inert grammatically: to wit, it is not contrastively marked on functional elements, it is does not trigger grammatical operations, and it is not active in any Agree relations: should such a feature exist, [Z] is not a good candidate for a formal feature.

(4) Formal features will have to be motivated *both* as interface instructions *and* as playing a role in grammatical relations and operations.[3]

In this paper I will use (1) as a guide in order to review the role of formal features in a (yet to come) Theory of Features. In doing so I will argue that they are the only unstructured Saussurean signs in natural language. I will then go on to examine what concepts formal features can signify and argue that purely semantic features, i.e. features not involved in grammatical operations and representations in the narrow sense as per (3) above, do not exist.

2. The primacy of formal features

Once we have established formal features as both instructions to the C-I interface and being "active", i.e. as involved in grammatical computation, we then must sharply distinguish them from purely semantic features, should such features exist. As Biberauer and Roberts (2015, 3) put it: "The formal features are […] interpretable or uninterpretable and, as such, are visible for syntactic operations such as Agree and Merge. The semantic features, on the

[3] The above is the strict scenario but it does make room for the workings of uninterpretable and unvalued features, see also footnote 1.

other hand, are invisible to the core computational system (Narrow Syntax), but presumably visible at the semantic interface."

Cowper and Hall (2014, 146) make the same point: "We can say that a feature is active if the grammar crucially refers to it in any way. In the case of potential morphosyntactic features, then, it is not enough to show that the semantic content of a feature is present in the encyclopedic meaning of some lexical item; rather, to be considered active it must be involved in inflectional paradigms, or trigger syntactic movement or agreement, or play some other demonstrably formal role."[4]

What then matters in formal representations and in grammatical operations is a different set of features than the set *possibly* involved in "meanings such as whatever distinguishes camels from reindeer or a joke from an insult" (Adger and Svenonius 2011, 18). More curtly, we must at least sharply distinguish lexical semantics (feature-based or not) from grammar, which is driven by formal features.

As clarified in the cited passages, we can now elaborate on (4) in a more precise way. Thus, an example of the formal-semantic distinction would be gender. We know that Slavic

[4] Cowper and Hall's criterion for distinguishing between formal and semantic features is (correctly I think) whether "the grammar crucially refers to it in any way". This is a more relaxed criterion than that of Zeijlstra (2008), who claims that "[c]hecking of uninterpretable features […] forms a diagnostic test to distinguish interpretable formal features from purely semantic features […]". Zeijlstra does on to lay out "three properties that could be harnessed to test for the presence of a feature [*u*F]: its semantic uninterpretability, the triggering of an operation Move and the triggering of an operation Agree. […] [A]ll three of these properties reduce to one single property: doubling."

possesses grammatical gender features because these are involved in concord and other agreement phenomena; indeed, such features are "active" in that they play a role in grammatical relations and operations: Slavic grammars refer to gender. We also know that English possesses 'natural' gender features because they are involved in the pronominal paradigms; again the grammar refers to gender, although it does so not via Move or Agree, but by making it manifest on *functional heads* – cf. footnote 4. Interestingly, this makes English 'natural' gender a bona fide *formal* feature: if it is marked on functional heads, then it matters for grammar.

At the same time, we can nevertheless safely claim that Turkish makes *no* use of *formal* gender features because gender distinctions (e.g. man-woman, mister-missus, boy-girl etc.) are indeed made, but have no grammatical effect whatsoever. Such distinctions are purely expressed within the domain of lexical semantics and only marked on contentful elements ('lexical heads'); gender is completely irrelevant to the grammar of Turkish. Now, whether Turkish distinctions reflecting biological and social gender, certainly not a matter of formal features, are encoded by way of semantic features is a different matter, to which we return below.[5]

One point to keep in mind is the one made in the Adger and Svenonius quote cited above: we somehow expect formal features not to simply encode instructions to the C-I interface, as per (2) and (4), but more precisely to point to concepts and functions of a particular sort: not all concepts are encodable via formal features – something we return to in Section 3.3.

[5] Corbett (1991, 146–47) has already stressed the importance of "agreement", precisely in establishing a gender category.

Having clarified that semantic (if existent) features and phonological features are excluded from the empirical domain of a Theory of (formal) Features, let us move on to present the desiderata of such a theory.

3. Four issues in a Theory of Features

As already stated in (1), three fundamental desiderata of a Theory of Features would be the following: "how many features are there?", "what are they?", "how do they distribute over syntactic structures?". These desiderata can be formulated as the following four questions that a Theory of Features must address:

I. What are formal features?
II. What is the correct *formalism* for them?
III. Why are particular concepts encoded, or rather: are *encodable*, as formal features (e.g. mass / number) and others are not (e.g. colour / brightness)?
IV. How do formal features combine into functional elements (e.g. Indo-European number); are they relevant in the case of 'modifiers' (e.g. Mandarin *men* plurals)?

In the rest of this section these four questions are elaborated upon and placed into context.

3.1. What

Formal features in (4) have already been described as instructions to the interface between the combinatorial system and the conceptual-intentional systems that at the same time "[are] involved in inflectional paradigms, or trigger syntactic movement or agreement, or play some other demonstrably formal role" (Cowper and Hall 2014, 146; cited above).

We therefore already understand formal features

i) as a subset of semantic features or

ii) as a set whose intersection with semantic features is non-empty but whose intersection with phonological features is the empty set (Zeijlstra 2008; Adger 2010; Emonds 2011; Adger and Svenonius 2011; Cowper and Hall 2014 and elsewhere).

The conviction that formal features cannot be articulatorily motivated, i.e. that their intersection with phonological features must be the empty set, originates from solid empirical observations about the Autonomy of Syntax (cf. Newmeyer 1998, chap. 2):

(5) Whatever is driving grammatical operations is expressible in non-phonological terms; moreover, morphological and syntactic relations are expressible in non-phonological terms.

Building on the above observations in their weakest formulation, we can return to (4) and claim that formal features are *about* semantic interpretation. As per (4), formal features regulate grammatical relations (e.g. Locality), operations (e.g. movement), and realisations (e.g. morphological contrasts); these in turn are sensitive to Animacy, Individuation, Definiteness, Quantification, Transitivity, Aspect, Tense, Mood, Finiteness, Illocutionary Force and the like – not to *phonological* properties such as voicing, height, roundness etc. Hence, formal features, which by definition drive and constrain grammatical operations, originate in cognition rather than in articulation (Hauser, Chomsky, and Fitch 2002; Hinzen 2006; Emonds 2011; Nóbrega and Miyagawa 2015; Berwick and Chomsky 2017; Golston 2018). Keeping (4) in mind, we can posit that formal, not semantic, features are the true parallel of phonological features, which are features motivated by certain articulatory

contrasts (better: *differences*) and acquired by paying attention to such contrasts (Dresher 2014). Hence phonological features are motivated by the A-P systems but at the same time they play a role in the workings of a combinatorial system, Phonology.

Similarly, as already hinted in Question III above, formal features are motivated by *certain* contrasts (or differences) the C-I systems make available. Only such contrasts play a role in the workings of the combinatorial system, syntax – i.e. the combinatorial system underlying both word and sentence formation (Harley and Noyer 1999).

The parallelism above is no more than a re-affirmation of the old Martinet precept of the 'double articulation' of language, popularised in the English-speaking literature by Charles Hockett (Emonds 2011; Golston 2018): language is organised

i) at a non-signifying phonological level (what we now understand to involve its externalisation) and
ii) at a signifying level (what we now understand to be FLN: the Faculty of Language in the Narrow sense).

Thus, phonological features, like semantic features (if they exist), are irrelevant for the workings of syntax. At the same time, formal features express concepts (or whatever we wish to call elements relevant for the C-I systems) that can somehow be quantised: formal features are about concepts that are encodable or, more informally, formal features encode concepts that are 'featurable'.

This of course begs the next question: whether there exists a fixed inventory, a closed set possibly defined by UG, of formal features (as has been understood for decades) or features emerge during acquisition through heuristic processes (Cowper and Hall 2014; Dresher

2014; Biberauer et al. 2014; Biberauer and Roberts 2015 among others). This is an important issue but it is an empirical one, it will have to inform our Theory of Features instead of being axiomatically resolved via theory-building. Whether features are given (say by UG) or they emerge is completely orthogonal to the concerns of a theory of formal features, which should in principle accommodate either option. Having said that, a Theory of Features should at the same time constrain what formal features an acquirer may and may not posit, if she is to posit formal features through heuristic processes and based on the input she receives. We return to this matter in Section 3.3.

3.2. Privative, equipollent, or else?

Let us turn to Question II now. The actual *form* of features is a more or less unresolved matter; by the 'form of features' we must understand their format in a rather abstract sense, i.e. what the *internal* structure of features would look like (Adger and Harbour 2008; Adger 2010; Adger and Svenonius 2011). There are roughly speaking three options: features are either *privative*, i.e. completely unstructured, *equipollent*, i.e. taking a + or – value, or of an [attribute:value] format.

The privative system is conceptually the simplest: a (monovalent) feature is there or isn't there.[6] The equipollent system is the familiar +/- one, introduced by the linguists of Prague School (and popularised in the English-speaking literature by Roman Jakobson) for phonological representations (see also Nevins 2008).

[6] "Privative […] characterizes systems where atomic features may be present or absent, but have no other properties" (Adger 2010, 187).

Adger and Svenonius (2011) successfully discuss the limitations of privative feature systems in defining natural classes, natural classes which are necessary e.g. for Locality and defective intervention effects. On top of that, Cowper and Hall (2014) convincingly show that it cannot be the case that privative feature systems are universal. In the meantime, Harbour (2011) focuses on the intricate number system of Kiowa, demonstrating the inadequacy of a privative feature system in describing it. In doing so he also explores and dismisses a notational variant of privativity that he calls the *pseudoprivative* alternative, i.e. using different versions of the same feature (e.g. F and F') in order to capture three-way distinctions.

If (formal) features do not belong to a fixed UG repertory but are arrived at by the acquirer precisely as she pays attention to contrasts (and/or distinctions) expressed by grammar, as seems to be the emerging consensus (Emonds 2011; Dresher 2014; Cowper and Hall 2014; Biberauer et al. 2014; Biberauer and Roberts 2015; Biberauer 2019 and elsewhere), the availability of all three systems (privativity, equipollence, and the [attribute:value] format) cannot be excluded a priori, as long as each of these systems would optimally accommodate the grammar-specific data. Which feature system is at play would ultimately then be an empirical, grammar specific matter, not one to be postulated by a Theory of Features. This of course sounds like a disappointingly permissive and slightly unsatisfying stance but Cowper and Hall (2014) have very convincingly shown that the actual form of features is definitely not a matter resolved by Universal Grammar: they argue that there is no UG-

constrained formal feature format along the lines of 'privative', 'equipollent' or '[attribute:value]'. A case in point is that of categorial features.[7]

Baker's (2003) influential work on categorial features posits a privative [N] feature (for nominality) and a privative [V] feature (for verbality). Panagiotidis (2015) follows Baker in positing the existence of just these two categorial features, arguing they encode what he calls 'interpretive perspectives', a sortal one for [N] and a temporal one for [V] (Panagiotidis 2015, 82–89). Inevitably, he asks whether "there [is] a principled reason to prevent [these features] from being the two values of a categorial feature, a [perspective] feature, more concretely […]" (2015, 100).

Although he does not come up with a principled reason to posit an [attribute:value] format for categorial features, he nevertheless suggests that this would be the appropriate format for categorial features in the face of cross-linguistic evidence. More specifically, the existence of Classless Words in Farsi (Karimi-Doostan 2008; 2011) leads him to suggest that " [N] should perhaps be recast as [perspective:sortal], [V] as [perspective:temporal], while Classless Words would perhaps be introduced by a categorizer with an unvalued [perspective:] feature" (Panagiotidis 2015, 105).

The above leaves us with a nuanced picture, where the format of formal features is one that optimally accommodates both grammar-specific and cross-linguistic data. Admittedly, a more restrictive solution would be welcome, say one that would settle for the '[attribute:value]' format for all formal features. In any case, such a potential solution would

[7] I am grateful to two anonymous reviewers for raising the matter as a way to gain insight into the format of features.

not form part of a Theory of Features per se, but would result from empirical enquiry (e.g. the availability of an unvalued option for category features in Farsi and elsewhere). I will however offer some relevant discussion in Section 5.3 towards the direction that not all is lost for the (conceptually) more restrictive privative system.

3.3. Which concepts can be encoded as formal features?

Moving on to Question III, from the seemingly unlimited range of concepts available to human cognition only a tiny subset is encoded as formal features. In language after language we encounter the same conceptual categories both organising grammatical categories and being implicated in grammatical operations – despite some most candid attempts at exoticisation in certain grammatical descriptions. These conceptual categories include but are certainly not restricted to Animacy, Individuation, Definiteness, Quantification, Transitivity, Aspect, Tense, Mood, Finiteness, Illocutionary Force and so on.

This matter is eloquently presented in Cinque (2013, 50–52), who for instance notes (ibid., 50): “Verbal projections in clauses grammatically encode (through affixes, particles, auxiliaries, etc.) distinctions relating to the external and internal temporal constituency of events (tense and aspect) and the speaker’s attitude toward the truth of the proposition (mood), but they are never found to grammatically encode such human cognitive universals as ‘‘shame’’, ‘‘mourning’’, ‘‘sexual taboos’’, etc. , nor otherwise cognitively significant concepts like ‘‘worry’’, ‘‘peril’’, ‘‘fear’’, ‘‘hunger’’, ‘‘love’’, ‘‘death’’, ‘‘awe of god’’, etc.”

Even the above remark should be enough to dismiss typical blasé statements claiming that formal features encode ‘cognitively salient’ categories and leaving the issue at that. Even the specimen above, sampled by Cinque, of ‘cognitively salient’ universals that never get encoded as formal features is quite telling. This issue becomes even more pressing if feature

systems are assembled on the basis of linguistic data during the course of acquisition, as discussed in the previous subsection. For instance, how come acquirers never attempt to assemble noun classification systems on the basis of the very salient bright / dark (and, even, red) contrast? Why has the wealth of quasi-systematic manner-of-motion types expressed among English verbs never yielded a grammatical taxonomy thereof? Why do noun classificatory feature systems may be based on animacy and sex, size and shape, but never on brightness and/or colour? What privileges the concept of surprise (in miratives) over that of worry, of desire or volition (in optatives) over that of fear, of failure (in frustratives) over that of shame (Cinque 2013, 51), those of honorification and deference over a range of diverse attitudes towards other humans?

There are precious few attempts to address the question of what kinds of concepts are encodable as formal features, of what concepts are featurable. Adger and Svenonius (2011, 18) make the following crucial point: “The kinds of meanings which distinguish edibles from inedibles and draft animals from mounts are arguably different from those with which formal semantics is concerned, and it is there we find the language of logic, set theory, predicate calculus, and other tools. Notions such as quantification, negation, gradability, boundedness, telicity, plurality, and so on are part of this system. Let us use the term SEMANTICS for such formal representations, excluding vaguer, prototype-based meanings such as whatever distinguishes camels from reindeer or a joke from an insult.”

Roberts and Roussou (2003, chap. 5) go one step beyond and formally define functional categories as precisely those terms that are purely *logical*, i.e. “invariant under isomorphic structures” (their (45)). If functional categories are composed exclusively of formal features, which would be the zero hypothesis, then formal features would exclusively express “the

logical content [which is] independent of the external factors, or in von Fintel's (1995) words, insensitive to facts about the world".

One can of course hardly downplay the importance of logical operators expressed as formal features: for instance, we expect conjunction and negation to be universal for rather obvious reasons, it also looks like they are expressed by way of formal features in all natural languages.[8] Still, claiming that formal features are about categories "such as quantification, negation, gradability, boundedness, telicity, plurality" etc. is problematic in two ways:

First, it is circular. Categories "such as quantification, negation, gradability, boundedness, telicity, plurality" (and not others) are "part of this system" (i.e. Semantics) because we understandably build our (theories of) formal semantics on the basis of natural language: the real question is why these categories, and not others, are part of the system in the first place. An answer to this would be along the lines of the approach of Roberts and Roussou to what makes a category functional: what is "restricted to logical meanings".

This brings us to the second problem. Indeed it is true that formal features like those underlying quantificational elements as well as those involved in individuation, modals, negation, and even Tense and Aspect are "restricted to logical meanings". However, already Roberts and Roussou point out that "[t]he status of demonstratives is unclear […] The question of the status of Person features also relates to the demonstratives; essentially the question here is whether 1st- and 2nd-person features can be seen as logical elements". Such

[8] Grammatically speaking there is always the option that, say conjunction, could be expressed with purely lexical means in a language. Mitrović (2014) offers a panorama of how conjunction may be expressed cross-linguistically, one that however does not seem to include purely lexical means; see also Zhang (2022).

reservations hold a fortiori for mirative, frustrative, honorific features – and the like: these are concepts encodable as formal features but they can hardly be construed as "purely logical".

(6) Not all formal features encode 'logical' (i.e. narrow semantic) concepts.

Before moving on, let's just concur with Adger and Svenonius that "whatever distinguishes camels from reindeer or a joke from an insult" must be relegated to semantic features, or whatever will have to replace them in a system that takes its Encyclopedia seriously – see Section 4.

Now, Golston (2018; 2019b; 2019a) has shown in some detail that concepts encoded as formal features predate the emergence of the human species. More specifically, he examines the pre-human origins of some ϕ-features (Golston 2018), of Tense and Aspect (Golston 2019b) and of thematic roles (Golston 2019a) in animals, some of which are quite temporally removed from humans along our ancestral timeline. Interestingly, Emonds (2011) had already made a more sweeping claim, namely that *only* concepts that predate the emergence of Homo sapiens sapiens (arguably the 'languaged' species of the genus Homo) can be featurable. These observations already exclude the featurability of all concepts about artefacts and about exclusively human social organisation; intriguingly they also exclude the option that the successor function be expressed as formal features (ibid., 56-7).

Having said that, Emonds (p. 58) immediately afterwards notices that "many other categories that are almost certainly part of primate cognition are not used in any system of syntactic computation: those of brightness, loudness, perceptions of speed and non-speaker

centred motion, awareness of emotion (sadness, fear, anger, anticipation, sexual arousal, illness), and essentially all categories of feeling, taste and smell".

What Emonds offers next is a conjecture regarding which concepts are encodable as formal features: first of all, such concepts must be *discrete* (ibid., 51). Discreteness, a fundamental analytical category in understanding language at least since Charles Hockett, is a prerequisite for concepts to be encoded as formal features, filtering out at the same time all the categories listed in the above passage. Based on this, Emonds (2011, 59) goes on to posit *Lexical Labelling* (his 20):

(7) "Lexical items are associated with ("syntactic") labels or categories drawn from the store of the mutant primates' discrete visual concepts (their only conceptually discrete system)."

The above looks like a promising thesis, as it provides a solid departure point for understanding what restricts the possible repertory of formal features. This departure point will be relevant in both plausible scenarios:

- Whether formal features are listed in fixed UG inventory, pre-selected among discrete visually accessible concepts;
- Or there exists a subset of discrete visually accessible concepts that is readily featurable, as opposed to other ones, while features themselves are emergent, arrived at during acquisition.

Certainly, the discreteness requirement goes a long way. For instance, discreteness is important even when it comes to Tense: time is not treated by tense features as an

undifferentiated flow but in discrete terms – something that is actually compatible both with the pronominal and with the quantification of theory of tense.

At the same time, (visually accessible) discreteness again can hardly be the whole story about why surprise (in miratives) but not worry, desire or volition but not fear, failure (in frustratives) but not shame are grammaticalised, possibly encodable as formal features (Cinque 2013, 51). Our Theory of Features will have to say more on this matter and pending serious empirical research into the matter, I will have to leave it at that.[9] At this point the take home message would be the following:

(8) Featurable concepts include 'logical' (i.e. narrow semantic) concepts and a limited number of concepts predating the emergence of anatomically modern humans, e.g. deixis, rank, volition.

3.4. From features to functional heads

Concluding the list of Questions with IV, we turn to functional heads as feature bundles or, perhaps, feature structures (Harley and Ritter 2002a). As mentioned above, we would hope that functional heads only encode formal features, whether they be somehow pre-assembled or assembled online from formal features available in the numeration, a la Hegarty (2005).

[9] What I think is certain is that featurable concepts must definitely *predate the emergence of language in the species* (Emonds 2011; Nóbrega and Miyagawa 2015; Nóbrega 2018; Golston 2018; 2019b; 2019a). Coming to think about it, there is no alternative to this particular constraint on the concepts formal features may encode, unless of course one would be ready to assume that language is still evolving in quite significant ways.

(9) Functional heads are made exclusively of formal features.

There are two points of significance to be made here.

First, we need to at least distinguish between necessary formal features and interpretations emerging as the reflex of (long-distance) syntactic relations. This is crucial in the face of the methodologically justifiable but empirically indefensible propagation of purported features in the last 35 years or so. Focus is a case in point: it is a structural relation usually analysed as the result of adding a [Focus] formal feature on the focused constituent, hence violating Inclusiveness among other things. Tense is another case in point if something like the quantificational theory thereof is true (Von Stechow 1995; Demirdache and Uribe-Etxebarria 2000; Stowell 2007): if Tense is about the correlation between time intervals, then formal features such as [past] and the like are superfluous.[10] The above would eventually create a true tension between competing feature-based and structure-based explanations of phenomena; Section 5.2 will offer some pointers towards how this tension can be resolved, with the general idea being that invoking structural relations trumps positing dedicated formal features.

Second, we need to (re-)examine how the known features are syntactically represented. In doing so, we must let the grammar itself do the explaining, precisely in how it treats the features (Marcel den Dikken, p.c.). Number is a case in point. We already have in place a very detailed and sophisticated understanding of

[10] Such non-feature approaches to Tense also capture sequence-of-tense effects or counterfactual conditionals without the need to posit 'expletive' Tense features. I wish to thank a reviewer for raising the matter.

- the correct values for Number features (Harley and Ritter 2002a; Harbour 2007; 2011 and elsewhere), e.g. that 'singular' and 'plural' are not among them;
- how number features work (Ritter 1991; Borer 2005)
- the role of their position within the nominal phrase (e.g. 'high' vs. 'low') in the way they are interpreted (Acquaviva 2008; 2017; Alexiadou 2011; Dali and Mathieu 2021 and elsewhere)
- the contrast between number on functional heads versus number on modifiers (Borer 2005, chap. 4; Wiltschko 2008; and especially 2014).[11]

Hoping to illustrate how grammar itself may "do the explaining", let me dwell a bit more on that last contrast. Whereas we can stand by the conception of functional heads in (9) as consisting exclusively of formal features, modifiers might (also) encode concepts that are not necessarily encodable as (formal) features – this is definitely so if modifiers are syntactically complex phrases that contain lexical material. On the empirical plane, this difference between the workings of a Number functional head in, say, Slavic and those of the Mandarin Chinese 'plurality' *men* modifier translates into the fact that the latter is *optional* whereas Number functional heads are not.[12] Interestingly, Wiltschko-style modifiers like Mandarin Number look a lot like pre-Fukui and Speas (1986) specifiers and might turn out to be more than just adverbial elements; to wit, den Dikken (2019) argues that Person features inside nominal phrases are *always* located within such modifiers and are never encoded within a functional head of the nominal spine / Extended Projection.

[11] Work by Acedo-Matellán and Real-Puigdollers (2014; 2019) on classifiers might be relevant here.

[12] Borer (2005, chap. 4) discusses the 'intermediate' case of Armenian, offering an analysis.

There are two ways to go about this. One is to say that number features do sit on a modifier like Mandarin Chinese *men*, but that they are inert: hence, they would be semantic features. Alternatively, we can think of "plurality" on Chinese *men* on a par with Turkish gender: as a matter of 'lexical meaning', what Adger and Svenonius call "prototype-based meanings such as whatever distinguishes camels from reindeer or a joke from an insult". Given that no number features participate in any grammatical distinction, relation, or operation in Mandarin Chinese, based on (4) we need not posit a formal feature [Number] in Mandarin Chinese, just like we need not posit gender features for Turkish.

4. Semantic features are superfluous

We have so far established the issues in which a theory of features should be framed. Before moving on to Section 5, where some sketches of answers to the relevant questions are offered, it is necessary to settle a matter that has mostly eluded scrutiny so far in linguistic theorising.

In Section 1 it was pretty uncontroversially stated in (4) that formal features must be both readable at the C-I interface and playing a role in grammatical relations and operations: formal features must be both *instructions* and *active*. The question is whether there exist purely semantic features, i.e. features that abide only by (2), being simultaneously readable at the C-I interface but grammatically inert. The answer I wish to defend here is in the negative: in a grammatical framework where formal structures are matched with conceptual content late, (purely) *semantic features do not exist*.

In separationist-realisational frameworks of grammar (Ralli 1988; Beard 1995; Halle and Marantz 1993; Harley and Noyer 1999 and elsewhere), all semantic interpretation takes

place at the interface between the combinatorial system, the grammar, and C-I systems. More specifically, all matching of meaning with form is mediated via syntactic structures built around roots (Borer 2013a; 2013b; Panagiotidis 2020): not even a simpex noun *cat* is an unstructured Saussurean sign (Marantz 1996; 1997). Of course, here we have the kind of rich conceptual meaning in mind that e.g. "distinguishes camels from reindeer or a joke from an insult" (Adger and Svenonius 2011, 18), what can perhaps still be loosely called 'lexical meaning'.[13]

Historically speaking, semantic features that are grammatically inert were posited in older frameworks as primitives into which 'lexical meaning' would be decomposed. Originating in Katz and Fodor (1963), such features were invoked upon in order to do decompositional lexical semantics,. Famously, *bachelor* would be decomposed into [+male] [-married]. This way of doing lexical semantics has long been superseded, but the idea that particular concepts are expressible in terms of grammatically inert features, i.e. semantic features, has persisted until today. Of course, those purely semantic features are nothing but a notational

[13] Roots can be understood as contentful but polysemous (Levinson 2007; Marantz 2013) or as radically empty differential indices, i.e. as solely the criteria of lexical identity (Acquaviva 2009; Borer 2014a; 2014b; Harley 2014; Panagiotidis 2014; 2020). Here I subscribe to the second thesis, taking roots to be completely contentless: different roots enable the same simplex syntactic structure – say an idealised *n*P consisting of nothing but a root and a categoriser *n* – to be associated with different rich concepts, from *ball* to *hell* and so on. Hence, by inserting different roots in otherwise identical structures, these structures become distinguishable at the interface with the Conceptual-Intentional systems and thus can be matched with different concepts (Acquaviva and Panagiotidis 2012; Panagiotidis and Nóbrega to appear).

variant of meaning postulates; methodologically they are a remnant of a classic but obsolete way of doing lexical semantics.

Consider again the state of gender in Turkish: clearly there are female and male concepts expressed on lexical nouns, i.e. *n*P structures built around roots, but there is no evidence of a (grammatically) active gender feature. For instance, all Turkish pronouns are gender-neutral, including *o*(*n*) ('she / he') and *kendi* (a version of a *se*-anaphor). Do we need to posit a purely semantic (i.e. non-formal) gender feature in Turkish?

Just like with the so-called 'plurality' of *men* in Mandarin Chinese, the answer is no: all that has to do with masculinity, femininity etc. is retrieved in the Encyclopedia once a suitable structure built around a root reaches the C-I interface. This forces us to think that semantic features, grammatically inert instructions to semantics, are superfluous; therefore inexistent:

(10) Purely semantic features do not exist.

A fortiori, the only kind of Saussurean encoding that exists in natural language, that is the only kind of matching of signifiers to signifieds without the mediation of structure (cf. Borer 2013a), is that of formal features:

(11) Formal features are the only unstructured Saussurean signs in natural language.[14]

[14] Adger and Svenonius (2011, 15) are the first (to my knowledge) to conceive features as Saussurean signs: "A given feature might consistently spell out in one way or another […].This simply reflects the usual Saussurean arbitrary pairing of phonological content with syntactic and/or semantic content."

Here, 'unstructured' must be understood as "not involving structures built by the combinatorial system of grammar" and it is not a statement about the format of features themselves, discussed in sections 3.2 and 5.3. A consequence of the inexistence of purely semantic features is that the 'signifieds' of (non-phonological) features in general are those of *formal* features: they are both *limited*, as summarised in (8), and *ancient* (Nóbrega and Miyagawa 2015; Nóbrega 2018).

A framing of formal features as Saussurean signs does not result from methodological syncretism or, worse, methodological sloppiness. The purpose of such framing is to highlight that features, not 'words' or similar, are the actual symbolic atoms of language, with all meaning not encoded as formal features being the result of matching structures of varying complexity to Encyclopedia entries.[15]

Now, features have a signifier in the sense of that they must be *somehow* be expressed, indirectly most of the time. As mentioned above, this abstract signifier is combined with a signified which comes from a limited number of featurable concepts. If, as Sauerland (2008) argues, semantic markedness of features distinct from morphological markedness exists, such semantic markedness would be exactly a property of features as signifieds; at the same time, morphological markedness would be a characteristic of features as signifiers. Again, such a signifier should be understood in the most abstract way possible, given that it is hardly ever the case that features are directly expressed via phonological representations. In the case of formal features, a signifier must be conceived not as a form but as the *potential for form*.

[15] I wish to thank two anonymous reviewers for raising the issue.

If semantic features do not exist and if most denotation is 'lexically' mediated, i.e. after structures built around roots are matched with Encyclopedia entries, we only need consider *formal* features in any Theory of Features. In doing so we can felicitously combat the Boeckxian (Boeckx 2015) anxiety towards coming up with a theory of features that would be called upon to accommodate a messy repertory of too many members, such as the infamous [±married] feature of the Katz and Fodor era, and so on. We can also establish a clearer distinction of what goes to functional heads, i.e. only formal features according to (9), and what *must* be relegated to (structurally complex) modifiers. Finally, we can form concrete expectations about what kinds of feature systems will never be assembled by acquirers. If the above are in the right direction, then the decision to exclude semantic features from a Theory of Features, initially made for methodological reasons, would end up reflecting an issue of substance, i.e. the *actual* inexistence of purely semantic features.

5. Sketching the Theory: answering the four questions

Let us now venture into addressing the four questions framed and elaborated upon in Section 3. The discussion below will only serve as a sketch of how an emerging Theory of Features should deal with such matters, as a sort of guide. Some issues falling out of it are briefly touched upon, others will surely remain unresolved at this very early stage. Recall that the questions we posed are the following:

I. What are formal features?

II. What is the correct *formalism* for them?

III. Why are particular concepts encoded, or rather: are *encodable*, as formal features (e.g. mass / number) and others are not (e.g. colour / brightness)?

IV. How do formal features combine into functional elements (e.g. Indo-European number)?

5.1. Formal features are (the only) Saussurean signs

As already reminded in Section 3.1, language is doubly articulated. The substance of the phonological articulation is phonological features: abstract instructions to the Articulatory-Perceptual systems. Thus, phonological features are the elements that externalisation processes manipulate.

Formal features concern the signifying level of articulation of language. Formal features are the only Saussurean signs in natural language, as in (11): they directly connect particular concepts with some *abstract formal realisation*. Crucially, unlike what happens elsewhere in FLN, signification in the case of formal features is not mediated by grammatical structure – recall Section 4. Thus, formal features are elements that grammatical processes manipulate.

Beginning with simple cases, a [neg] feature consists of a signified, the logical operator ¬, and of an abstract signifier, the realisation of which is down to the choice of exponents at Morphology. Crucially, a formal feature will *have* to be realised *somehow*, the vagaries of morphological Impoverishment, syncretism and/or feature deletion notwithstanding (Halle 1997; Calabrese 2008; Harley 2008 among others).

Moving on to something like a [Q] feature, this one consists of a signified, the illocutionary Force of question, and of a signifier. In languages without question morphemes this signifier is the external Merge this feature might force, or the Agree relation it will establish, or similar.

What needs be stressed is that, in its idealised version, the following statement holds

(12) The signifier of formal features is realised i) as (part of) an exponence or ii) via a grammatical relation and/or operation.

Purely semantic features, as already claimed in (10), do not exist. If a feature with a signified has no abstract signifier, it simply is not there. There is nothing making manifest a feature [-married] on words such as *bachelor* or the horrid *spinster*; therefore there exists no feature [±married]. The semantic interpretation of contentful ('lexical') structures in language is a matter of lexical semantics, and meaning postulates are not features. Finally, let us note once more that contentful structures will be built around a contentless root – see footnote 13. Stepping back to assess the bigger picture, semantic features would only be relavant to the proposition, not to the sentence, thus they have no place in grammar.

Recall that the account here, unlike the one sketched in Zeijlstra (2008) is flexible enough to allow us to differentiate between 'natural' gender distinctions in English as the reflex of a formal feature and lexical gender distinctions in a language like Turkish. In English, gender distinctions are marked on a functional head that creates pronouns by means of a formal feature, a feature also restricting pronominal reference (Heim 2008), whereas in Turkish no gender distinctions are marked on any functional element and such distinctions are a matter of the lexical semantics of contentful structures meaning 'man', 'woman', and the like.

Therefore, although both English and Turkish possess a wealth of lexical items making gender distinctions, in Turkish these are definitely a matter of lexical knowledge, with the male-female distinction being a matter of lexical semantics and in this case a distinction identical to "whatever distinguishes camels from reindeer or a joke from an insult" (Adger

and Svenonius 2011, 18).[16] Similarly, although Korean honorific features exist, and they are formal features, in English honorification is a matter of lexical choice and lexical semantics, ultimately about choosing between different items from the Encyclopedia.

The division of labour regarding signification in natural language falls out like this:

(13) A limited number of concepts is featurable, i.e. they can be directly signified as formal features, whereas every other concept will have to be signified by a structure involving (a) root(s).

Statement (13) links questions I and III. Only formal features exist and they are signs; moreover, the range of their signifieds is restricted by some extra-grammatical principle (once again, recall Section 3.3).

5.2. Positing formal features

Revisiting the remarks in Section 3.4 let us adumbrate an empirical strategy we can follow so as to decide on the scope and validity of something like Emonds' conjecture in (7). This strategy would involve carrying out in-depth typological work that will pursue at least the following:

(14) *How to compile an inventory of formal features*

a. List all and only the concepts that are encoded as formal features.

b. Decide on feature-based versus structure-based interpretations.

[16] The same distinctions on nouns in English (e.g. *actor-actress*, *duke-duchess*, *poet-poetess*) might or might not involve the 'natural' gender features made manifest on a functional head like that of *she*.

c. Let the grammar do the explaining: follow a *theoretically informed* algorithm.

First we need of course to list all the concepts expressed as formal features cross-linguistically. This work will have to be carried out under the restrictive definition of formal features encapsulated in (4) and motivated throughout sections 3.4 and 5.1. We must be careful to list only those features in a particular language that are "involved in inflectional paradigms, or trigger syntactic movement or agreement, or play some other demonstrably formal role" (Cowper and Hall 2014, 146). In the light of (10), i.e. the inexistence of purely semantic features, one should for instance count in [animacy] in Spanish but count [number] out in Mandarin Chinese, and so on. Moreover, given that we expect functional heads to be composed exclusively of formal features, as per (9), one could use Cinque (1999; 2006; 2013), Cinque and Rizzi (2010), and similar kinds of work as a starting point, even if one does not necessarily subscribe to strictly cartographic approaches.[17]

Second, now with reference to point b. in (14), one should remain mindful, as hinted in sections 1 and 3.4, of the inevitable analytical tensions between competing feature-based and structure-based explanations of grammatical phenomena. I believe a path worth following is that, all other things being equal, structure-based explanations of phenomena trump feature-based ones. In other words,

(15) Formal features are not to be posited *praeter necessitatem*.

[17] We will however have to be very careful when admitting evidence exclusively from adverbs as making manifest a formal feature in a particular grammar. The cartographic heuristic procession 'adverb → functional specifier → dedicated functional head → distinctive formal feature' in Cinque (1999; 2006; 2013), Cinque and Rizzi (2010), and elsewhere *cannot always be taken at face value*. See Larson (2021) for a review and criticism.

To give but one example of this tension, we return to the Focus, mentioned earlier: do we really need (at least one) [Focus] feature in all languages? Even when we narrow down our investigation of focus to a sample of languages that unambiguously express it grammatically, like Hungarian, is it always the case that we need to posit [Focus] features in them? Would it not be the case that in at least some languages a focus interpretation is the result of an A'-movement operation that might be otherwise motivated, i.e. not as a result of a purported [Focus] feature? A case in point would be Verb Second (V2), about which Biberauer and Roberts (2015, 16) note that its simplest analysis "requires the acquirer to postulate only a single left-peripheral head which is not specifically associated with formal features like [topic] or [focus]".

Third, and related to invoking V2 above, "letting the grammar do the explaining" involves not only being consistent with the Theory of Features sketched here (or similar), but also both making theoretical and methodological commitments and keeping them. This is more than just a possibly vapid call for consistency or even for avoiding eclecticism, and it is more about having a solid theoretically informed method. I will briefly present here three such methods which I consider promising.[18]

The first example is Ramchand and Svenonius' (2014) method of investigating the order of English auxiliaries and the interactions among them. In their effort to benefit from the syntactic maps drawn out by proponents of the cartographic approach, while keeping an

[18] My presentation of these three methods is as far as I am going to go in this paper towards probing Question IV, namely "how formal features combine into functional elements".

eye on the disparate origin of various constraints (a path explicitly followed by Biberauer 2019), they lay out the ingredients of their account:

(16) *The Ramchand and Svenonius (2014) analytical steps:*

a. A Cartographic contribution—the ordering of syntactic nodes in the (conceptually grounded) functional sequence, for example giving us the order of T_{PERF} over V_{EVT} (Perf over Prog).

b. A selectional contribution—for example the selection of Asp*$_{en}$ by T_{PERF}, rather than some other featural instantiation of Asp*.

c. A default rule for the spell out of heads in the eventive domain when those heads cannot be filled by raising. This gives us the illusion of *be* 'selecting' for the passive phrase and the progressive phrase.

d. A featural stipulation on English modals that they exist only in a morphological form that includes a Fin* feature, like the other tensed morphological forms. This needs to be a stipulation because it is an idiosyncratic fact about English (we give this real semantic content via world anchoring).

One might not agree with the details of the account sketched in (16), or even with the examples supplied. Still, it must definitely be noted that the "featural stipulation" comes last, once other factors at play have been considered. In the case of (16) such factors are order, selection, and externalisation. Such a tactic allows us to exhaust all other explanatory paths before actually positing formal features.

A second example of "letting the grammar do the explaining" before positing features comes from Wiltschko (2014). She begins by arguing against both a cartographically-inspired Universal Base Hypothesis and an 'anything goes' No Base approach; she then goes on to

argue for a Universal Spine Hypothesis (USH). According to her USH, four core functions must be satisfied by both clauses and nominal projections, allowing at the same time for considerable variability with respect to *which functional heads* (hence *formal features*) would satisfy these functions.

These four core functions are deployed in clausal and nominal spines as domains of Classification, Point-of-View, Anchoring, and Linking. These functions can be served by different functional heads (and features). Exemplifying with reference to clausal Anchoring, Wiltschko claims that, while this core function in English is taken care of by Tense, it is served by Person in Blackfoot, by Location in Halkomelem, and by Realis in Upper Austrian German (Wiltschko 2014, sec. 4.4). Wiltschko herself acknowledges (2014, chap. 8) that her USH can be employed to make concrete claims about categorial repertories in different languages, thus about formal features, too. This programme is further nuanced by the fundamental distinction between functional heads and modifiers (see Section 3.4).

A third example of methodologically putting structure considerations before positing features is a taxonomic method suggested by Marcel den Dikken (p.c.), the most speculative one. Den Dikken's startegy can be applied only after something like the previous two methods have yielded results and it involves moving from partial formal feature inventories to potential feature families or even geometries, like what Harley and Ritter (2002a; 2002b) did for ϕ-features of simplex pronouns. Once this is accomplished, then family relations among families of features themselves could be traced. This would hopefully identify and establish general feature patterns in different domains, e.g. ϕ, spatial, quantification, event, categorial, degree / scalar etc.

For instance, it could well be the case that an identical 'point vs. stretch' pattern underlies number (singular vs. plural), space (point vs. path), events (points vs. episodes) etc. If this works out, tough questions like "what would be the counterpart of the gender system in other domains?" could then be asked. This way we would be able to move towards a more structured way of figuring out how different formal features fall into a potential feature system – as opposed to them being isolated individual signs, as we have tacitly assumed so far.

If that last strategy works, it would lead to positing general feature patterns in different domains, a *formal feature system*: it could consequently be the case that feature taxonomies broader than those afforded by the [attribute:value] rendering are in place. Of course it could well be the case that no such system or systems exist and that only individual formal features exist: the matter is, again, ultimately empirical.

This last issue however already invites discussion of the correct formalism of features.

5.3. On the correct formalism for formal features

Moving to Question II at the beginning of Section 5, I wish to reiterate the interim conclusion reached in Section 3.2, namely that in an emergentist approach to the acquisition of features, formal features can be privative, equipollent or of the [attribute:value] sort and that the matter will have to be ultimately resolved empirically. At this point, the only way I can supplement that conclusion is to offer two somehow speculative points.

Adger and Svenonius (2011, 7) in their criticism of the privative feature formalism correctly point out that "in practice, feature classes are almost always assumed" and classes are

assumed because they make the task of using formal features to cross-classify categories possible, or at least straightforward. Having said that, cross-classification is not always necessary within a particular grammar.

Suppose for instance that in some grammar there exist two equipollent person features, [±author] and [±participant], as in Halle (1997). Suppose also that, unlike what happens in Kiowa (Harbour 2007; 2011), there exists a privative [Atomic] feature: its presence is interpreted as 'singular', whereas its absence as 'plural'. Now, the feature being privative, we are not allowed, so to speak, to call it a 'Number' feature, because this immediately would impose an [attribute:value] format to it, namely the [number:atomic] one. Still, perhaps this restriction privativity imposes may be moot in the particular grammar, provided that

a) only one functional head – call it ϕ – can host these features and that
b) it can host exactly three features: [±author], [±participant] and [Atomic].

In this case, no reference to an attribute [number] is necessary here, provided that 'person' (i.e. [±author], [±participant]) and 'number' (i.e. [Atomic]) features are only present on this very ϕ head, a pronominal one presumably.

This state of affairs would be reminiscent of 'natural' gender in English: whether we claim that English gender is expressed on a 'semantic gender' head (Kramer 2009) as [masculine], [feminine], and nothing ('neuter', i.e. 'inanimate') is ceteris paribus a notational variant of claiming that it is expressed as [animate:masculine], [animate:feminine], and nothing. Perhaps it would make sense to go for the privative set [masculine], [feminine] and nothing,

considering that gender is not marked *anywhere* else in English: the presence of a privative [masculine] or [feminine] feature would by default also entail animacy.

Going back to the ϕ head of our hypothetical grammar, the privative [Atomic] feature would have to be construed as [number:atomic] if and only if it is probed by an unvalued Probe somewhere in the grammar. In this case, the feature on the Goal, [number:atomic] and not a privative [Atomic] one, is probed for an Agree operation by a Probe bearing its unvalued version, i.e. [number:]. Hence, [number:] would probe the structure looking to be valued via Agree by a [number:atomic] Goal.[19] Therefore:

(17) *On the availability of privative features (first version)*

Privative features can only be posited by the acquirer iff i) they do not cross-classify and ii) they never function as Goals for unvalued Probes.

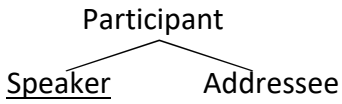
The second point is as follows. The restrictions regarding the syntactic activity of privative features seem unresolvable: once we posit an unvalued feature (or an uninterpretable one – see footnote 19), a more complex formalism becomes necessary in order to express the feature that participates in the Agree relation, either an equipollent or an [attribute:value] one. Still, there is indeed a way to make privative features create feature classes, and that is no other than Harley and Ritter's (2002a; 2002b) feature hierarchy. Their feature-geometric

[19] I am broadly following Adger and Svenonius (2011) here regarding unvalued features. Harbour (2007, 76–78) argues uninterpretability to result from a (bivalent) feature being valued both as + and -. Trivially, + and – can be construed as values of any given attribute, still leaving space for no value, i.e. unvaluedness (Adger 2010). A reviewer points out that privative features can well be *uninterpretable* if interpretability is a meta-feature – but I would think that positing meta-features cancels the privative character of any feature system.

analysis has undergone a lot of criticism (e.g. Harbour 2007; Nevins 2007), but it carries a potential advantage.

The feature-geometric account goes the opposite direction of what Adger (2010, 194–96) sees as a potential weakness of [attribute:value] systems: the possibility of such rich systems "allowing an entire category to be a possible value of another attribute", a weakness which Adger goes on to resolve invoking locality. Now, in a feature hierarchy, all (privative) feature relations are local, locked together in dominance relations that yield strict entailment relations. Consider for instance this fragment of the Harley-Ritter ϕ hierarchy:

(18)



As Harley and Ritter (2002a, 502) elaborate, the Person feature schema above offers the following options, which are available to different languages:

- Participant vs. nothing (where 'nothing' will be interpreted as non-1st, given that Speaker is the default interpretation of the Participant node in this case);
- Participant (2nd) vs. Participant-Speaker (1st) vs. nothing (3rd);
- Participant (1st) vs. Participant-Addressee (2nd) vs. nothing (3rd);
- Participant (contrastive 1st) vs. Participant-Speaker (1st) vs. Participant-Addressee (2nd) vs. Participant-[Speaker Addressee] (1st inclusive) vs. nothing (3rd).

Details aside, we see how the feature geometric-approach could ultimately subsume an [attribute:value] system by essentially translating both attributes (e.g. Participant) and

values (e.g. Addressee) into hierarchically arranged nodes.[20] This could be desirable if such hierarchical relations reflect the order of acquisition (e.g. the positing of features): Harley and Ritter (2002a, 499–501) already discuss this. Moreover, feature-seeking algorithms like the one in Dresher (2014) can actually be mapped in feature-geometric terms, something that has already been acknowledged and implemented in the parameter-positing algorithm of Biberauer, Holmberg, Roberts, and Sheehan (2014), Biberauer and Roberts (2015), Biberauer (2019) and elsewhere.

5.4. A short note on unvaluedness and uninterpretability

Uninterpretable and unvalued formal features in the light of (17) can only be construed as non-privative. In this assumption I follow the spirit of Adger and Svenonius (2011) here regarding unvalued features: understanding an unvalued feature to be an attribute without a value, e.g. [number:] in the previous subsection. This necessarily renders any unvalued feature non-privative, this allowing for equipollence as trivially + and – can be construed as values of any given attribute, still leaving space for no value, i.e. the unvaluedness of neither + nor - (Adger 2010).

Let us turn to the uninterpretability of certain formal features, recalling that according to Pesetsky and Torrego (2001; 2004; 2007) uninterpretability of a formal feature is distinct to unvaluedness, yielding the following four way cross-classification (as in Pesetsky and Torrego 2007):

[20] The equalisation of first-order and second-order features, i.e. of attributes and values (Adger 2010), could also accommodate defaults and markedness in individual grammars: the default interpretation of dominating nodes would be the unmarked one (cf. Sauerland 2008).

(19) *Types of features according to Pesetsky and Torrego*

*u*F *val* (uninterpretable, valued)	*u*F [ ] (uninterpretable, unvalued)
*i*F *val* (interpretable, valued)	*i*F [ ] (interpretable, unvalued)

If uninterpretable formal features exist and if the proposed state of affairs in (19) is anything to go by, with (un)valuedness being orthogonal to (un)interpretability, then how are we to capture the latter? A way forward is to side with Harbour (2007, 76–78), who argues that uninterpretability results from a (bivalent) feature being valued *both* as + and -. If this or a similar explanation for uninterpretability of formal features is valid, then it again follows that if the uninterpretable version of a feature is made use of in a grammar, then this feature cannot be privative.[21] Hence, we have to supplement the statement in (17) as follows:

(20) *On the availability of privative features (second version)*

Privative features can only be posited by the acquirer iff

i) they do not cross-classify

ii) they never function as Goals for unvalued Probes

iii) they are interpretable only.

[21] A reviewer points out that privative features can well be uninterpretable if interpretability is a meta-feature – but I would think that positing meta-features cancels the privative character of any feature system.

6. A consequence of the proposed sketch: the status of derivational affixes in a system without semantic features

If we go by the hypothesis in (2), (8), and (11) that formal features encode concepts of a particular sort, and if (10) is indeed the case, i.e. that grammatically inert semantic features do not exist, then we are faced with potential problems regarding the explanations available for particular empirical phenomena. One of these problems is the status of derivational affixes, given that derivational affixes are customarily understood as pure feature structures that may attach to root structures or to categorised structures such as *n*Ps (nouns), *v*Ps (verbs), and adjectives (cf. Fabb 1988). Such structures are in practice assumed to comprise *both* formal features and inert semantic features. This contrasts them with functional heads, which only bear formal features by the hypothesis in (9).

Looking at suffixes like Portuguese *-eiro*, Greek *-(a)tz-* or the semantically rich affixes in Bella Coola (examples from Haspelmath and Sims 2010, 19–22, where there is some discussion of such affixes), one is faced with elements that appear to bear quite complex and/or concrete meanings: their interpretations look like those of nouns, although they are all clearly affixal. Thus, Portuguese *-eiro* means 'tree', with *pinheiro* being the word for 'pine tree', Greek *-(a)tz-* means 'profession' (at least in older dialects), with *pagot-atz-is* being the word for 'ice cream seller', whereas Bella Coola contains affixes such as *-lst* ('rock'), *-lik* ('body'), *-altwa* ('sky, weather'), *-an* ('ear'), *-uc* ('mouth') – and so on.

In a system where pretty much any concept can be directly fetched by a 'semantic feature', it is easy to capture the above: *-eiro* bears a semantic [tree] feature, *–(a)tz-* a [profession] feature, *-lst* a [rock] feature, *-uc* a [mouth] one, and so on. Positing inert semantic features

is the typical solution to describing the rich content of some derivational affixes, i.e. of morphologically bound elements that are seemingly composed exclusively out of features, without any roots involved.

It is of course the wrong answer, because semantic features do not exist. What we are dealing with in affixes like those sampled above is obviously rich lexical meaning, as these derivational affixes pretty ostensibly encode nominal concepts (Acquaviva 2014). Even setting aside the (in)existence of semantic features, the issue of what the *syntactic* status of derivational affixes would be a broader one.

This is an important question to ask because "affix" is a morphological analytical category describing how a morpheme combines with other morphemes and "derivational" describes its morphological function (roughly, 'word making'). Identifying an element as a "derivational affix" reveals hardly anything about what structures these affixes are and what features they are made of. Being content with pretheoretically contrasting them with inflectional affixes is not enough, even if we somehow get our theory (correctly, I think) to understand inflectional affixes as exponents of functional heads.

It has of course been noted before that distinguishing between roots and derivational affixes is not always a straightforward matter. Panagiotidis (2014, 297–98) cites an empirical point raised by Pullum (2010) who considers "the endings of the words [such as] *–like*, *–esque*, *–ward*, *–proof*, *–(a)thon*, […] *–ism*, […] *–(o)phile*, *–(i)licious*, and *–gasm*". Pullum goes on to make the theoretical judgment "that only *–like*, *–esque*, *–ward*, and *–ism* should be called suffixes", with the rest of them roots. Panagiotidis in the above quote sides with Pullum in that "even an apparently easy question, such as whether an element like *–proof* is a root or an affix, must be decided on principled theoretical grounds" (ibid. 2014, 298).

Now, of course there are well articulated accounts venturing to settle the matter by casting *all* derivational affixes as (involving) roots, including those in De Belder (2011), Lowenstamm (2014), and Acedo-Matellán and Real-Puigdollers (2014). I agree with the above that all contentful derivational affixes indeed involve roots, as also implied in Pullum's short treatment, including the examples from Portuguese, Greek, and Bella Coola presented at the beginning of this section, and also Pullum's *-proof*, *-(a)thon*, *-ism*, *-(o)phile*, *-(i)licious*, and *-gasm*.

The whole issue actually boils down to a choice between these elements being roots (or structures containing roots) and to positing inert semantic features fetching whatever the meaning(s) of *-ism* would be, or fetching a complex notion of 'loving something' as in *franco-phile*, *biblio-phile* etc. – even setting aside any nefarious connotations some of the nouns derived from it might have. At the end of the day, we have to choose between

i) lexical meaning being expressible only by root-based structures and

ii) inert semantic features that can fetch any kind of (nominal) concept.

If the latter were the case, one should wonder why it is not the case that all (nominal) concepts be encoded as (inert) semantic features, given that such concepts as 'profession', 'tree' or 'mouth' are expressible as such. Actually this would entail analytically going several steps backwards, even behind Katz and Fodor (1963): nominal concepts such as TREE or MOUTH would no longer be necessarily decomposed into semantic features but would promptly be featurable as attributes themselves. In other words, we would regress from taking meaning postulates like 'married' to be semantic features to taking 'bachelor' to be a feature.

Would the above entail that *all* derivational affixes are roots? Not necessarily, given that the analytical category 'derivational affix' is morphophonological, not syntactic: it has to do with the realisation and exponence of word-making elements and not with their structure. If no features but formal features exist, then we would expect that pure feature structures that surface as derivational affixes should also exist. A possible candidate for this is English *-ness* / *-ity*: it selects adjectives and yields nouns, usually of an abstract sort. It is then perhaps the case that *-ness* / *-ity* is an exponent of the nominaliser *n*, along with *-th* and, perhaps, the likes of *-ment*. Affixes like *-ize* would realise a special verbaliser *v,* one that bears a [causation] formal feature, which is independently motivated for English, next to a categorial feature [V].

If the 'menagerie' below, adapted from Panagiotidis (2011, 381), is anything to go by, derivational affixes could therefore belong to any of the four elements predicted below.

(21) *The elements of grammar*

	made of	*categorial status*	*includes*	*examples*
categorisers	formal features	[N] or [V]	*n*, *v*	*–ment*, *–th*
functional heads	formal features	uninterpretable [N] or [V]	Voice, Asp, T, C, D, Num…	*–ing*, *to*, *will*, *if*, *the*, *–s*
subcategorial elements / "inner morphemes"	formal features	categoryless	particles, low applicatives, low causatives…	*–ee*, *de–*, *up*, *in*
roots	?	categoryless	roots	CAT, WORK, KTB

Derivational affixes could then be roots (De Belder 2011; Lowenstamm 2014; and even a version of Acedo-Matellán and Real-Puigdollers 2014; 2019) or complex structures

containing roots. In this case they can encode rich meanings, well beyond the limited language-specific repertory drawn from the pool of featurable concepts – recall (13). As already suggested, Portuguese *–eiro*, Greek *–(a)tz–* and Bella Coola *–lst*, *–lik*, *–altwa*, *–an*, *–uc* belong here, as well as *–ism*, *–phile* and the like.

As per the above table, derivational affixes could also be subcategorial feature structures (Marantz 2000; 2005; 2006; Pylkkänen 2008), consisting of formal features only and typically contributing to idiosyncratic interpretation due to their close affinity to roots before the categorisation of the constituent containing the root (Panagiotidis 2011; 2015, 67–70 and elsewhere). The Japanese causative –(*s*)*ase*, of Marantz (1997) fame, could be an example of such an element in its subcategorial realisation.

Turning to categorising derivational affixes, we have already touched upon *–ness* / *–ity*, an element apparently only encoding an [N] feature, with of derivational affixes being 'rich' categorisers such as *–ize*, which bear more formal features than just the categorial one.

Finally, some derivational elements could also be bona fide functional heads, a suspicion that has already been around at least since Spencer (1991; 2000).

7. (An inevitably provisional) Conclusion

There exist phonological features; they abstractly encode articulatory instructions. There also exist formal features, signs which abstractly encode a limited set of pre-human concepts – as opposed to concepts encoded by root-embedding structures via grammar. No other types of features exist, most notably: no grammatically inert semantic features.

Functional heads are composed exclusively of formal features. Formal features are perhaps emergent, acquired, and not universally available in a UG inventory for the acquirer to pick from. However, the signifieds of formal features, i.e. the concepts that are featurable, are restricted by some general cognitive (i.e. UG-external) principle(s). Formal features may belong to families, in which case they can cross-classify categories. The correct formalism for features should capture their cross-classifying function, but it should also be flexible enough to accommodate privativity when no such cross-classification is manifested. Finally, derivational affixes may belong to any of the four (or more) types of structures at play in the combinatorial system: roots, inner morphemes, categorisers, and (even) functional heads.

Bibliography

Acedo-Matellán, Víctor, and Cristina Real-Puigdollers. 2014. “Inserting Roots into (Functional) Nodes: Categories and Cross-Linguistic Variation,.” *Linguistic Analysis* 39 (1–2): 125–68.

———. 2019. “Roots into Functional Nodes: Exploring Locality and Semi-Lexicality.” *The Linguistic Review* 36 (3): 411–36. https://doi.org/10.1515/tlr-2019-2019.

Acquaviva, Paolo. 2008. *Lexical Plurals: A Morphosemantic Approach*. Oxford Studies in Theoretical Linguistics 20. Oxford ; New York: Oxford University Press.

———. 2009. “Roots and Lexicality in Distributed Morphology.” In *York-Essex Morphology Meeting 5: Special Issue of York Working Papers in Linguistics*, edited by Alexandra Galani, Daniel Redinger, and Norman Yeo, 2:1–21. York: University of York. http://ling.auf.net/lingbuzz/000654.

———. 2014. “The Roots of Nominality, the Nominality of Roots.” In *The Syntax of Roots and the Roots of Syntax*, edited by Artemis Alexiadou, Hagit Borer, and Florian Schäfer, 33–56. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

———. 2017. “Number in Language.” In *Oxford Research Encyclopedia of Linguistics*, by Paolo Acquaviva. Oxford University Press.

https://doi.org/10.1093/acrefore/9780199384655.013.61.

Acquaviva, Paolo, and Phoevos Panagiotidis. 2012. “Lexical Decomposition Meets Conceptual Atomism.” *Lingue e Linguaggio* XI (2): 105–20.

Adger, David. 2010. “A Minimalist Theory of Feature Structures.” In *Features, Perspectives on a Key Notion in Linguistics*, edited by Anna Kibort and Greville G. Corbett, 185–218. Oxford ; New York: Oxford University Press.

Adger, David, and Daniel Harbour. 2008. “Why Phi?” In *Phi Theory: Phi-Features across Modules and Interfaces*, edited by Daniel Harbour, David Adger, and Susana Béjar, 1–34. Oxford Linguistics 16. Oxford ; New York: Oxford University Press.

Adger, David, and Peter Svenonius. 2011. *Features in Minimalist Syntax*. Oxford Handbooks Online. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199549368.013.0002.

Alexiadou, Artemis. 2011. “Plural Mass Nouns and the Morpho-Syntax of Number.” In *Proceedings of the 28th West Coast Conference on Formal Linguistics*, edited by Mary Byram Washburn, Catherine McKinney-Bock, Erica Varis, Ann Sawyer, and Barbara Tomaszewicz, 33–41. Sommerville: Mass.: Cascadilla Press. http://www.lingref.com/cpp/wccfl/28/paper2433.pdf.

Baker, Mark C. 2003. *Lexical Categories: Verbs, Nouns, and Adjectives*. Cambridge Studies in Linguistics. Cambridge, UK; New York: Cambridge University Press.

Beard, Robert. 1995. *Lexeme-Morpheme Base Morphology: A General Theory of Inflection and Word Formation*. SUNY Series in Linguistics. Albany: State University of New York.

Berwick, Robert C, and Noam Chomsky. 2017. *Why Only Us: Language and Evolution*.

Biberauer, Theresa. 2019. “Factors 2 and 3: Towards a Principled Approach.” *Catalan Journal of Linguistics*, no. Special Issue (December): 45–88. https://doi.org/10.5565/rev/catjl.219.

Biberauer, Theresa, Anders Holmberg, Ian Roberts, and Michelle Sheehan. 2014. “Complexity in Comparative Syntax: The View from Modern Parametric Theory.” In *Measuring Grammatical Complexity*, edited by Frederick J. Newmeyer and Laurel B. Preston, 103–27. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199685301.003.0006.

Biberauer, Theresa, and Ian Roberts. 2015. “Rethinking Formal Hierarchies: A Proposed Unification.” *Cambridge Occasional Papers in Linguistics* 7 (1): 1–31.

Boeckx, Cedric. 2015. *Elementary Syntactic Structures: Prospects of a Feature-Free Syntax*. Cambridge Studies in Linguistics 144. Cambridge, United Kingdom: Cambridge University Press.

Borer, Hagit. 2005. *In Name Only*. Structuring Sense, volume I. Oxford; New York: Oxford University Press.

———. 2013a. *Taking Form*. First edition. Structuring Sense, volume III. Oxford: Oxford University Press.

———. 2013b. "The Syntactic Domain of Content*." In *Language Acquisition and Language Disorders*, edited by Misha Becker, John Grinstead, and Jason Rothman, 54:205–48. Amsterdam: John Benjamins Publishing Company. https://doi.org/10.1075/lald.54.09bor.

———. 2014a. "The Category of Roots." In *The Syntax of Roots and the Roots of Syntax*, edited by Artemis Alexiadou, Hagit Borer, and Florian Schäfer, 112–48. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

———. 2014b. "Wherefore Roots?" *Theoretical Linguistics* 40 (3–4). https://doi.org/10.1515/tl-2014-0016.

Calabrese, Andrea. 2008. "On Absolute and Contextual Syncretism: Remarks on the Structure of Case Paradigms and on How to Derive Them." In *Inflectional Identity*, edited by Asaf Bachrach and Andrew Nevins, 156–205. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

Chomsky, Noam. 1995. *The Minimalist Program*. Current Studies in Linguistics 28. Cambridge, Mass: The MIT Press.

———. 2001. "Derivation by Phase." In *Ken Hale: A Life in Language*, edited by Michael Kenstowicz, 1–52. Cambridge, Mass.: MIT Press.

———. 2020. "The UCLA Lectures." Unpublished lectures. UCLA. https://ling.auf.net/lingbuzz/005485.

Cinque, Guglielmo. 1999. *Adverbs and Functional Heads*. Oxford ; New York: Oxford University Press.

———. 2006. *Restructuring and Functional Heads*. The Cartography of Syntactic Structures, v. 4. Oxford; New York: Oxford University Press.

———. 2013. "Cognition, Universal Grammar, and Typological Generalizations." *Lingua* 130 (June): 50–65. https://doi.org/10.1016/j.lingua.2012.10.007.

Cinque, Guglielmo, and Luigi Rizzi. 2010. “The Cartography of Syntactic Structures.” In *The Oxford Handbook of Linguistic Analysis*, edited by Bernd Heine and Heiko Narrog, 65–78. Oxford Handbooks in Linguistics. Oxford; New York: Oxford University Press.

Corbett, Greville G. 1991. *Gender*. Cambridge Textbooks in Linguistics. Cambridge [England] ; New York: Cambridge University Press.

Cowper, Elizabeth, and Daniel Currie Hall. 2014. “Reductiō Ad Discrīmen: Where Features Come From.” Edited by Martin Krämer, Sandra Ronai, and Peter Svenonius. *Nordlyd* 41 (2 Special Issue on Features): 145–64.

Dali, Myriam, and Eric Mathieu. 2021. *A Theory of Distributed Number*. Linguistik Aktuell/Linguistics Today, volume 269. Amsterdam ; Philadelphia: John Benjamins Publishing Company.

De Belder, Marijke. 2011. *Roots and Affixes: Eliminating Lexical Categories from Syntax.* Utrecht: LOT.

Demirdache, Hamida, and Miriam Uribe-Etxebarria. 2000. “The Primitives of Temporal Relations.” In *Step by Step. Essays on Minimalist Syntax in Honor of Howard Lasnik*, edited by Roger Martin, David Michaels, and Juan Uriagereka, 157–86. Cambridge, Mass: MIT Press.

Dikken, Marcel den. 2019. “The Attractions of Agreement: Why Person Is Different.” *Frontiers in Psychology* 10 (May): 978. https://doi.org/10.3389/fpsyg.2019.00978.

Dresher, B. Elan. 2014. “The Arch Not the Stones: Universal Feature Theory without Universal Features.” Edited by Martin Krämer, Sandra Ronai, and Peter Svenonius. *Nordlyd* 41 (2 Special Issue on Features): 165–81.

Emonds, Joseph E. 2011. “From Primate to Human in Two Easy Steps.” In *The Evolution of Literature: Legacies of Darwin in European Cultures*, edited by Nicholas Saul and Simon James, 43–69. Amsterdam: Rodopi.

Fabb, Nigel. 1988. “English Suffixation Is Constrained Only by Selectional Restrictions.” *Natural Language and Linguistic Theory* 6 (4): 527–39.

Fintel, Kai von. 1995. “The Formal Semantics of Grammaticalization’.” *NELS* 25: 175–89.

Fukui, Naoki, and Margaret Speas. 1986. “Specifiers and Projection.” *MIT Working Papers in Linguistics* 8: 128–72.

Golston, Chris. 2018. “ϕ-Features in Animal Cognition.” *Biolinguistics* 12: 55–98.

———. 2019a. “Thematic Roles in Animal Cognition.” Paper, California State University

Fresno, March 12.

———. 2019b. “Tense and Aspect in Animal Cognition.” Paper, University of Zurich, May 28.

Halle, Morris. 1997. “Distributed Morphology: Impoverishment and Fission.” *MIT Working Papers in Linguistics* 30: 425–49.

Halle, Morris, and Alec Marantz. 1993. “Distributed Morphology and the Pieces of Inflection.” In *The View from Building 20. Essays in Honor of Sylvain Bromberger*, edited by Kenneth L. Hale and Samuel Jay Keyser, 111–76. Cambridge, Mass.: MIT Press.

Harbour, Daniel. 2007. *Morphosemantic Number: From Kiowa Noun Classes to UG Number Features*. Studies in Natural Language and Linguistic Theory, v. 69. Dordrecht, The Netherlands: Springer.

———. 2011. “Valence and Atomic Number.” *Linguistic Inquiry* 42 (4): 561–94.

Harley, Heidi. 2008. “When Is a Syncretism More than a Syncretism? Impoverishment, Metasyncretism, and Underspecification.” In *Phi Theory*, edited by Daniel Harbour, David Adger, and Susana Béjar, 251–94. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

———. 2014. “On the Identity of Roots.” *Theoretical Linguistics* 40 (3/4): 225–76.

Harley, Heidi, and Rolf Noyer. 1999. “State-of-the-Article: Distributed Morphology.” *GLOT International* 4 (4): 3–9.

Harley, Heidi, and Elizabeth Ritter. 2002a. “Person and Number in Pronouns: A Feature-Geometric Analysis.” *Language* 78 (3): 482–526.

———. 2002b. “Structuring the Bundle: A Universal Morphosyntactic Feature Geometry.” In *Pronouns: Features and Representations*, edited by Heike Wiese and Simon Horst, 23–39. Linguistik Aktuell = Linguistics Today. Amsterdam ; Philadelphia: John Benjamins.

Haspelmath, Martin, and Andrea D. Sims. 2010. *Understanding Morphology*. 2nd ed. Understanding Language Series. London: Hodder Education.

Hauser, M. D., Noam Chomsky, and Tecumseh Fitch. 2002. “The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?” *Science* 298 (5598): 1569–79. https://doi.org/10.1126/science.298.5598.1569.

Hegarty, Michael. 2005. *A Feature-Based Syntax of Functional Categories: The Structure, Acquisition, and Specific Impairment of Functional Systems*. Studies in Generative Grammar 79. Berlin ; New York: Mouton de Gruyter.

Heim, Irene. 2008. “Features on Bound Pronouns.” In *Phi Theory*, edited by Daniel Harbour,

David Adger, and Susana Béjar, 35–56. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

Hinzen, Wolfram. 2006. *Mind Design and Minimal Syntax*. Oxford ; New York: Oxford University Press.

Karimi-Doostan, Gholamhosein. 2008. “Classless Words in Persian.” Talk, Université Sorbonne Nouvelle-Paris III, France, July 5.

———. 2011. “Lexical Categories in Persian.” *Lingua* 121 (2): 207–20. https://doi.org/10.1016/j.lingua.2010.06.014.

Katz, Jerrold J., and Jerry A. Fodor. 1963. “The Structure of a Semantic Theory.” *Language* 39 (2): 179–210.

Kramer, Ruth. 2009. “Definite Markers, Phi-Features and Agreement: A Morphosyntactic Investigation of the Amharic DP.” University of California at Santa Cruz.

———. 2015. *The Morphosyntax of Gender*. 1st ed. Oxford Studies in Theoretical Linguistics 58. Oxford: Oxford University Press.

Larson, Richard K. 2021. “Rethinking Cartography.” *Language* 97 (2): 245–68. https://doi.org/10.1353/lan.2021.0018.

Levinson, Lisa. 2007. “The Roots of Verbs.” PhD thesis, NYU.

Lowenstamm, Jean. 2014. “Derivational Affixes as Roots.” In *The Syntax of Roots and the Roots of Syntax*, edited by Artemis Alexiadou, Hagit Borer, and Florian Schäfer, 230–58. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199665266.003.0011.

Manzini, Maria Rita, and Leonardo Maria Savoia. 2011. *Grammatical Categories: Variation in Romance Languages*. Cambridge Studies in Linguistics 128. Cambridge ; New York: Cambridge University Press.

Marantz, Alec. 1996. “‘Cat’ as a Phrasal Idiom: Consequences of Late Insertion in Distributed Morphology.” Unpublished ms. MIT.

———. 1997. “No Escape from Syntax: Don’t Try Morphological Analysis in the Privacy of Your Own Lexicon.” *U. Penn Working Papers in Linguistics* 4: 201–25.

———. 2000. “Words.” Unpublished ms. NYU.

———. 2005. “Rederived Generalizations.” Unpublished ms. MIT.

———. 2006. “Phases and Words.” Unpublished ms. MIT. https://files.nyu.edu/ma988/public/Phase_in_Words_Final.pdf.

———. 2013. “Locality Domains for Contextual Allomorphy across the Interfaces.” In

Distributed Morphology Today, edited by Ora Matushansky and Alec Marantz, 95–113. The MIT Press. https://doi.org/10.7551/mitpress/9780262019675.003.0006.

Mitrović, Moreno. 2014. “Morphosyntactic Atoms of Propositional Logic.” PhD thesis, Cambridge, UK: Cambridge.

Muysken, Pieter, and Henk C. van Riemsdijk. 1986. “Projecting Features and Featuring Projections.” In *Features and Projections*, edited by Pieter Muysken and Henk C. van Riemsdijk, 1–30. Studies in Generative Grammar 25. Dortrecht, Holland ; Riverton, U.S.A: Foris.

Nevins, Andrew. 2007. “The Representation of Third Person and Its Consequences for Person-Case Effects.” *Natural Language & Linguistic Theory* 25 (2): 273–313. https://doi.org/10.1007/s11049-006-9017-2.

———. 2008. “Cross-Modular Parallels in the Study of Phon and Phi.” In *Phi Theory*, edited by Daniel Harbour, David Adger, and Susana Béjar, 329–67. Oxford Studies in Theoretical Linguistics. Oxford ; New York: Oxford University Press.

Newmeyer, Frederick J. 1998. *Language Form and Language Function*. Language, Speech, and Communication. Cambridge, Mass: MIT Press.

Nóbrega, Vitor. 2018. “Isomorphic Approach: Articulating the Lexicon and Syntax in the Emergence of Language.” Unpublished PhD thesis, São Paulo: São Paulo.

Nóbrega, Vitor, and Shigeru Miyagawa. 2015. “The Precedence of Syntax in the Rapid Emergence of Human Language in Evolution as Defined by the Integration Hypothesis.” *Frontiers in Psychology* 6 (March). https://doi.org/10.3389/fpsyg.2015.00271.

Panagiotidis, Phoevos. 2011. “Categorial Features and Categorizers.” *The Linguistic Review* 28: 325–46.

———. 2014. “A Minimalist Approach to Roots.” In *Minimalism and Beyond: Radicalizing the Interfaces*, edited by Peter Kosta, Steven Franks, Lilia Schürcks, and Teodora Radeva-Bork, 287–303. Amsterdam; Philadelphia: John Benjamins Pub. Co.

———. 2015. *Categorial Features: A Generative Theory of Word Class Categories*. Cambridge Studies in Linguistics 145. Cambridge; New York: Cambridge University Press.

———. 2018. “(Grammatical) Gender Troubles and the Gender of Pronouns.” In *Gender, Noun Classification, and Determination.*, edited by Eric Mathieu and Gita Zareikar, 186–99. Oxford; New York: Oxford University Press.

———. 2020. “On the Nature of Roots: Content, Form, Identification.” *Evolutionary Linguistic Theory* 2 (1): 56–83.

Panagiotidis, Phoevos, and Vitor Nóbrega. to appear. “Roots as Indices, and Beyond.” In *The Cambridge Handbook of Minimalism*, edited by Kleanthes K. Grohmann and Evelina Leivada. Cambridge [England]; New York: Cambridge University Press.

Pesetsky, David, and Ester Torrego. 2001. “T-to-C Movement: Causes and Consequence.” In *Ken Hale: A Life in Language*, edited by Michael Kenstowicz, 355–426. Cambridge, Mass.: MIT Press.

———. 2004. “Tense, Case and the Nature of Syntactic Categories.” In *The Syntax of Time*, edited by Jacqueline Guéron and Jacqueline Lecarme, 495–537. Cambridge, Mass.: MIT Press.

Pesetsky, David, and Esther Torrego. 2007. “The Syntax of Valuation and the Interpretability of Features.” In *Linguistik Aktuell/Linguistics Today*, edited by Simin Karimi, Vida Samiian, and Wendy K. Wilkins, 101:262–94. Amsterdam: John Benjamins Publishing Company. https://doi.org/10.1075/la.101.14pes.

Pullum, Geoffrey. 2010. “Isms, Gasms, Etc.” *The Language Log* (blog). February 8, 2010. http://languagelog.ldc.upenn.edu/nll/?p=2108.

Pylkkänen, Liina. 2008. *Introducing Arguments*. Cambridge, Mass.: MIT Press. http://site.ebrary.com/id/10229589.

Ralli, Angela. 1988. “Eléments de La Morphologie Du Grec Moderne: La Structure Du Verbe.” Montreal: Université du Montréal.

Ramchand, Gillian, and Peter Svenonius. 2014. “Deriving the Functional Hierarchy.” *Language Sciences* 46 (November): 152–74. https://doi.org/10.1016/j.langsci.2014.06.013.

Ritter, Elizabeth. 1991. “Two Functional Categories in Modern Hebrew Noun Phrases.” In *Perspectives on Phrase Structure: Heads and Licensing*, edited by Susan Deborah Rothstein, 37–62. Syntax and Semantics, v. 25. San Diego: Academic Press.

Roberts, I., and A. Roussou. 2003. *Syntactic Change: A Minimalist Approach to Grammaticalization*. Cambridge Studies in Linguistics. Cambridge University Press. https://books.google.gr/books?id=SMXbhgAUWccC.

Sauerland, Uli. 2008. “On the Semantic Markedness of Phi-Features.” In *Phi Theory*, edited by Daniel Harbour, David Adger, and Susana Béjar, 57–82. Oxford Studies in Theoretical

Linguistics. Oxford ; New York: Oxford University Press.

Spencer, Andrew. 1991. *Morphological Theory: An Introduction to Word Structure in Generative Grammar*. Oxford: Blackwell.

———. 2000. “Inflection and the Lexeme.” *Acta Linguistica Hungarica* 47 (1/4): 335–44. https://doi.org/10.1023/A:1014026901690.

Stowell, Tim. 2007. “The Syntactic Expression of Tense.” *Lingua*, 437–63.

Von Stechow, Arnim. 1995. “On the Proper Treatment of Tense.” *Semantics and Linguistic Theory* 5 (June): 362–86. https://doi.org/10.3765/salt.v5i0.2700.

Wiltschko, Martina. 2008. “The Syntax of Non-Inflectional Plural Marking.” *Natural Language and Linguistic Theory* 26 (3): 639–94.

———. 2014. *The Universal Structure of Categories: Towards a Formal Typology*. Cambridge Studies in Linguistics 142. Cambridge, United Kingdom: Cambridge University Press.

Zeijlstra, Hedde. 2008. “On the Syntactic Flexibility of Formal Features.” In *The Limits of Syntactic Variation*, edited by Theresa Biberauer, 143–73. Amsterdam; Philadelphia: John Benjamins Pub. Co.

Zhang, Niina Ning. 2022. “Conjunct and Adjunct: Two Sides of the Same Coin.” National Chung Cheng University.

[i] Acknowledgements: [to be added later]. I remain the proprietor of all misunderstandings and errors.