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Features and affix-hop

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Abstract: In this paper, I review how formal features are currently regarded and used in the Minimalist Program. Although features are the cornerstone in Minimalism, they are used in many different and conflicting ways. Features may seem particularly relevant to affix-hop because the affix has to be checked against a higher verb or auxiliary. Chomsky's (1957) analysis of affix-hop has the affix connected with an auxiliary, e.g., the *-en* of *have-en,* move to a verb on its right, as in *have see-en.* This analysis is one of the high points of early generative grammar but, with each new instantiation of the generative model, it has needed adjustments and the phenomenon is still debated. I will elaborate on a proposal made in van Gelderen (2013) who argues that interpretable tense, mood, or aspect are in a low position being probed by the relevant uninterpretable features in a high position. This view I claim is consistent with data from change and acquisition. I also discuss the implications of this reliance on features for learnability and Universal Grammar.

Keywords: acquisition, affix-hop, features, interpretable, uninterpretable

1. Introduction

Features have come to play a very prominent role in Minimalist work. All parametric variation between languages and varieties is now due to differences in the features that are selected by the language learner. The role of features is wide-ranging and there are many different kinds to consider. In this paper, I consider the English tense, mood, and aspect system. It is complex in that each feature is expressed twice, once on the auxiliary (or on T) and once as an affix. As an example, take (1), where *have* requires a past participle to its right.

(1) They **have see-n** that movie.

The phenomenon is known as affix-hop, or affix-hopping, because the *-(e)n* hops on the verb to its right. There is of course also a (present) T(ense) in (1), whose affix hops on *have.* Affix-hop received a lot of attention in early generative syntax but has not received an adequate analysis in terms of interpretable and uninterpretable features.

In section 2, I first introduce how features are used in early and later generative grammar and then outline some of the current views on the relationship between interpretable and uninterpretable features (in Adger 2003, van Gelderen 2013, and Pesetsky & Torrego 2007) that derive Affix Hop. I provide extra evidence for van Gelderen's approach from acquisition and language change data.

In section 3, I present earlier analyses of affix-hop and argue specifically for a lexicalist analysis with interpretable features on verbs and auxiliaries and uninterpretable features in functional categories. Approaches to affix-hop, such as Lasnik (1999) and Freidin (2004), focus on the mechanisms of the analysis as given in Chomsky (1957), in particular the stranded affix in T, the linear order of the various auxiliaries and the negative element, the absence of main verb movement in English, and the appearance of *do*. I will emphasize bringing interpretable and uninterpretable features and feature checking into this picture.

In section 4, I address where features "come from". I will argue that our genetic endowment is rich and that some of the features go back to a pre-language stage in the development of our species. This makes it harder to distinguish between the first and third factors of Chomsky (2005; 2007).

2. Features in Generative Grammar

In section 2.1, I outline the minimalist starting point regarding features, namely as interpretable and uninterpretable, as mainly found in Chomsky (1995). Then, in section 2.2, I examine some elaborations on this, in particular those that add features for mood and aspect.

2.1. Chomsky (1965), (1995), (2000), and (2008)

In early generative grammar, e.g., Chomsky (1965, 87–88), features play a role. They are considered relevant to the phonological, semantic, and syntactic components of the derivation and are stored in the lexicon. Some syntactic features of that early work (*ibid.*, 85) involve [+N, −Count, +Abstract] for e.g., the noun *sincerity* and [+M] for the modal *may*. There is, however, no checking of inflection features in this model.

In the 1970s and 1980s (e.g., Chomsky 1981), grammatical features play a minor role, mentioned mainly in connection with pronouns and coreferentiality. In the late 1980s and afterwards, however, this changes and Chomsky (e.g., 1995, 230ff; 236; 277ff) emphasizes semantic (e.g., abstract

object), phonological (e.g., the sounds), and formal features. The formal ones are relevant to syntax and are divided into intrinsic or optional. The intrinsic ones are "listed explicitly in the lexical entry or strictly determined by properties so listed" (Chomsky 1995, 231) and include categorial features, the Case assigning features of the verb, and the person and gender features of the noun. The person, number, and gender features are usually referred to as phi-features.

Apart from optional and intrinsic features, there are interpretable and uninterpretable features. The interpretable ones are relevant for interpretation at LF and include categorial and nominal phi-features. Unlike interpretable features, uninterpretable features are not relevant for LF and are transferred to the PF; they involve the Case features of NPs and verbs and the phi-features of verbs. There are a number of reasons behind the distinction between interpretable and uninterpretable features. Some features (e.g., phi-features of nouns) remain active after checking. This is the reason nouns (and of course the phrases they head) can move cyclically and provide the phi-features along the way (Chomsky 1995, 282). This is not true of the uninterpretable Case feature. Once Case has been checked by a DP, that DP cannot move to check Case elsewhere. Figure 1 provides the interpretable and uninterpretable features of the noun *airplane* and the verb *build*. Note that many intrinsic features are interpretable (and valued) but that connection is not absolute.

	airplane	build
interpretable:	[nominal]	[verbal]
	[3 person]	
uninterpretable:	[Case]	[phi]
		[assign accusative]

Figure 1: Interpretable and uninterpretable features of *airplane* and *build* (adapted from Chomsky 1995, 278)

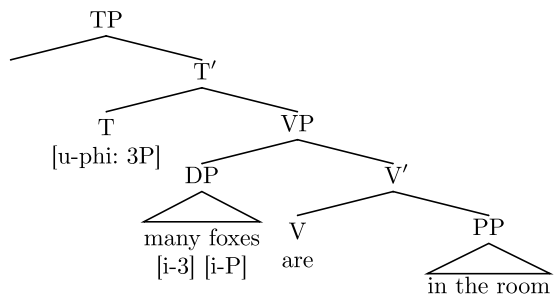
In connection to features and movement, there is a major shift after 1995 (Chomsky 2000), namely checking through Spec-head agreement is replaced by a probe-goal checking system based on the c-command relationship. Functional categories with uninterpretable features search down the tree for a goal DP with interpretable features that will value the features of the higher head, via an operation called AGREE. An advantage of this shift is a simplification of the existential construction in English (and other languages that have this). The pre-2000 derivation of (2) involved invisible

raising of the post-verbal DP *many foxes* to the Spec TP for agreement with the verb in T. The invisibility was achieved by means of LF-raising of the DP or movement of the features of the DP, both ad-hoc procedures.

(2) a. There were **many foxes** in the room.
b. There was **a fox** in the room.

The AGREE-version of (2a) is given in (3). The uninterpretable agreement features on T look down into their c-command domain and find the interpretable person and number features on the DP in the Spec of VP (i.e., vP). The latter's features value the phi-features of T as plural in the case of *many foxes*.

(3)



The T also has tense features that are responsible for getting nominative case to the DP which has uninterpretable case features. Since Chomsky (2008), the T inherits these features from C and V inherits them from v (for accusative case). As a result of the shift to an AGREE-based system, the subject no longer moves to the specifier of the TP to check Case and another mechanism, an EPP feature, ensures that something fills the Spec of TP, either an expletive *there* or *many foxes*.

After this basic outline of features, in particular uninterpretable and interpretable ones, I look at three different elaborations of the direction in which these features check tense, mood, and aspect. I focus on these three because they give a representative overview of some of the issues that are still debated. Section 3 will then show how they fit in the earlier work.

2.2. Adger, van Gelderen, and Pesetsky & Torrego

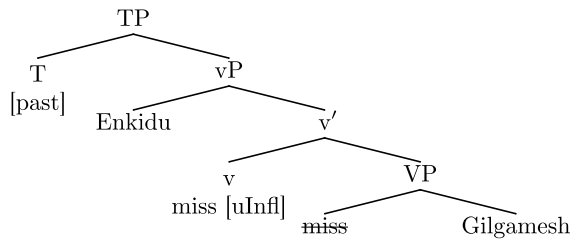
Adger (2003) presents an elaborate explanation of how features work in English. They come in various types. First, he suggests uninterpretable

categorical features on V and v to select arguments. These features are not relevant for affix-hop and will be ignored. Secondly, Adger has uninterpretable phi-features on T and v, in much the same way as (3), and Case and EPP, again in ways similar to Chomsky.

Where Adger differs is his claim that the tense features in T (and the perfect and progressive features in the heads of the Perfect and Progressive Phrase, etc) are interpretable in this higher head and that a main verb (or auxiliary verb) in a lower position has uninterpretable inflection features. Thus, in (4), T has interpretable past and the verb will be valued under c-command as [~~uInfl~~: past] which is visible to the rules of Spellout as *-ed*.

(4) a. Enkidu missed Gilgamesh

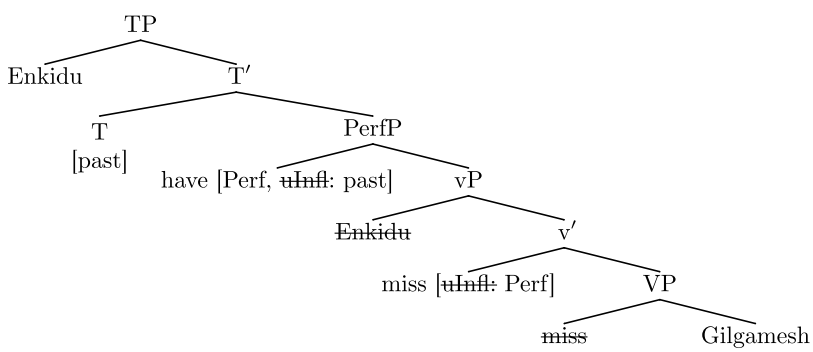
b.



(adapted from Adger 2003, 170)

Adger accounts for perfects and progressives in the same way: there is an interpretable perfect feature on *have* Perf in (5) which values the lower verb but which itself has uninterpretable tense features valued by the higher T. The result is (5).

(5)

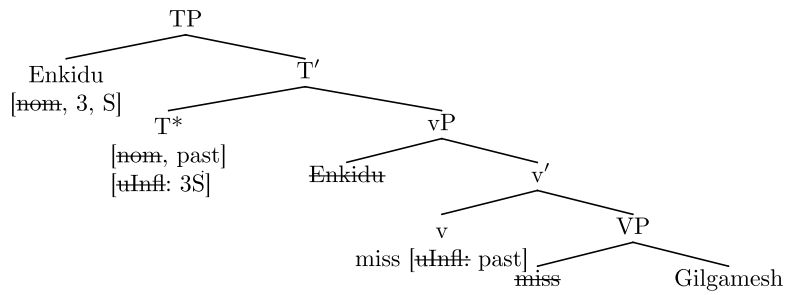


(adapted from Adger 2003, 173)

Adger's T also has uninterpretable phi- and Case features and probes for a nominal with interpretable phi-features as it was merged. This is the

same as in Chomsky and other approaches. The end result is shown in (6), where * marks the EPP feature.

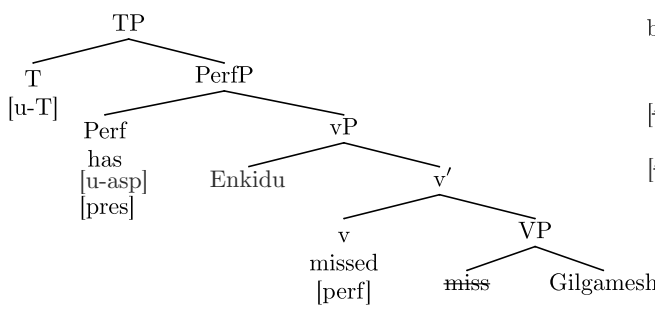
(6)



Thus, the verb is merged with uninterpretable tense features and is dependent on an appropriate tense to c-command it.

The proposal by van Gelderen (2013) reverses the checking of the tense features of (4) to (6). She too adds mood and aspect but instead argues that verbs (and auxiliaries) are taken out of the lexicon with interpretable features and are checked by a higher probe with uninterpretable features, as in (7a) for the same sentence as (4a). The EPP and phi-feature checking will be similar to (3) and (6) so (7) focuses on tense and aspect. As the heads merge, they will be valued, as shown in (7b)

(7) a.



b.

[~~u-T~~: pres]

[~~u-asp~~: perf]

The motivating idea for this proposal, i.e., that the features on the verb are what make a tense interpretable, is because participles are easily learned and the auxiliaries that accompany them come later. Looking at Allison at age 2 year and 10 months (Bloom 1973), we find the bare verbs, as in (8a), and present participles, as in (8b), given with their entire utterance. There are no other verb forms at this stage.

(8) a. pull, hurt, eat, ride, drive, get, tumble, sit squeeze

b. wiping baby chin, shaking, peeking Mommy, eating, squeezing, screaming, walking around (all from Allison 2;10, Bloom 1973)

Radford (2000), in one of the rare works that talks about features in first language acquisition, argues that the verb combined with the *-ing* affix has interpretable aspect and that these are learned first.

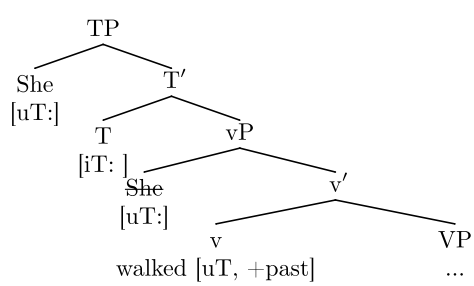
A second reason for assuming that participles have interpretable tense and aspect features is that their endings are not easily lost; the *-ing, -ed* and *-en* endings have been retained in English for centuries. This is not surprising in that the origin of participles is as independent nominal that only gradually is connected with other verbs that grammaticalize as a result, as in (9).

(9) on feoht**end**e wæron oþ niht
on fighting were until night
'were fighting till night' (Chronicle C and D, anno 871, Visser 1963–1973, 1998)

The present participle has, since Indo-European times, had the meaning of duration and that makes that feature interpretable. It is the uninterpretable agreement features on verbs that have been unstable, as Hughes and Trudgill (1996) have shown for British dialects. The third person present *-s*, for instance, has disappeared in East Anglia. Throughout the history of English, there have been changing *-e, -est, -eth, -en* agreement endings (van Gelderen 2014, 103) but the participle endings have remained stable as has been an identifiable infinitive.

Another approach to feature checking is that in Pesetsky & Torrego (2001; 2004 but especially 2007). They have complicated the feature-checking system in a number of ways in that they see tense as crucial and they allow unvalued interpretable and valued uninterpretable features. The T has interpretable but unvalued features that look down the tree for a value on the verb, as in (10).

(10)



(Pesetsky & Torrego 2007, 270)

The [iT] feature is valued as [past] and this interpretable tense feature of T shares case with the [u-T] on the nominal in its domain, i.e., the case on *she* will be nominative; phi-features are as in other work. Pesetsky and Torrego's proposal has characteristics of the models of both Adger and van Gelderen, namely that T is looking to be valued through c-command (as in van Gelderen) but starts out as interpretable (as in Adger) but that the tense on the verb is valued (as in van Gelderen).

In conclusion to section 2, I have shown how interpretable and uninterpretable features work for relating the uninterpretable and interpretable features of affix-hop. I will now turn to earlier accounts and then show how the Adger and van Gelderen approaches compare. Since Pesetsky and Torrego do not specifically address aspect and mood, I leave that proposal out of the discussion and focus on the two more extreme versions of the spectrum.

3. The features of affix-hop

In this section, I will start with the early generative account by Chomsky (1957) and then move to Pollock (1989), Lasnik (1999), and Freidin (2004) before fitting in the Adger and van Gelderen approaches discussed in section 2. I also outline how this approach fits a cartographic one.

Chomsky (1957; 1965) sees affix-hop as a central problem although he has not included it in recent analyses. English poses quite a challenge having sentences such as (11) with four auxiliary verbs.

(11) He **might have be-en be-ing** see-n (committing that crime).
modal perfect progressive passive

The phenomenon is known as Affix Hop because the affix that belongs to one auxiliary moves to the next verb or auxiliary. The modal needs an infinitive to its right, the perfect a participle, the progressive an *-ing*, and the passive a participle.

Chomsky (1957) accounts for the discontinuous nature of this system by means of the Phrase Structure Rules in (12). The Aux position minimally has a C, whose abbreviation is not explained, but which is later replaced by T(ense). The C is a past, or present *-s*, or zero present tense marker. In addition to this tense, the Aux part maximally contains four auxiliaries.

(12) a. Sentence → NP + VP
b. VP → V + NP
c. Verb → Aux + V
d. Aux → C (M) *(have + en) (be + ing) (be + en)* (Chomsky 1957, 39)

If there is just a C, with e.g., the present *-s* affix, transformation (13) will change the C + V sequence into a well-formed verb affix sequence, as shown in (14a). When auxiliaries are part of the structure, the same transformation will ensure that any affix will be attached to the verb or auxiliary following it, as shown in (14b). If an affix is stranded, *do* is inserted before this affix and rule (13) will make sure the stranded affix is attached, as in (14c). Finally, auxiliary inversion in questions is handled by means of a transformation (not shown here) that takes the first affix if no auxiliary follows or the first affix and auxiliary and transposes it with the subject, as in (14d).

(13) Auxiliary Transformation – obligatory
Structural Description: X – *Af* – *v* – Y
Structural Change: 1 – 2 – 3 – 4 → 1 – 3 – 2 – 4
(where *Af* is any *C* or is *en* or *ing*; *v* is any *M* or *V*, or *have* or *be;* adapted from Chomsky 1957, 113)

(14) a. John s walk → John walk s (John walks)
b. John s have en walk → John have s walk en (John has walked)
c. John s not walk → John s do not walk → John do s not walk (John doesn't walk)
d. John s have en walk →s have John en walk → Have s John walk en (Has John walked)

In this model, the negative is inserted transformationally after the first morpheme in AUX (if there is only one morpheme) or after the second (if it contains more than one element). This ensures that the first affix will be able to affix hop with an auxiliary but not with the main verb.

After Phrase Structure is generalized in the 1970s and 1980s as X-bar Theory, it moves away from (12) and the negative *not* gets to have its own position below T, as do other auxiliaries. The question then becomes why auxiliaries move to the left on their way to T but main verbs do not in English. Pollock (1989) suggests a reason why auxiliaries move in English and French but main verbs only in French. It is based on verbs in French being able to assign theta-roles after they move to a morphologically rich T. Various other refinements follow as to why verbs move or not. The

reason is still somewhat stipulative, e.g., Chomsky's (1995) and Adger's (2003) strong and weak features result in movement or not respectively.

Lasnik (1999, 105) argues that *have* and *be* (and all French verbs) "are fully inflected in the lexicon" but main verbs in English are not. In addition, the T can be a set of features or an affix. If a verb has inflectional features (as English auxiliaries do), it needs a T with similar features to check; if the verb is bare (which main verbs are), T will have to have an affix and this affix needs to be adjacent to the verb at PF. Lasnik uses this to account for the well-known ellipsis cases, as in (15a) and (15b) where an inflected main verb can be the antecedent for a bare form; *have* and *be* do not allow this, as (15c) and (15d) show for *be*.

(15) a. John slept and Mary will too. (*sleep* deleted)
b. John has slept and Mary will too. (*sleep* deleted)
c. *John is here and Mary will too. (*be* deleted)
d. *John has been here and Mary will too. (*be* deleted)
(all from Lasnik 1999)

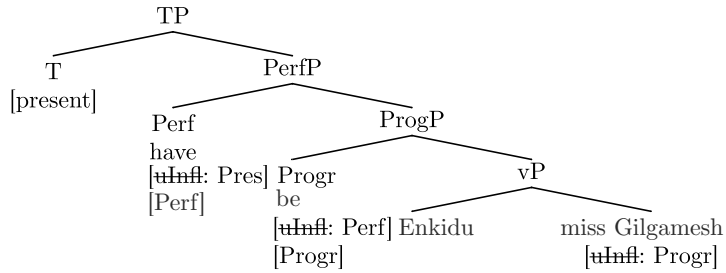
Main verbs of all morphological types can license the deletion of non-finite forms but *be* and (auxiliary) *have* cannot, so tense and aspect "can be ignored in the same way that phi-features typically can be" (Lasnik 1999, 109). Lasnik's account is that main verbs are not inflected in English and their bare forms can license deletion, as in (15ab) before they get associated with an affix; *be* and (auxiliary) *have* are inflected so never identical with the base form in (15cd). Based on Sag (1977), Warner (1985; 1993) disagrees and provides sentences like (16) where the lexical verb *loved* doesn't license the deletion in the second clause. This may be because the passive is different.

(16) *John has loved but hasn't himself been.

Lasnik's position is partly lexicalist, in that some words are in the lexicon fully inflected. Chomsky's (1995) approach to inflection is fully lexicalist: verbs are taken out of the lexicon fully inflected and subsequently checked with functional categories. The crucial difference between Adger's and van Gelderen's approaches, discussed in section 2.2, is this issue of lexicalism: in the former verbs check with higher functional categories, as shown in (17) for affix-hop, whereas in the latter verbs have valued interpretable features, shown in (18).

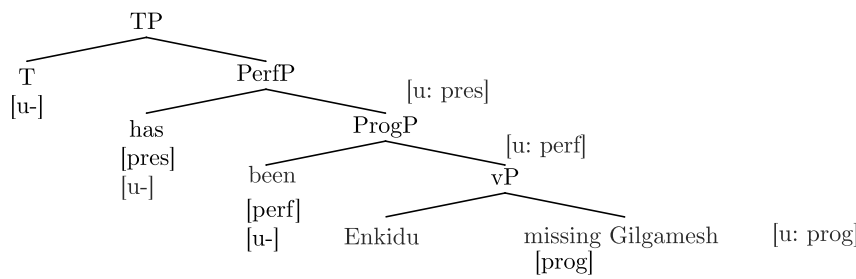
(17) a. Enkidu has been missing Gilgamesh.

b.



(adapted from Adger 2003, 173–174)

(18)

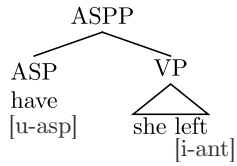


(adapted from van Gelderen 2013, 120)

Freidin (2004, 117), noting some problems with Lasnik's analysis, goes back to a fully lexicalist analysis and points out affix-hopping is not needed under such an analysis. His alternative involves selection by the auxiliary of the form of the verb or auxiliary that follows: modals and infinitival *to* select a bare verb, *have* selects a past participial, and so on. It is this selection to which I turn now and for which (18) provides an update using interpretable and uninterpretable features.

Freidin (2004) relies on selection and I will formulate this insight in terms of features. I suggest there is checking by the uninterpretable aspect features of the functional head *have* with the interpretable features on *left*, as in (19), where (20a) shows the unvalued state and (20b) the valued one. This means that the participle ending on *left* is responsible for the (present) perfect meaning.

(19) She has left.

(20) a.


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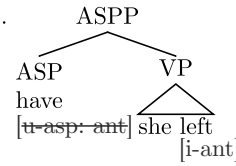
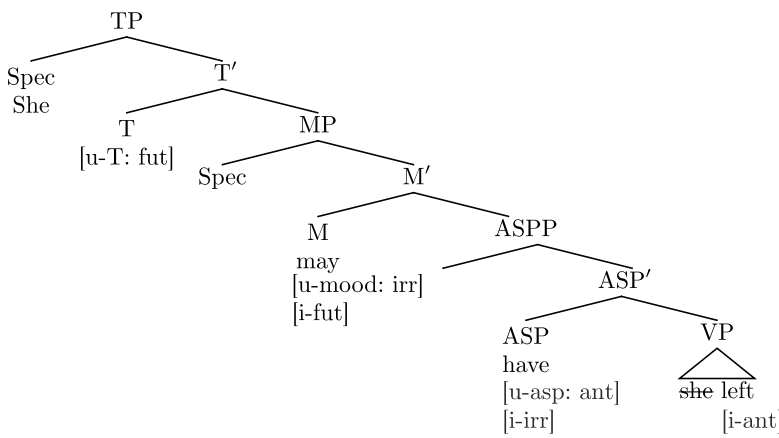
b.


There are of course other features. I have provided T(ense), M(ood), and ASP(ect) in (21) but have not shown the checking of the phi-features (see (3) above). The relevant abbreviations in (21) are 'fut' for future, 'irr' for irrealis, and 'ant' for anterior. The infinitival form of *have* represents the interpretable irrealis features.

(21)


The model of checking, as in (21), is the spelling out of a lexicalist approach through the interpretable features on the auxiliaries and verbs.

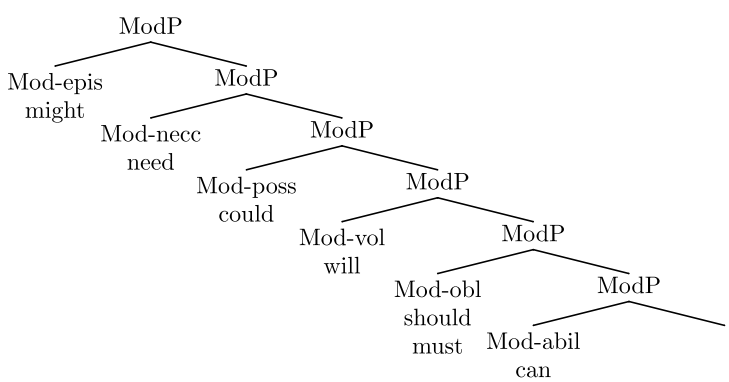
The only features not yet provided are progressive and passive. I will not discuss the latter since the passive is more connected with the VP-layer. The infinitival verb has irrealis and the one marked by *-ed* has anterior or passive meaning.

The features in (21) are not the only ones, however. Cinque (1999) proposes the cartography of (22) for the adverbs, but each of these positions could also have an auxiliary as head, as shown in (23) for some of the modals.

(22) **The universal hierarchy of clausal functional projections**

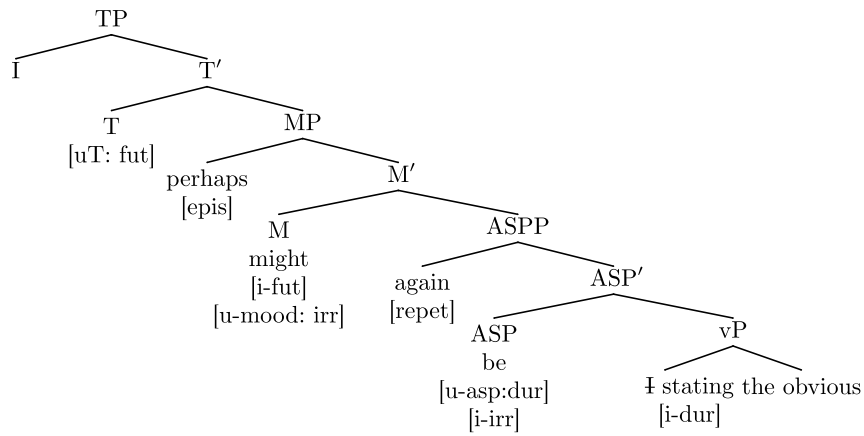
[Moodspeech-act *frankly*
[Moodevaluative *fortunately* **CP-adverbs**
[Moodevidential *allegedly*
[Modepistemic *probably*
[Tpast *once*
[Tfuture *then*
[Moodirrealis *perhaps*
[Modnecessity *necessarily*
[Modpossibility *possibly*
[ASPhabitual *usually*
[ASPrepetetive *again*
[ASPfrequentative(I) *often* **TP-adverbs**
[Modvolitional *intentionally*
[ASPcelerative(I) *quickly*
[Tanterior *already*
[ASPterminative *no longer*
[ASPcontinuative *still*
[ASPperfect(?) *always*
[ASPretrospective *just*
[ASPproximative *soon*
[ASPdurative *briefly*
[ASPgeneric/progressive *characteristically*
[ASPprospective *almost*
[ASPsg.completive(I) *completely*
[ASPpl.completive *tutto*
[Voice *well* **VP-adverbs**
[ASPcelerative(II) *fast/early*
[ASPrepetetive(II) *again*
[ASPfrequentative(II) *often*
[ASPsg.completive(II) *completely*]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]] (Cinque 1999, 106)

(23)



The tree in (24) represents (25), a sentence with a variety of adverbs and auxiliaries but with M and ASP phrases unspecified for the flavor of these in a Cinque-like sequence.

(24)



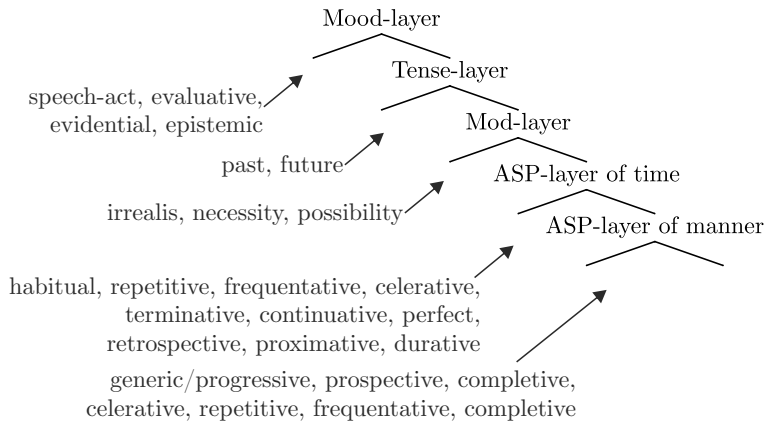
(25) I guess I **might perhaps again be** "stating the obvious" and I apologise to FTers who feel annoyed by this. (http://flyertalk.com/forum/archive/index.php/t-63529.html)

The features on the auxiliaries are as we have seen before. As for the question if adverbials participate in feature checking, Laenzlinger (2004, 208–209) argues they are interpretable and checked by Merge. The complexity that is added is how the features of the adverb interact with those of the auxiliary; I will leave that question unaddressed.

Cinque and Rizzi (2008) discuss the question of the number of functional categories. There are 30 in (20), 32 in Cinque (1999, 130), and around 40 in Kayne (2005). Cinque and Rizzi, using Heine & Kuteva's (2002) work on grammaticalization, come up with 400 features that are targets in Heine & Kuteva. Benincà and Munaro (2011, 6–7) note that syntax has reached the detail of phonological features.

Cinque's categories are hard to decide on sometimes, for instance, is *probably* evidential or epistemic; is *again* repetitive or habitual or both? There are over 4000 adverbs in English and they could all be argued to need accommodation in the functional hierarchy. Haumann (2007, 232) happens to have the same 18 as TP adverbs as Cinque does but the inclusion of others is possible, e.g., *sometimes* and *finally*. To avoid the problem of thousands of functional categories and features, I suggest (as in Butler 2003) that certain areas in the TP (and the other domains) are typical for certain moods, tenses, or aspects. I will suggest (26) instead of (22).

(26)



In this section, I have translated the affix-hop account of (12) and (13) into a feature checking account as shown in the tree in (21). This provides a more consistent picture of how interpretable and uninterpretable features are used in connection with T, ASP, and M. I have also considered the work by Cinque (1999) and suggest a pruning of his categories. I will now consider features from a learnability standpoint.

4. The acquisition of features

In this section, I first discuss some general changes concerning the nature of Universal Grammar in current generative grammar. I conclude by arguing that features have to be innate although whether they are part of Universal Grammar or are a third factor is not clear. Feature Economy, however, is a Third Factor effect and helps with the translation of semantic into syntactic features.

The Minimalist program has shifted the emphasis from Universal Grammar to innate factors that are not specific to the language faculty. One of the reasons for Chomsky to deemphasize Universal Grammar is the evolutionary time it had to develop. If language arose in humans between 100,000 and 150,000 years ago, Universal Grammar would not have had much time to develop. The factors not specific to language are therefore preferred and listed as (3) in (27) and referred to as 'third factors'.

(27) **Three Factors:**

"(1) genetic endowment, which sets limits on the attainable languages, thereby making language acquisition possible; (2) external data, converted to the experience that selects one or another language within a narrow range; (3) principles not specific to FL [the Faculty of Language]. Some of the third factor principles have the flavor of the constraints that enter into all facets of growth and evolution.... Among these are principles of efficient computation". (Chomsky 2007, 3)

Unfortunately, the third factors are quite broad and have been invoked to account for a number of phenomena, e.g., pro-drop (Sigurðsson 2011), phrase structure (Medeiros 2011), and language change (van 2011). Constraints on word learning, such as the shape over color bias (Landau et al. 1988), would also be third factor.

Generative Grammar has also shifted emphasis from syntactic parameters to lexical ones, i.e., features, and the ontological status of these features are not as clear as one would hope. This position has been coined the Borer–Chomsky-Conjecture by Baker and is formulated as (28).

(28) **Borer–Chomsky-Conjecture**

"All parameters of variation are attributable to differences in the features of particular items (e.g., the functional heads) in the lexicon." (Baker 2008, 156)

Principles used to include the Subjacency Principle (Chomsky 1973), the Structure Preserving Hypothesis (Emonds 1976), the Head Movement Constraint (Travis 1984), Relativized Minimality (Rizzi 1990), and many more. They are now much more restricted, perhaps just to the Inclusiveness Condition (Chomsky 1995, 225–228) and Full Interpretation (see Richards 2008). In Figure 2, I have summarized the major shift in the role of UG, where I-language refers to the internalized grammar.

Principle & Parameters Framework		**Minimalist Program**
Universal Grammar		UG and **Third factors**
(Principles and Parameters)		(UG = **A few** principles and **lexical** parameters)
+	≫	+
Input (e.g., Scottish English, Western Navajo)		Input
=		=
I-language		I-language

Figure 2: Changes in the model of language acquisition

Having outlined the major shifts in the thinking about Universal Grammar, I turn to the problem of feature acquisition, both grammatical and semantic. If grammatical features are parametric, how does the child know which features to consider and their hierarchical order. In addition, if a child uses semantic features such as [animate], [future], [abstract] to learn words and concepts – and this acquisition is very fast –, the (ancient) question arises where our knowledge of these features comes from. I am assuming with Chomsky (1965, 142) that "semantic features [...] are presumably drawn from a universal 'alphabet'"(although Chomsky continues that "little is known about this today and nothing has been said about it here"). In 2000, he is more explicit that "UG makes available a set F of features (linguistic properties)" (Chomsky 2000, 100) but does not give examples of such features.

In Chomsky (1993, 24), there is the cryptic statement that vocabulary acquisition shows poverty of the stimulus. That means Universal Grammar has to give some concepts and structure. When a child looks at the world, it knows how to categorize things; it is not just abstracting from its environment. This is clear with logical concepts, as the philosopher Geach (1957, 22–23) writes: "[a]bstractionists rarely attempt an abstractionist account of logical concepts, like those of *some, or*, and *not* [...]. In the sensible world you will find no specimens of alternativeness and negativeness from which you could form by abstraction the concept of *or* or of *not*".

The ability to categorize is not unique to humans. Certain animals are excellent at categorization, e.g., prairie dogs have sounds for specific colors, shapes, and sizes (Slobodchikoff 2010). Jackendoff (2002), based on Bickerton (1990), suggests that pre-linguistic primate conceptual structure may already use symbols for basic semantic relations. This may include spatial and causal concepts. "Agent First, Focus Last ... are 'fossil principles' from protolanguage". Homo erectus (1 million BP) may have had protolanguage. I will therefore assume that semantic features are part of our genotype but probably as a third factor rather than Universal Grammar.

Semantic features are, however, not the only ones and I will now look at the acquisition of grammatical features, interpretable and uninterpretable ones, a little more. Here, I will assume a greater role for the third and second factor, as in e.g., Lebeaux (1988, 44) who argues that grammatical categories are centered in cognitive ones. As mentioned above, Chomsky (1995, 230; 381) suggests that "formal features have semantic correlates and reflect semantic properties (accusative Case and transitivity, for example)". I interpret this to mean that, if a language has nouns with semantic phi-features, the learner will be able to hypothesize uninterpretable fea-

tures on another functional head (and will be able to bundle them there). Initially, a child would use lexical categories (as well as demonstrative pronouns) with interpretable features (see Radford 2000) which then would be experimented with as uninterpretable features. A third factor principle, such as (29), seems to be at work.

(29) **Feature Economy**

a. Utilize semantic features: use them as formal features.

b. If a specific feature appears more than once in a CP domain, one of these is interpretable and the others are uninterpretable.

Principle (29a) is adapted from Feature Economy as it appears in e.g., van Gelderen (2011) and (29b) follows from Muysken (2008, 46) who writes that "features which are doubly expressed [...] but receive a single interpretation, must be functional." Thus, innate concepts such as time, cause, agent, etc. together with the data available to the child (modality or past tense) trigger the grammaticalization of the semantic features into interpretable and uninterpretable ones.

In Figure 3, some innate semantic categories are represented, as well as learned ones derived from them.

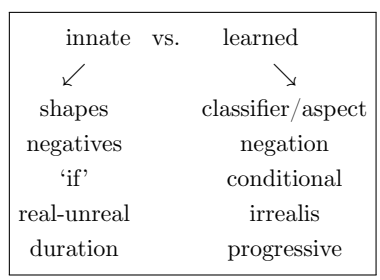


Figure 3: Innate vs. learned features

As we saw in (22), not only is there a substantial set of functional categories and features, there is also a strict order. How is the basic order acquired? There are two answers that are compatible with minimalism. (a) The order is due to a third factor effect, namely the relative scope of these categories. (b) The order and the categories themselves are innate, i.e., provided by Universal Grammar.

A third factor approach might be to think about scope. For instance, Bybee (1985, 15) formulates the notion of semantic relevance: "a category is

relevant to the verb to the extent that the meaning of the category directly affects the lexical content of the verb stem." A verb stem describes an action or state so aspect is very relevant to it and will be merged closer to it than mood. Zagona's work (e.g., 2007) argues that the interpretation of modals depends on what they merge with. Hacquard (2010, 109), similarly, argues in connection with modal auxiliaries that the same modal verb can have a high and low meaning, i.e., epistemic or deontic, depending on how it relates to an event. "[A]n epistemic modal base needs to be bound by a contentful event, which both attitude and speech events are, but regular VP-events aren't". To put it in simpler terms, an epistemic modal expresses the likelihood of an assertion (and need not occur in an actual world) but a deontic modal modifies an actual event (and needs to occur in an actual world). One example of such ordering is that a "[p]erfective takes a predicate of events (VP) and returns a predicate of times, which then combines with tense" (Hacquard 2009, 294) and this determines the order.

The other possibility, namely that the order is given by Universal Grammar, is avoided as much as possible in current minimalism (although I think Chomsky's main worry that there was not enough evolutionary time for Universal Grammar to develop a lot of detail is not warranted if non-humans already have a lot of semantics, as mentioned above. The order could be third factor although Universal Grammar could also be involved, as Chomsky (2001, 12) suggests: "Assume that substantive categories are selected by functional categories. V by a light verb, T by C".

In section 4, I have reviewed what is implicit in the minimalist program about semantic features, namely that they are innate. Whether this means they are part of the first or the third factor is an open question. Grammatical features can be seen as being abstracted away from these.

5. Conclusion

In this paper, I have provided a sketch of the status of interpretable and uninterpretable features and have elaborated on an analysis of affix-hop using these features by van Gelderen (2013). That analysis is based on a lexicalist approach. I have also raised some issues on the acquisition of features.

Semantic and grammatical features play a central role in the Minimalist Program and they have a lot of explanatory power. With phonetic features, we know that children babble sounds they haven't heard but that are somehow dictated by internal mechanisms. This may be the case

for features and functional categories as well though 'Syntactic Feature Babble' has never been observed. A child needs to have lexical input for grammatical categories to appear but also needs some sense as to what to look for.

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