Chapter Sixteen
Impossible Words: The Final over Final Constraint in Morphology

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Introduction

In this chapter, we look at some possible effects of FOFC below the word level, and at FOFC in relation to the interaction of the word and phrase levels. Although I will not adopt all the details of the Distributed Morphology framework, I will try to follow the leading idea that morphology is "syntax all the way down" (Marantz 1997). Specifically, I will adhere as far as possible to the Single Engine Hypothesis, the idea that complex morphological objects (i.e. derived words of various kinds) are constructed in the same way as complex syntactic objects, by the iteration of binary (internal or external) Merge. The principal focus here will be on the extent to which head-movement/incorporation (as well as phrasal movement, see Julien 2002 and below) plays a role in constructing complex words, and how FOFC interacts with these processes. Accordingly the main focus will be on inflectional morphology.

More specifically, the empirical focus will be a striking typological generalisation regarding suffixing morphology, put forward by Hawkins & Gilligan (1988; henceforth H&G): the suffixing preference. This states that OV/postpositional languages show a strong preference for suffixing, while VO/prepositional languages show no preference among suffixation and prefixation. We will suggest an account of this preference which combines FOFC and the Linear Correspondence Axiom (LCA), and look at some of the ramifications of this.

The chapter is organised as follows: §1 introduces the suffixing preference, showing how recent evidence from the *World Atlas of Language Structures* (*WALS*) supports H&G's original observations. In §2 I propose an account of the suffixing preference in terms of FOFC and the LCA. §3 deals with derivation and compounding and §4 offers a speculation regarding the relation between incorporation and FOFC.

This chapter owes a particular debt to Neil Myler's 2009 University of Cambridge MPhil dissertation, which dealt with many of the same topics. Myler (2009) refers to a revised and extended version of that dissertation, whose inspirational nature is hereby acknowledged.

1. The "suffixing preference": Hawkins & Gilligan (1988)

H&G present the evidence in favour of what they refer to as the suffixing preference. As they point out, the original observation was made by Greenberg (1966), in the form of his Universal 27, given here in (1):

(1) Greenberg's Universal 27:
If a language is exclusively suffixing, it is postpositional; if it is exclusively prefixing, it is prepositional.

In this connection, Greenberg remarks "[e]xclusively suffixing languages are fairly common, while exclusively prefixing languages are quite rare" (57). H&G (219) elaborate as follows: "[l]anguages with VO and/or Pr+NP word orders in their syntax regularly have prefixes and/or suffixes in their morphology. But in a suggestively large number of cases, languages with OV and/or NP+Po have suffixes only". Drawing on developments in morphological theory in the early 1980s, notably Aronoff (1979) and Williams (1981), which postulated that complex words are endocentric and that both inflectional and derivational affixes act as heads, they proposed the Head-Ordering Principle (HOP: H&G's (19), p.227):

(2) The affixal head of a word is ordered on the same side of its subcategorized modifier(s) as P is ordered relative to NP within PP, and as V is ordered relative to a direct object NP.

H&G postulated 18 implicational universals based on a database of 16 morphological categories in approximately 200 languages, of the type "[i]f a language has NP + Po, GENDER affixes on N (if any) are suffixed" (223). From these implicational statements relating to specific affix-types, H&G derived the following generalisation: "NP+Po and/or SOV always implies suffixing, never prefixing; and prefixing implies Pr+NP and/or VO, but never NP + Po and/or SOV" (228). Moreover, they note the following prefixing-to-suffixing ratios (230):

(3) VO languages: 52%:48%. Prepositional languages 44%:56%
OV languages:22%:78%. Postpositional languages: 22%:78%.

They also note that nominal and verbal suffixes differ somewhat in their cross-linguistic incidence, formulating the following implicational statement (224):

(4) "If a language has any prefixes on N, then, any affixes on V will also include prefixes with more than chance frequency."

In other words, there are more prefixes on V than on N. The prefixing-to-suffixing ratios for nominal morphology are 34%:66% (VO languages), 33%:67% (Prepositional languages), i.e. roughly 2 to 1 in favour of suffixing in head-initial languages, and 13%:87% (OV languages), 16%:84% (Postpositional languages), i.e. between 5 to 1 and 7 to 1 in favour of suffixing in head-final languages.

The *World Atlas of Language Structures* (*WALS*) supports H&G's results. Dryer (2011a) contributes an entry on "Prefixing vs. Suffixing in Inflectional Morphology" (Chapter 26), where he looks at ten affix types across a sample of 971 languages. The affix types are all separately covered as chapters in *WALS*, and are as follows: case affixes on nouns, pronominal subject affixes on verbs, tense-aspect affixes on verbs, plural affixes on nouns, pronominal possessive affixes on nouns, definite or indefinite affixes on nouns, negative affixes on verbs, interrogative affixes on verbs and adverbial subordinator affixes on verbs. The affixation index for each language was calculated by looking at each of the affix types and, if found in the language, adding one point to the suffixing index if it is mainly suffixing, one point to the prefixing index if it is mainly prefixing and half a point to each if it equally suffixing and prefixing. In the case of the first three of the affix types just listed (case affixes on nouns, pronominal subject affixes on verbs and tense-aspect affixes on verbs), the indices were doubled. Finally, the prefixation/suffixation index is calculated as the percentage of the overall affixation index (e.g. if a language has 4 affixation points and 2.5 prefixing, then the prefixing index is 2.5/4 = 62.5%).

In these terms, a language is classed as having "little or no inflectional morphology" if it has 2 or less affixing points. A language is classed as "predominantly suffixing" if its suffixing index is greater than 80%, as having a "moderate preference for suffixing" if its suffixing index is between 60% and 80%. The classes of "moderate preference for prefixes" and "predominantly prefixing" are likewise defined as those languages with a prefixing index of 60-80% and over 80% respectively. Finally, languages with a suffixing or prefixing index of 40-60% are

classed as having "approximately equal amounts of prefixing or suffixing". The results are given in Table One:

Affixation type	**Number of languages**	**Percentage of languages**
Little or no inflectional morphology	141	14.5
Predominantly suffixing	406	41.8
Moderate preference for suffixing	124	12.8
Approximately equal amounts of prefixing and suffixing	147	15.1
Moderate preference for prefixing	94	9.7
Predominantly prefixing	59	6.1
Totals	**971**	**100**

TABLE ONE: numbers and percentages of languages showing various prefixing and suffixing tendencies (based on *WALS* Feature/Chapter 26 "Prefixing vs. Suffixing in Inflectional Morphology" (Dryer 2011a, 971 languages). Accessed 6/5/11.

Here, as Dryer observes, the suffixing preference is readily apparent. In particular, predominantly suffixing languages outnumber predominantly prefixing languages by almost 7 to 1. In fact, as Dryer observes "of the five types other than those with little affixation, those which are predominantly suffixing are about as frequent as the other four types combined (382 vs 390)" (4).

The typological skewing regarding suffixing becomes still more evident if the above figures are combined with those for OV and VO languages. This is shown in Table Two (where I have combined predominantly suffixing/prefixing and moderately suffixing/prefixing):

	Number of OV	**% of OV**	**Number of VO**	**% of VO**
Little affixation	35	7.8	100	23.4
Mainly suffixing	339	75.0	137	32
Equal suffixing and prefixing	49	10.9	78	18.2
Mainly prefixing	29	6.3	113	36.4
Totals	**449**	**100**	**428**	**100**

Table Two: percentages and numbers of OV and VO languages with different affixing patterns (based on *WALS* Feature/Chapter 26 "Prefixing vs. Suffixing in Inflectional Morphology" (Dryer 2011a, 971 languages) and Feature/Chapter 83 "Order of Object and Verb" (Dryer 2011b, 1,519 languages)). Accessed 6/5/11.

Here we see that OV suffixing languages outnumber OV prefixing languages by a factor of over 11, while suffixing and prefixing are just about equally distributed in VO languages. As H&G point out, there are two things to account for in this data: first, the very strong suffixing preference in OV languages; second, the almost equal possibility of suffixing or prefixing in VO languages. Note that there is more going on here than a simple preference for harmony of head-complement order within the word and the phrase: this idea immediately accounts for the strong suffixing preference in OV languages, but fails to account for the equal distribution of suffixing and prefixing in VO languages. If it were purely a matter of cross-categorial harmony across word and phrase, we would expect an equally strong prefixing preference in VO languages. But, aside from a very slight preference for prefixing (36.4% vs 32% suffixing), this is not observed. So one way of phrasing the question is: why do we only observe harmony between word-structure and phrase structure in OV languages? As we shall see, this is where FOFC has a role to play.

Two further questions also arise from the data presented in Table Two. The first concerns the residue of prefixing in OV languages. We cannot treat the suffixing preference as categorical on the basis of the data we have here: 6.3% of OV languages do show a prefixing preference, and 10.9% have equal suffixing and prefixing. So this must also be accounted for. Finally, we should also try to account for what seems to be a preference for affixation in OV languages, with only 7.8% of these languages showing little affixation, while 23.4% of VO languages fall into this category.

I now present three more illustrations of the suffixing preference, in relation to specific affixes. Tables Three, Four and Five give the percentages of suffixes vs prefixes overall and then in OV and VO languages for case marking on nouns, tense/aspect marking on verbs and plural marking on nouns (the cases of affixation judged most significant by Dryer (2011a)):

	Overall number	**Overall %**	**Number OV**	**% OV**	**Number VO**	**% VO**
Case suffixes	452	44.1	286	56.4	91	22.5
Case prefixes	38	3.6	4	0.8	32	7.9
Other case marking[1]	163	15.3	116	22.9	26	6.4
No case marking	379	37	101	19.9	255	63.2
Totals	**1,032**	**100**	**507**	**99[2]**	**404**	**100**

TABLE THREE: the percentages of suffixes vs prefixes overall and in OV and VO languages for case marking on nouns. Based on *WALS* Feature/Chapter 51 "Position of Case Affixes" (Dryer 2011c, 1,032 languages) and Feature/Chapter 83 "Order of Object and Verb" (Dryer 2011b, 1,519 languages)). Accessed 6/5/11.

This table confirms the basic observation of Greenberg's Universal 41: "if in a language the verb follows both the nominal subject and the nominal object in the dominant order, the language almost always has a case system" (if we take "almost always" to mean "in 80% of cases").

	Overall number	**Overall %**	**Number OV**	**% OV**	**Number VO**	**% VO**
Tense/aspect suffixes	668	59	443	81.3	137	29.7
Tense/aspect prefixes	153	13.5	23	4.2	120	26
Other tense/aspect marking[3]	159	14.1	42	7.7	100	21.6
No tense/aspect marking	152	13.4	37	6.8	105	22.7
Totals	**1,132**	**100**	**545**	**100**	**462**	**100**

TABLE FOUR: the percentages of suffixes vs prefixes overall and in OV and VO languages for tense/aspect marking on verbs. Based on *WALS* Feature/Chapter 69, Dryer 2011d ("Position of

[1] These include case tone (5 languages), case stem change (1 language), mixed morphological case (i.e. both prefixes and suffixes, 9 languages), postpositional clitics (123 languages), prepositional clitics (18 languages) and inpositional clitics (i.e. where a case clitic attaches to a constituent inside the NP/DP, usually the first; 7 languages). The adpositional clitics include many instances which are commonly thought of morphological case systems, e.g. Japanese. If we collapse this class with case affixes, we obtain 575 case-suffixing languages, or 56.2%, vs a combined total of 38+18 = 56, or 5.4% case prefixes. Suffixes then outnumber prefixes by a factor of more than 10. For OV languages, the combined total of case suffixes and postpositional clitics is 286+107 = 77.5%. There is only one VO language with postpositional clitics, Anindilyakwa, a Northern Australian language of the Gunwinyguan subfamily, spoken by the Warnindhilyagwa people on Groote Eylandt in the Gulf of Carpentaria.

[2] This is a rounding effect.

[3] These include tone (13 languages) and mixed types (i.e. both prefixes and suffixes, 146 languages).

Tense/Aspect Affixes", 1,132 languages), Feature/Chapter 83 "Order of Object and Verb" (Dryer 2011b, 1,519 languages)). Accessed 6/5/11.

	Overall number	**Overal %**	**Number OV**	**% OV**	**Number VO**	**% VO**
Plural suffixes	513	48.1	299	67.8	149	31.2
Plural prefixes	126	11.8	8	1.8	102	21.3
Other plural marking[4]	329	30.9	93	20.7	186	38.9
No plural marking	98	9.2	44	9.7	41	8.6
Totals	**1,066**	**100**	**444**	**100**	**478**	**100**

TABLE FIVE: the percentages of suffixes vs prefixes overall and in OV and VO languages for plural marking on nouns. Based on Feature/Chapter 33, "Coding of nominal plurality"(Dryer 2011e, 1,066 languages) , Feature/Chapter 83 "Order of Object and Verb" (Dryer 2011b, 1,519 languages)). Accessed 6/5/11.

On the basis of these tables, the average rate of suffixing in OV languages is 68.5% (this rises to 75.5% if we count "postpositional case clitics" as classified by *WALS* as case suffixes – see Note 1), while the average rate of prefixing is 2.3%. In VO languages, on the other hand, the average rate of suffixing is 27.8% and prefixing is 18.4%. The overall suffixing preference is thus extremely clear, as is the fact that the preference holds much more strongly in OV languages than in VO languages.

I now turn to the investigation of the questions raised by the suffixing preference in relation to FOFC.

2 Accounting for the suffixing preference in OV languages

2.1 The suffixing preference in OV languages

We expect FOFC to be relevant for the suffixing preference, since it is in essence a constraint on head-final orders. Assuming suffixes to head the words they form, suffixed words are an instance of head-final order, and so FOFC should apply (if syntax and morphology are part of the same generative system, cf. the "Single Engine Hypothesis" mentioned in the Introduction). Indeed, one simple formulation of FOFC is as follows:

[4] These include stem change (6 languages), tone (4 languages), mixed marking (i.e. combining prefixes, suffixes tone, separate words, etc., 60 languages), plural words (170 languages) and a plural clitic (81 languages).

(5) A head-final category cannot immediately dominate a head-initial category in the same Extended Projection.

Assuming (5), along with the general idea that head-final orders are derived by complement-movement to the left, which we take to be a consequence of Linear Correspondence Algorithm (LCA; see Kayne (1994); and see BHR, and Chapters 1 and 3, foir discussion and formulation of the LCA in relation to FOFC), then all structures are first-merged in head-initial order. Now, supposing F is a bound functional morpheme merged immediately above VP, we have five possibilities involving leftward-movement of V, VP, both or neither, as shown in (6):

(6) a. $[_{FP}$ F $[_{VP}$ V O]]
b. $[_{FP}$ $[_{VP}$ V O] [F (VP)]]
c. $[_{FP}$ $[_{VP}$ O V (O)] [F (VP)]]
d. $[_{FP}$ $[_{F}$ V+F] $[_{VP}$ (V) O]]
e. $[_{FP}$ $[_{VP}$ (V) O] $[[_{F}$ V+F] (VP)]]

In (6a), nothing moves. The result is a head-initial structure in which F is a prefix (still assuming it is a bound morpheme). In (6b), we have VP-movement to SpecFP. If VP is head-initial, this leads to a FOFC violation. In (6c), we have VP-movement of a head-final VP, hence there is no FOFC violation. Here F suffixes to V. This the structure that, according to Julien (2002), underlies the cross-linguistically common pattern of OV order combined with agglutinative morphology. Note that if we iterate the operations that derive (6c), merging a further functional head G, containing a bound morpheme, above FP, and moving FP into SpecGP, we obtain (7):

(7) $[_{GP}$ $[_{FP}$ $[_{VP}$ O V (O)] [F (VP)]] [G (FP)]]

Here V appears with two suffixes, F and G, in that order. We thus obtain the result that agglutinating affixes in head-final languages stack up in mirror-image order to their free-morpheme counterparts (auxiliaries, particles) in head-initial languages. Julien (2002:114ff.)) shows that this kind of derivation works for a range of head-final agglutinating languages, including Japanese and Turkish (see also Cinque (1999, Chapter 2/3). Most important for present purposes is the fact that it is impossible for F

or G to surface as prefixes in (7). If this is the general way in which OV order is derived, then we can seemingly explain the suffixing preference in OV languages.

In (6d), we have just verb-movement. Here, since the LCA requires the verb to left-adjoin to F, F is a suffix. (6d) gives VO order, and here we see how suffixing may be derived with this order, a point we return to in the next section.

Finally, (6e) features the combination of VP- and V-movement. Again, V must left-adjoin to F, and hence F will be a suffix.[5]

Although the LCA does most of the work in deriving the suffixing preference here, FOFC still plays a crucial role in forcing the fronted VP to be head-final: this is what gives rise to verbal suffixing in OV languages. Hence the suffixing preference results from the interaction of the LCA and FOFC.

However, there are in fact two further options that should be considered, in addition to those in (6). One is object-shift alone, without V- or VP-movement, shown in (8a). The other is left-adjunction to V of some part of the complement of V, presumably its head, followed by complement-movement, as shown in (8b):

(8) a. $[_{FP}$ O [F $[_{VP}$ V (O)]]]

b. $[_{FP}[_{VP}[_{XP}$ (X) Y] X+V (XP)] [F (VP)]]

(8a) can in fact be ruled out by Holmberg's generalisation (see Holmberg (1986), (1999)): the object can only move when the verb moves. Hence either V or VP must move when the object moves.[6] Holmberg (p.c.) points out that phase-based spell-out operations may be relevant here. For example, if we introduce vP into the picture, then we have the structure in (9):

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[5] One possibility is that where V adjoins to F by head-movement, fusional morphology results. On the other hand, where V and F are merely contiguous thanks to VP-movement alone, we have agglutination. I will not pursue this idea here, but see Bazalgette (2011) for an in teresting implementation of it in relation to the internal structure of pronouns and Neeleman & Szendrői's (2007) account of radical pro-drop. Julien (2002:136-142) argues against verb-movement in Japanese (as proposed by Otani & Whitman (1991), Koizumi (1995) and Nakajima (1999)). She concludes that "the verb does not move in head-final languages", but we are not forced to this conclusion purely on the basis of her discussion of Japanese. Indeed, in §4, we will suggest a reason to suspect that V *always* moves in head-final languages.

[6] Actually, some variant of this statement is needed for every cycle of movement. Otherwise, the object could move to G, creating a prefix on V in F, and Holmberg's generalisation would be satisfied by V-to-F movement. This is shown in (i):

(i) $[_{GP}$ O] [G $[_{FP}$ (O) [V+F $[_{VP}$ (V) (O)]]]]

(9) $[_{FP}\ F\ [_{vP}\ v\ [_{VP}\ V\ O\ ]]]$

Here, if V moves out of the vP phase, then it will adjoin to the left of F. If V doesn't move (but O does) then, since V remains in the lower (vP) phase, V will be spelled out before F can prefix to it (on the simplest construal of Phase Impenetrability Condition in relation to cyclic spell-out; see §4 for more on this). So, again, prefixing will be impossible where the object raises. Note further that the core cases of Holmberg's generalisation that have been discussed in the literature concern VO languages (principally Mainland Scandinavian). For OV languages, we can rule out the possibility in (8a) by assuming that OV typology must involve leftward VP-movement, i.e. either the derivation in (6c) or that in (6e). This is reasonable to the extent that in typical OV languages, all complements and most adjuncts to V and VP precede V. Object-shift alone, on the other hand, leaves all VP-internal material except the object itself to the right of V. I leave the possibility in (8b) aside for now, and return to it in §4, where incorporation is treated in more detail.

Finally, let us briefly return to the case of FOFC inside complex heads, after two iterations of head-movement. Here there are two structures of interest:

(10) a. $[_{G}\,[_{F}\,V + F\,] + G\,]$

b. $*[_{G}\,[_{V}\,F + V] + G]$

(10a) is a case of a harmonically head-final (suffixing) word, and as such is allowed by FOFC (and readily attested in languages with rich inflectional morphology). (10b), on the other hand, violates FOFC. We return to this in §2.3 and when we briefly discuss infixation in §2.4. For the moment, we can note that (10b) is largely unattested, suggesting that FOFC is also operative word-internally.

To conclude, we can see how FOFC and the LCA together account for the suffixing preference in OV languages, as long as we assume that OV order must involve leftward VP-movement (and leaving aside the potentially problematic (9b) for now).

2.2 Suffixing in VO languages

Here we look at the second of the questions raised by H&G: why VO languages show the possibility of both suffixing or prefixing. Recall that, in terms of the HOP, this is unexpected, since if the affix is the head of the derived word and if there is harmony between words and phrases as regards head-complement order (as the very strong suffixing preference in OV languages suggests), then we expect VO languages to show a prefixing preference. All other things being equal, this preference should be as strong as the suffixing preference is in OV languages. But the data clearly show that this is not at all the case. Here, I will briefly show how the assumptions adopted here, most importantly the LCA as it applies to both head-movement and XP-movement, can explain the lack of a prefixing preference and predict, to a good approximation, the distribution of suffixing and prefixing orders in VO languages.

To see how this works, let us consider again the options in (6):

(6) a. $[_{FP}\ F\ [_{VP}\ V\ O\ ]]$
b. $[_{FP}\ [_{VP}\ V\ O\ ]\ [\ F\ (VP)\ ]]$
c. $[_{FP}\ [_{VP}\ O\ V\ (O)\ ]\ \ [\ F\ (VP)\ ]]$
d. $[_{FP}\ \ [_{F}\ V+F\ ]\ [_{VP}\ (V)\ O\ ]]$
e. $[_{FP}\ [_{VP}\ (V)\ O\ ]\ \ [[_{F}\ V+F\ ]\ \ (VP)\ ]]$

Only options (6a) and (6d) are available in a VO language. (6b) is ruled out by FOFC, while (6c) and (6e) give OV order. (6a) gives rise to prefixing; (6d) to suffixing since the LCA requires head-movement to create left-adjunction structures. As we mentioned in §1, these orders are roughly equally instantiated. Table Two gives 32% suffixing and 36% prefixing. Averaging the figures for Tables 3, 4 and 5 gives 27.8% suffixing, 18.4% prefixing and 54.8% "other" or no prefixing. These last figures suggest that there is roughly a 50% chance of a functional morpheme being realised as an affix in VO language, and that there is a roughly equal chance of that affix being a prefix or a suffix (the relatively low proportion of prefixes emerging from Tables 3-5 is probably due to the extremely low proportion of case prefixes, something remarked on also by H&G and by Myler, and for which neither we nor they have an explanation). If the presence of an overt affix in F triggers V-movement 50% of the time it is present, we expect suffixing in VO languages to occur about 25% of the

time (and prefixing about 25% of the time); this is approximately correct, as these figures show.

In fact, the situation is more interesting than this, once we take the nature of the functional hierarchy and the cyclic nature of movement into account. For each functional head H in the hierarchy, the probability of its being realised by an affix is chance, or 1 in 2. But the probability of a functional head H attracting the lexical head diminishes steadily as a function of the H's position in the hierarchy, given the cyclic nature of movement and the idea that head-movement on any given cycle occurs at chance. If the appearance of an affix in H and lexical-head movement to H are completely independent variables, then the probability of V-movement to v is 1 in 2, while the probability of V-to-v movement followed by V-to-T is 1 in 4; in fact, for all functional heads H above v the probability of V-movement to H can be calculated as 1 in 2*n*, where *n* is the number of heads in the Extended Projection c-commanded by H. For T, then, the probability of V-movement is 1 in 4, since T-commands two heads in the Extended Projection, and for C the probability is 1 in 6. But the probability of any of these heads being realised as an affix is constant at 1 in 2. It follows that, if suffixation is invariably a reflex of head-movement, the probability of suffixal realisation is 1 in (2*n* x 2), for all heads above v, for which it is 1 in 4.

It now follows that the probability of T being realised as a suffix should be in 1 in 8, or 12.5%. However, Table 4 gives 29% suffixation in VO languages for tense/aspect heads. Assuming the *WALS* data is not historically or areally skewed, and assuming that "tense/aspect suffixes" uniformly appear in T,[7] then we appear to be faced, again, with a surprising suffixing preference.

The explanation for this lies in the nature of head-movement: if we think that there is a 1 in 2 chance of a given functional head H being morphologically realised, and a 1 in 2 chance of that morpheme being bound, then there is a 1 in 4, or 25%, chance of a suffix, to which, as we pointed out above, the 29% seen in Table 4 approximates rather well. What this means that the chances of a suffix in H, alone, dictate the chances of movement of the lexical-head to H. In other words, as has frequently been suggested in the literature on head-movement, if a given functional head is suffixal it will attract the lexical head. In other words, the appearance of an affix in H and

[7] Note that if we split tense and aspect, placing Tense above Aspect as is generally assumed (see in particular Cinque (1999) on this), and maintain v, then the probability of suffixal Aspect is 12.5% and the probability of suffixal Tense is half of that (6.25%), still further removed from the 29% shown in Table 4.

lexical-head movement to H are not independent variables: the latter is triggered by the former. The statistical evidence in Table 3 can be seen as supporting this contention.

Moreover, the same can be said about plural marking. Suppose plural-marking is located in Num, in a DP with the structure in (11) (see Chapter Five on FOFC in DPs):

(11) $[_{DP}\ D\ [_{NumP}\ Num\ [_{nP}\ n\ [_{NP}\ N\ ..\ ]]]]$

Then the probability of N-movement to Num would be 1 in 4 and the probability of a suffixal plural 1 in 8. But Table 5 shows that suffixal plurals appear 31.2% of the time, i.e. at a rate of almost 1 in 3. If N-movement to Num is dictated purely by the chances of Num containing a suffix, then we predict a 25% instance of suffixal plural-marking. In this case, this is not quite right, but certainly much closer than 1 in 8. Again, then, we see the statistical case for suffixes triggering movement of the lexical head.

The same reasoning holds for case-marking. If we take case morphemes to occupy a K head which takes DP as its complement, then the chances of K attracting N should be 1 in 8, since K c-commands 4 heads in the Extended Projection of N seen in (11). So the chances of suffixal case-marking should be 1 in 16, or about 6%. But, Table 5 gives 22.5% case suffixes in VO languages. Again, this approximates much more closely to 1 in 4. So it appears that the suffixal nature of K alone is responsible for attracting N. (What remains anomalous is the very low proportion of case prefixes, as noted above).

A final, and very intriguing, observation arises if we now look at the corresponding figures for suffixation in OV languages. Averaging the figures for Tables 3, 4 and 5 for OV languages gives 54.5% suffixing, 8.7% prefixing and 33.5% "other" or no prefixing. Recall that for VO languages the figures were 27.8%, 18.4% and 54.8%. The figure for suffixing in OV languages is roughly double that of VO languages, while that for prefixing is roughly half. Now, if suffixing can arise either through the suffix attracting the lexical head or through XP-movement to the specifier of the head occupied by the suffix, and if these are chance parametric options, we expect twice as much suffixing in OV languages as in VO languages, since any given head has, as it were, two chances of being a suffix (and recall that it is possible that

these are different kinds of suffix; see Note 5). So this seems to be exactly right. Of course, if XP-movement is cyclic its incidence should decline as a function of the position in the hierarchy. But this is not what we observe, and so again we see that affixes appear to play a triggering role in relation to both head and XP-movement.

To conclude this section, there is no prefixing preference in VO languages. Instead, there is an approximately chance distribution of affixal functional heads, and an approximately chance incidence of incorporation into those heads. Once these probabilities are worked out, the figures obtained from *WALS* approximate quite closely to the expected possibilities.

2.3 Suffixing-preference violations in OV languages

We have now accounted for the two basic observations made by H&G: the very strong suffixing preference in OV languages, and the fact that VO languages do not show a corresponding prefixing preference. However, the account given of the suffixing preference in §2.1 is, as it stands, too strong, in that it does not allow for a significant residue of exceptions to the suffixing preference in OV languages. In this section, again inspired by the proposals in Myler (2009), I will propose an account of these.

H&G in fact note that five affix-types fall outside the general OV+Suffixing pattern. These are as follows:

(11) possessive, subject-marking, object-marking, negation, voice

According to H&G (225), with these suffixes "anything goes", i.e. there are no cros-linguistic generalisations to be made about the ordering of these elements. Similarly, Myler (2009:13f.), on the basis of the survey of inflectional morphology in 530 languages in Julien (2002, Appendix 2), finds 82 (16%) apparent cases of **[[F + V] + G]*, i.e. FOFC violations inside the words (this corresoinds to (10b), briefly discussed at the end of §2.1). Myler argues quite convincingly that in the vast majority of cases the F or G is one of the following classes of elements: an argument-adding morpheme, usually causative (42 languages), a "high" mood marker (17 languages), negation (10 languages), or discourse particles (7 languages). Aside from

these cases, only 6 languages appear to violate FOFC in their inflectional system.[8] Finally, Julien (2002:235) observes that agreement morphemes are found in a very wide range of positions in the word.

There is a parallel here between the exceptions found by Myler and H&G, as well as Julien's observation regarding agreement morphemes. If we construe "subject-marking" and "object-marking" as agreement, and take "possessive-marking" to be DP-internal agreement, then we can combine the three sets of observation as follows:

(12) FOFC-violators in inflection:
Agr, Neg, discourse markers/"high" mood markers, voice/causativisers

Since Chomsky (1995), it has been widely held that Agr-elements are not autonomous categories, but rather φ-bundles associated with another head. Because the φ-bundles can appear with various other heads (T, D, v, etc), we expect them to be able to appear in a wide range of positions in clause structure, as observed by Julien (see also Cinque 1999:53ff.).

Concerning Negation and discourse markers (a category which may overlap with "high" mood markers), BHR observe that these elements frequently appear to violate FOFC at the clausal level, if they are taken to be heads. The following examples illustrate for question particles (one kind of discourse particle) and negation:

(13) a. Ni yao kan zhe-ben shu **ma**?
you want read this-CL book Q
'Do you want to read this book?'
(Mandarin; Aldridge 2009)

b. Bagirmi (Nilo-Saharan; Dryer 2009:317)
deb-ge tol kobio **li**
person-pl kill lion not
'The people didn't kill the lion'

[8] Igbo, Oromo (East Cushitic), Mokilese (Central-Eastern Malayo-Polynesian), Hua (East New Guinea Highlands), Russian and North Puebla Nahuatl. See Myler (2009:32-4) for discussion of these cases.

To account for this class of apparent FOFC exceptions, BHR suggest that the categories in question have a special status as syncategorematic elements. Such elements, they suggest, have the following set of properties:

(14) i. They are not c-selected;
ii. they do not c-select;
iii. they (therefore) occupy no fixed position in the clausal hierarchy;
iv. they have surface scope determined by their position;
v. they may violate consistent word-order patterns of the language;
vi. they may violate FOFC.

Essentially these elements function somewhat like "pure" logical constants, in lacking any form of argument structure, hence c-selection properties. As such, they can appear anywhere in the clause (or, we can add, the word), subject only to the condition that the default interpretation is that they take surface scope.[9]

Finally, regarding Voice morphemes (e.g. passivisers) and causativisers, it is possible that these categories head their own (verbal) Extended Projection (see Chapter 21 for some discussion and motivation of this idea). If so, then apparent FOFC violations would be expected in their complement.

By and large, then, the systematic exceptions to the suffixing preference in OV languages can be accounted for. However, as we saw in §1, there are still some exceptions to the general tendency regarding other affixes. Table 3 shows the very low incidence of case prefixes in OV languages (4 languages, 0.8% of the total). According to Table 4 there are 23 OV languages with tense/aspect prefixes (4.2% of the total) and Table 5 shows that there are 8 OV languages (1.8%) with plural prefixes. Let us now look at the languages in question in more detail.

The OV, case-prefixing languages are Burrara, an Australian language of the Northern Territories, Gapapaiwa, an Austronesian language spoken in Papua New Guinea, Prasuni, an Indic language of Afghanistan, and Takelma, an Amerind language spoken in Oregon.

[9] Of course, sentential negation does not by any means always take surface scope, but this species of negation may be special in being bound up with both focus and finiteness for its interpretation, which may be determined in large part by abstract elements in the left periphery (see for example Biberauer & Roberts (forthcoming)). Constituent negation, which is of course much freer in its distribution, tends very strongly to scope over just its surface c-command domain.

In three of these languages (Gapapaiwa, McGuckin (2002:314); Prasuni, Morgenstierne (1949:220); Takelma; Sapir (1922:241)), there is a small class of locative (pro)clitics, but these can hardly be regarded as constituting a system of case prefixes; the vast majority of nouns in Gapapaiwa and Takelma have no case-marking at all, while Prasuni has a residual suffixal case-system inherited from Indic (which seems to show split-ergativity). Burrara, on the other hand, has prefixes which are glossed as "acc" in Glasgow (1984:6-8), appearing in between a descriptive prefix which characterises one of four noun classes and the stem, e.g. *an-mu-jaruk* "descriptive prefix – acc – story" ("messenger"). It is unclear whether there are any other case morphemes, or what the motivation for referring to these morphemes as "accusative" was. If we leave Burrara aside as an unresolved instance, then we see that there are no really convincing examples of OV languages with case prefixes. This is a very interesting observation, which we can explain along the lines given in §2.1; what we cannot explain, however, is the differences between case-marking and other forms of prefixation in this regard.

Turning now to the data from Table 4, the 23 OV languages with tense/aspect prefixes are as follows: Western Apache, Chipewyan, Gooniyandi, Gumawana, Gyarong(Cogtse), Iduna, Iwam, Ket, Kiliwa, Maisin, Maklew, Marind, Navajo, Päri, Seri, Sinaugoro, Slave, Tanacross, Tawala, Toussian, Yaqay, Yelî Dnye and Zimakani.

Of the languages in this group I was able to obtain further information on, several appear to show functional systems where there is no roll-up and little or no head-movement: for example, Ket (a Yeniseian language spoken in Siberia) has T > (Agr) > Asp > V, suggesting no V-movement (Werner 1997:154f.).[10] OV order must then be derived by object-fronting or, if V incorporates with v, remnant VP-fronting. Three different Papuan languages are described in Boelaars (1950). In all of these cases, there is some evidence for partial V-movement through the functional system, and some evidence that the prefixes are separate auxiliaries.

[10] Werner (p. 167) makes the following comment:

"Nach E.A. Krejanovič's Auffassung entstanden die verbale Komposita aus Wortfügungen, die historisch in Wörter zusammengezogen wurden. Solche Gebilde, die man als Zusammenrückungen bezeichnen konnte, gibt es im Ketischen in der Tat; sie haben aber mit Inkorporation nichts zu tun, den sie gehen auf analytischer Verbalformem zurück."

("According to E.A. Krejanovič's description, the compound verbs consist of sequences of words, which historically combined to form larger words. Such a picture, which could be called *Zusammenrückung* does in fact exist in Ket; this has nothing to do with incorporation, since the forms go back to analytic verb forms"). This seems to support the analysis sketched in the text.

Marind has AgrS > T > AgrO > (Num) > V except with a 3pl subject, where T (=Future, Aspect, Negation or Perfect) precedes the subject, in which case it looks like a separate auxiliary (Boelaars (1950:5-8). Makleu has T > V > (Distant Past)/AgrS (Boelaars (1950:20-1), suggesting partial V-movement through the functional hierarchy. Yaqay, related to Marind, has Preterite, Future and Evidential markers preceding the subject, but the subject preceding the Present marker. The former again looks like separate auxiliaries rather than prefixes (Boelaars (1950:62-3)). In all these languages, if V moves to v, then OV order can be derived by remnant VP-fronting.

Navajo shows the typical Athapaskan system involving a complex prefixal morphological template on the verb, featuring up to ten prefixes (depending on the analysis); see Speas (1990:205ff.) and the references given there. The basic word order is SOV. Speas argues that part of the prefixing system, the conjunct prefixes, is constituted by functional heads, as shown in (20) (from Speas (1990:279)):[11]

(15)

1	2	3	#	4	5	6	7	8	9	V
ADV	ITER	DIST PL		DO	DEIC SU	ADV	MODE	SU	VOICE	

The # between positions 3 and 4 marks a phonological boundary, which Speas suggests corresponds to the left edge of the functional system making up the inflected verb. Speas goes on to identify prefixes 4-8 with functional heads in a head-final version of the clause structure proposed in Chomsky (1991), as follows (she does not comment on position 5):

(16)

4	5	6	7	8	9	V
DO	DEIC SU	ADV	MODE	AGR-S	VOICE	
Agr-O		Asp	Finite	Agr-S		

She then suggests that "the verb originates immediately to the left of the object-agreement morpheme and moves to the highest INFL position" (280). We can adapt the main elements of this analysis to our general assumptions here, in particular the

[11] The abbreviations are as follows: ADV = adverbial, ITER = iterative, DIST PL = distributed plural, DO = direct object, DEIC SU = deictic subject (indefinite or 4th-person), MODE "marks perfective, imperfective, progressive or optative" (Speas (1990:206)), SU = subject.

head-initial configuration of functional heads, by assuming that V (and possibly Voice) do not raise, but that v=Agr-O (since it instantiates object φ-features) raises through Asp to T, which contains Finiteness and subject φ-features. As Speas comments "the Pollock/Chomsky theory of the structure of S in English and French makes these languages look much more like Navajo than had previously been suspected" (280).

Slave, like Navajo, shows the Athapaskan pattern of rich, templatic prefixation to the verb. Position 11 in the template, according to the description in Rice (1989:425ff.), is occupied by "mode", aspect or tense, and this position precedes a subject-marker, a voice/classifier morpheme and the verb root. It thus seems similar to Position 7 in (16), suggesting that perhaps a similar analysis to that developed by Speas for Navajo could apply here. A further point of interest in Slave is that there are periphrastic past-tense markers which follow the entire verbal complex:

(17) k ǫ ´é ghóhtsį yįlé
house 3-perf-build PAST
"He had built a house." (Rice (1989:1115)

(Navajo has a class of postverbal modal particles, which may be comparable; see Speas (1990:276f.) and the references given there). Clearly, we can treat this order as involving movement of the constituent containing the object and the inflected verb to the left of the Past morpheme. However, if one of the prefix positions instantiates T, then we are compelled to treat these structures as biclausal, with the Past marker functioning somewhat like a restructuring trigger. On the other hand, if the prefixes represent a functional hierarchy below T, then we can treat this as iterated head-movement of functional elements to Mode/AgrS followed by phrasal movement of ModeP to SpecTP. The position of the object reflects object movement; as a pronominal-argument language, Slave is quite freely able to place arguments in a variety of positions; in fact the object may occupy an adjunct position here. The structure of (17) would thus be as follows:

(18)

$[_{TP}\ [_{ModeP}\ O\ [_{ModeP}\ [_{Mode}\ [_{Asp}\ v\ Asp\ ]\ Mode\ ]]\ [_{AspP}\ (Asp)\ [_{vP}\ (v)\ [_{VP}\ V\ (O)\ ]]]]\ T\ (ModeP)\ ]$

Of course, many more details are required in order to support an analysis of this type, but it is certainly a possibility. Most importantly for present purposes, it does not involve any FOFC violation.

Finally, Tawala (an Austronesian language spoken in Papua New Guinea) has SOV order, with Tense, subject-marking and aspect prefixes, but object suffixes: Frequently, but not always, the subject and tense prefixes form a single syncretic element (Ezard (1997:112)), suggesting that subject φ-features are associated with T:

(19) Awai' i yam e- an- an'-i ?
What our(excl) food 3sg+Pres-Dur-eat-3sg
"What is eating our food?" (Ezard (1997:113))

Here it looks as though we have V-to-v movement (with the object φ-features instantiating v), combined with remnant VP-fronting to SpecTP.

Looking at Table 5, the OV plural-prefixing languages are Bininj Gun-Wok, Cherokee, Eudeve, Lafofa, Nevome, Ngandi, Tunen, Wedau.

Of these languages, Evans (2003) describes Bininj Gun-Wok (an Australian language spoken in the Northern Territories) as having completely free word order. As such there is no evidence that the language is OV, and so it need not be a counterexample. Nevome (an Uto-Aztecan language of Northern Mexico) forms plurals by reduplication (Shaul (1986:42)); it is unclear that such markers need to be treated as syntactic prefixes. Ngandi (another language of the Northern Territories) has unclear word-order and noun-class prefixes for masculine singular, feminine singular, masculine dual and plural/feminine dual/masculine-plus-feminine dual. Again, it is unclear whether such prefixes represent autonomous functional heads or are manifestations of φ-features of the Noun. Tunen, a Bantoid language of Cameroun, also has fairly typical Bantu-style noun-class prefixes. No information was available to me regarding the other languages, but again, no clear counterexamples to FOFC are found here.

In general, then, we see that we can account for the cases of prefixation in OV languages without having to allow for FOFC violations, and so our general account holds. What is quite common in the languages discussed here, especially those with tense/aspect prefixes, appears to be partial movement of functional heads, or in some

cases v/V, through the functional system. This clearly supports our overall thesis concerning the role of FOFC in the suffixing preference.

2.4 A note on infixing and other possibilities

Here Greenberg's Universal 26 is relevant: " a language has discontinuous affixes, it has either prefixing or suffixing or both". Given this, and given the fact that our approach to affixation only allows suffixation of X to Y, derived by movement of X to Y, or prefixation of Y to X, derived by lack of movement of X to Y where X and Y are adjacent and Y is specified as a bound morpheme, I regard infixation as resulting from the combination of suffixing and prefixing. We have seen that the combination of prefixing and suffixing in a given system is fairly rare (see Tables 1 and 2, and Notes 3 and 4, above); this is presumably a subcase of the general infrequency of disharmonic types. We thus expect infixing to be rarer still, since it can only take place in a system which allows both suffixing and prefixing, and it requires both operations in the same derivation.

Let us consider what the possibilities of infixing are, in terms of basic assumptions. Let us start from a structure with a lexical head V and two functional heads F and G, as in (20):

(20) $[_{GP}\ G\ [_{FP}\ F\ [_{VP}\ V \ldots\ ]]]$

Infixing of F can be directly derived from this structure, simply by specifying both F and G as bound here. Infixing of G can only be derived by raising F, giving the derived structure in (21), where, all else equal, F+G can be a prefix to V:

(21) $[_{GP}\ [_{G}\ F + G\ ]\ [_{FP}\ (F)\ [_{VP}\ V \ldots\ ]]]$

The otherwise analogous XP-movement operation is not available, since FP does not form a constituent without VP, and so FP cannot be fronted over G without V also being fronted. The comparative rarity of this construction must be due to (a) the rarity of incorporation of a functional head without prior incorporation of the relevant lexical head (this would also account for the rarity of the prefix-dominant systems of the Athapaskan type, if the analysis the previous section is right), and (b) the need for

G to be specified as both hosting incorporation of F and being bound to V. Other conceivable structures include those in (22):

(22) a. $[_F$ F + G] + V

b. $[_F$ F + $[_G$ G + V]]

(22a), which could be seen as a FOFC violation (if V is the head of the whole complex and F the head of F+G, can only be derived by lowering and right-adjunction of G to F, and both of these operations are ruled out by our general assumptions. (22b) could only be derived by lowering of G to V, again an impossible operation.

Ambifixing can be derived by raising V to F and no further. Cases of this involving Tense and Aspect (where Tense = G and Aspect = F) are documented by Myler's (2009:13ff.) summary of Julien's (2002:330f.) database of tense-aspect systems; these have the structure G $[_{FP}$ V + F]. The structure *[$_G$ G + V] + F* is impossible, since it would have to involve right-adjunction of V to G (and a violation of the Head Movement Constraint, although that in itself may not be problematic – see in particular Roberts (2010a, Chapter 5)).

The other conceivable case is *[[F + V] + G]*. This is impossible as a case of head-movement, since it would have to feature right-adjunction of V to F (the heads V and F do not otherwise form a constituent which excludes other elements). It is a possible order derived from FP movement, however it then violates FOFC.

A further case that might be relevant is the root-and-template morphology characteristic of the Semitic languages. As is well-known, in these languages roots are expressed as triconsonantal morphemes, and much inflectional and derivational information is encoded in vowel sequences interpolated among the consonants; there are also suffixes and prefixes. A very partial illustration of this kind of system is given in (23), showing some of the forms based on the root *ktb* "write" in Arabic:

(23) a. katab (perfective active)

b. kutib (perfective passive)

c. aktub (imperfective active)

d. uktab (imperfective passive) (Spencer (1991:135))

In DM terms, this might be handled in terms of fusion of the consonantal root and the vocalic melody (Bert Vaux, p.c.), suggesting a syntactic derivation of these forms involving head-movement of V through various clausal projections; in fact, there is good independent motivation for V-to-T movement in Arabic (Fassi-Fehri (1993:19f.), Shlonsky (1997:7f.)).

Most Semitic languages, including all varieties of Arabic and Hebrew, are VO. However, there is a group of OV Semitic languages spoken in Ethiopia, including Tigrinya (Kogan (1997)) and Tigré (Raz (1997)). These languages clearly both have root-and-template morphology, with some prefixing (e.g. Tigré imperfect *te-*). Probably the best analysis, then, would be a combination of V-movement and "roll-up" movement of the remnant VP, etc., although of course the details remain to be worked out.

2.5 Conclusion

In this section, I have tried to how FOFC combines with the LCA to give an account of the suffixing preference in OV languages. Regarding VO languages, suffixation occurs almost at chance, reflecting the parametric options of suffixal relaisation of functional heads and incorporation (with the latter triggered by the former, as we saw).

One important consequence of this conclusion is that we have evidence that FOFC applies in morphology, which in turn supports the Singe Engine Hypothesis; in these conclusions we concur with Myler (2009).

Two questions are left open so far, however. First, can we find evidence that FOFC applies in the other major areas of morphology, derivation and compounding? Second, what lies behind FOFC itself? In the next sections I will deal with these questions in turn.

3. Derivation and compounding

Concerning derivational morphology, Myler (2009:40-1) observes that FOFC comes very close to deriving the Right-hand Head Rule (RHR), originally proposed by Williams (1981:248), which states that "[i]n morphology, we define the head of a

morphologically complex word to be the right-hand member of that word". Myler points out that the RHR can be broken up into two parts, as follows:

(24) a. Where suffixes appear, they project.
b. Where prefixes appear, they do not project. (Myler's (5), p. 40)

Myler observes that, given Kayne's (1994) Linear Correspondence Axiom (LCA), which requires all structures, and in DM this includes the internal structure of words, to be head-initial, a suffix must trigger movement of its complement. In order for this to happen, the suffix must project. Prefixes, on the other hand, do not trigger movement of their complements. One way to ensure this is to treat them as non-projecting. In this case, FOFC is derived. Myler concludes "[t]he RHR is thus reconceptualised as one of many strategies for avoiding the possibility of FOFC-violations" (41).[12]

There are, however, many cases of derivational morphology which appear to violate FOFC. Nominals derived from denominal and deadjectival verbs, where the verbalising morphology is a prefix, are a case in point, as in (25):

(25) a. $[_N\ [_V$ be $[_N$ head]] ing]
b. $[_N\ [_V$ en $[_A$ noble]] ment]

Here we see cases where the prefix projects, converting the noun or adjective into a verb (although it does not trigger movement of its complement, and hence surfaces as a prefix; see Note 12). Further suffixation of the nominalising morphology creates a structure which is a FOFC violation. These can be admitted if we allow for a general Category Proviso on FOFC, stating that the constraint only applies to heads of the same category, or in the same Extended Projection. In that case, since derivational morphology almost exclusively involves category change, FOFC will in general not apply in the case of derivation.[13]

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[12] An alternative is to allow prefixes to project and treat them as not triggering movement, as in the previous section.

[13] In §4 I will sketch an approach to FOFC which does not explicitly state the Category Proviso, but rather derives it from a condition on incorporation (that the incorporee must have a subset of the formal features of the incorporation host, see below and Roberts (2010a)). That condition is clearly violated in derivation morphology, if incorporation is the operation forming the complex words. If that

Turning to compounds, we can immediately observe that productive synthetic compounding in English obeys FOFC:

(26) a. [$_N$ [[$_N$ can] [$_V$ open]] er]
b. [$_N$ [[$_N$ rocket] [$_N$ scient]] ist]
c. [$_A$ [[$_N$ ear] [$_V$ split]] ing]

The affixes characteristic of synthetic compounds are suffixes, and so the complement to this affix must be head-final, given FOFC. We observe that English, although of course a head-initial language in VP, shows head-final order in these compounds; this can be seen as a necessary FOFC-compliance strategy, in that VO order (**open-canner*, etc.) would violate FOFC. Other types of verb-object compound, which lack a suffix, can show VO order: *pick-pocket, cut-purse*, etc. (although this is not obligatory: cf. *corkscrew*, *fly-spray*, etc.). Also, verb-object compounds in Romance languages, although less productive than English synthetic compounds, lack a suffix and show VO order: French *ouvre-boîte* "open-can" ("can-opener"), *tue-mouches* "kill-flies" ("fly-killer"), *tire-bouchon* "pull-cork" ("corkscrew"); Italian *gira-dischi* "turn-records" ("turn-table"). Finally, we can observe that, in certain semantic fields, English features both compounds involving head-initial phrasal expressions and head-final compounds, e.g. *history of science* and *rocket science*. Only the latter can enter into synthetic compounds, as observed by Ackema & Neeleman (2004: 164ff.); this is a further FOFC effect. Note further the contrasts in (27), also attributable to FOFC playing a role in compounding:

(27) a. the boy has red hair → he is [red-hair]ed
b. the boy is red of hair → *he is [red of hair]ed
c. gold-mining → gold-mining expert
d. mining of gold → *mining of gold expert

It appears, then, that FOFC plays a role in compounding.[14]

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condition is violated, then maybe FOFC too can be violated, although derivational morphology remains both mysterious and a problem for the Single Engine Hypothesis on this view.

[14] However, Myler (2009:54ff.) points out examples like the following, which appear problematic for the general thesis that FOFC constrains compounding:

We can in fact say a little more about synthetic compounds like those in (30) are derived. Let us assume that sub-word-level roots may a lack a lexical specification (cf. Marantz (1997) and Note 17). Then $can_{ø}$ and $open_{ø}$ Merge to form $\{ \{ open_{ø} \}, \{ open_{ø}, can_{ø} \} \}$. Here incorporation is possible here since neither head has any formal features and so their features are non-distinct. This structure incorporates into $–er_{N}$, since its features (none) are properly included in those of *–er* (N). And here N must project: The order inside the root is forced by FOFC. This account predicts that root compounds can have either order in a VO language (this is correct, as the above examples from English and Romance show), but FOFC would require head-final order in an OV language.

Veenstra (2006) gives examples of V-O-affix order in synthetic compounds in the Dutch-English based creole Saramaccan:

(28) a. bébe-daán-ma
drink-rum-aff
"drunkard" (i.e. "rum-drinker")

b. séi-kónde-ma
sell-country-aff
"traitor" (i.e. "country-seller") (Veenstra (2006:203))

These would appear to pose a problem for FOFC, but Veenstra (2006:215) in fact argues (i) that the notional verb and its object in these compounds form a VP and (ii) that Saramaccan has a null nominalising affix (for which he provides independent evidence), which he suggests can attach to the compound, with *–ma* attaching outside it. So the structure of (28a) is as in (29):

(i) a. an [[I-couldn't-care-less] attitude]
b. the [[man-of-the-match] award]
c. an [[easy-to-please] customer]
d. the [[Final over Final] Constraint] (!)
e. the [[channel four] news]

Myler (2009) suggests that the complex modifiers in these examples are able to undergo "Renumeration" in the sense of Johnson (2002) and Harley (2009), thus being structurally opaque ("spelled out" in the sense of Uriagereka 1999, Nunes & Uriagereka 2000) at the point at which they are combined with the element which becomes the head of the compound. We will not go into this question here (on renumeration in relation to FOFC more generally, see the discussion and analysis in Biberauer & Sheehan 2010).

(29) $[_N [_N [_{VP}$ bébe-daán] ø] ma]

There is no FOFC violation here as the zero affix and the VP are categorically distinct (and hence different Extended Projections). The structure of (29) is almost exactly analogous to English *pizza delivery-man*, which we can analyse as *[$_N$ [$_N$ [$_ø$ pizza deliver] y] man]*; here there is no FOFC violation, as the compound is consistently head-final. The ill-formed English compound **deliver-pizza(-y) man* is ruled because there is no VP inside the English compound; as suggested above the compound *can-open* in English is formed from two category-neutral roots (which may even be freely ordered, given the existence of both VO and OV root compounds, as we saw). We can see that this cannot be a VP precisely because it can be "head-final" (i.e. display the order θ-assignee > θ-assigner); there is no motivation for positing that English verbs either allow noun-incorporation or trigger complement-to-specifier movement.[15]

3.3 Conclusion

FOFC has an important role to play in relation to the ordering of elements in synthetic compounds and, less directly, in root compounds. It has almost no role in derivational morphology, however, owing to the intrinsic nature of derivational processes.

4. But what is FOFC anyway? A quasi-morphological explanation

This section has a slightly different goal from the preceding ones, although the theme remains the relationship between FOFC and morphology. Here, however, instead of looking at the role of FOFC in determining certain aspects of morphology, I will speculate as to how a partially morphological operation, namely incorporation, may play a central role in deriving FOFC. If the proposals put forward here are correct, then, we have a further possible account FOFC, in addition to those discussed in Chapter Three.

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[15] Veenstra (208-9) notes some very interesting language-acquisition evidence which supports FOFC. First, Lardiere & Schwartz (1997) show that Spanish-native L2 learners of English never produce synthetic compounds of the type **chase-micer*, although Englsih-style synthetic compounds do not exist in Spanish, and they do produce a range of erroneous forms. Similarly, citing Clark, Hecht & Mulford (1986), Veenstra observes that L1 acquirers of English go through a stage around age 4 where they make various errors in synthetic compounds, including producing forms like **dry-hairer*. However, these forms are in a minority and very short-lived. See Chapter One for more discussion.

One background assumption concerns the nature of incorporation/head-movement. Roberts (2010a) proposes that incorporation of Y to X where X asymmetrically c-commands Y is triggered just where X and Y Agree, in the standard way, and Y's formal features are (properly) included in those of X. Let us refer to this as *Agree-driven incorporation*. According to Roberts, this kind of incorporation underlies many cases of cliticisation, verb-movement, noun-incorporation, etc.

A second assumption I want to introduce is the idea that the "core functional categories" that make up the basic functional hierarchy in both clauses and nominals (and probably elsewhere, e.g. in the extended AP, although I will say nothing about that case here) contain progressively more formal features as one moves up the hierarchy. So, the lexical verb, for example, has (at most) one formal feature, that which characterises it as a verb, namely V. The "light" v also has this feature, as well as φ-features. T also has a V-feature and φ-features, but in addition has its intrinsic Tense features. Finally, C has V-features, φ-features (which may be shared in one way or another with T, following the suggestion in Chomsky (2008)), T-features (see numerous analyses of tense and sequence of tense stemming from Enç (1987)) and its intrinsic clause-typing features (Cheng (1991)). So we have the following picture:[16]

(30) Basic clause structure:

C[V, T, φ, Clause Type] T[V, T, φ] v[V. φ] V[V]

Analogously, we can think of the basic structure of nominals as follows (see Chapter Five):

(31) Basic nominal structure:

D[N, Q, φ, Def] Num[N, Q, φ] n[N, φ] N[N]

If we now take on Roberts' proposals regarding incorporation, each head would have to incorporate with the "next head up". But note that this only follows if the heads are

[16] The notion of a "cartographic field" can now be defined as a sequence of functional heads with the same set of formal features; more formally, the functional sequence $<F_1 \ldots F_n>$ such that all F_j have identical formal features. See Roberts (2010a) for the proposal that what distinguishes, say, the sequence of aspectual heads which Cinque (1999) argues constitute the lower part of the clausal functional sequence, are actually semantic features. Similarly, we can define the notion of Extended Projection as follows: α and β form an Extended Projection where α c-selects β and α and β are non-distinct in lexical categorial features.

in an Agree relation regarding these formal features. Let us suppose, then, that Agree in the standard sense is restricted to φ-features. On standard assumptions, v's φ-set is distinct from that of T/C, and so the only case where Agree-driven incorporation may take place is where T's φ-set is included in that of C.

At this point, we need to introduce a third assumption. Following Rizzi (2008), let us take c-selection to be external search, while Agree is internal search. C-selection, then, involves a head searching the numeration for another head bearing formal features of the relevant kind,[17] triggering external Merge with that head. We can now make a distinction between Agree-driven incorporation, defined and discussed in Roberts (2010a), *Selection-driven incorporation*, i.e. head-movement of a selected category to its selector. Given the assumptions above, incorporation through the functional hierarchy is always possible. In fact, according to Roberts (2010a) Agree-driven incorporation is obligatory. On the other hand, I postulate that select-driven incorporation is always in principle optional, subject to parametrisation.

The final postulate necessary for a new account of FOFC is as follows:

(32) Where incorporation of X takes place, pied-piping of XP is a parametric option.

"Pied-piping" here refers, standardly, to the movement of the category containing the goal, in this case the goal of external search. Since the goal itself incorporates to the selecting head, the pied-piped XP must move to a position as close to the that head as possible, internally merging with it to form a specifier.

Now consider the order of operations as an EP is built. After the VP is built, v c-selects the lexical head V, and VP thus Merges with v; this is a combination of External Search and External Merge. Next, we have the parametric option of incorporation of V to v (External Search and Internal Merge). Then, and only then, comes the option of pied-piping of YP to SpecX (Internal Merge). From this, we can

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17 This can be stated, technically, by treating the selecting feature as uninterpretable, hence v has an uninterpretable V-feature, while V has an interpretable one, etc. (see Bazalgette (2011) on this). More precisely, v has an uninterpretable Categorial feature, [Cat:__], which is valued in the standard way by copying V's value for Cat. Interestingly, this appears to invert the more common view originating in Marantz (1997) that v "categorises" the acategorial lexical root. But it does not really, since we can still assume that roots are acategorial, and that each lexical head has the form [$_{\text{Cat}}$ Root Cat], quite visible in many languages although in English Cat is usually phonologically null. It may be that copying of this categorial feature that makes the fundamental difference between the two types of Extended Projection, entailing a different kind of external argument, different substantive features on the higher heads, etc. See also the Conclusion to Chapter Five.

see that the basic cases of FOFC now follow; the basic FOFC-violating structure in (33a) is underivable, since, wherever αP moves to SpecβP, α must have iucorporated into β, as shown in (33b):[18]

(33) a. *[$_{\beta P}$ [$_{\alpha P}$ α γP] β]
b. [$_{\beta P}$ [$_{\alpha P}$ (α) γP] α+β]

In order to fully derive FOFC, more is needed. In particular, we have to require that incorporation can only "start at the bottom" of the EP, with the lexical head. However, there are clear cases in the literature of head-movement affecting only relatively high position an Extended Projection, e.g. v-to-T movement (possibly the correct analysis of English "*have/be* raising"; see Emonds (1976, 1978)), T-to-C movement (as in English subject-aux inversion, Germanic V2, etc); moreover we postulated movement of higher heads in the clausal hierarchy without V-movement in our sketches of analyses of Navajo and various other OV languages with tense/aspect prefixes iu §2.3 above.

Consider what would happen in a case of v-to-T movement associated with vP-pied-piping, but no V(P)-movement. The resulting structure for TP would be as follows:

(34) [$_{TP}$ [$_{vP}$ (S) [$_{v'}$ (v) [$_{VP}$ **V O**]]] [$_{T'}$ **v+T** (vP)]]

Assuming eith v or T to contain an auxiliary, (S)VOAux order results, contra FOFC. Furthermore, T could incorporate to C with pied-piping, giving VO .. C.

In fact, there is a ready and interesting solution available to this problem, already foreshadowed in Richards & Biberauer (2006). Let us assume the stricter version of the two versions of the Phase Impenetrability Condition (PIC) put forward in Chomsky (2001:13), viz:

(35) For a (strong) phase HP with head H, the domain of H is not accessible to operations outside HP, only H and its edge are accessible to such operations.

[18] Note that this implies that OV orders always have the derivation in (6e).

Assuming cyclic spell-out, governed by the PIC as in (35), VP is transferred to the interfaces before T is merged and therefore before v can incorporate to it; therefore it cannot be moved to SpecvP or further under pied-piping. In other words the VP in (34) is no longer structurally present after vP is constructed. So, bringing in the PIC and cyclic spell-out, the above assumptions (select-driven incorporation and (30)) can now derive FOFC in full.

Note that this approach does not rely on a special movement-trigger for linearization. The parametric options for linearisation are:

(36) a. merge > incorporate > pied-pipe (head-final order)
b. merge > (incorporate) (head-initial order)

The operations merge, incorporate and pied-pipe are all intrinsically ordered in relation to one another. Note further that, if incorporation is intrinsically linked to affixation (see Tables 3 and 4), this also explains the greater incidence of affixation in OV language, since these languages must feature incorporation on the view developed here.

A further interesting consequence of this approach is that it accounts for one derivation of prefixation in head-final languages that we left open earlier. This is the case in (9b), repeated here:

(9b) $[_{FP}\,[_{VP}\,[_{XP}\ (X)\ Y\ ]\ \ X+V\ (XP)\ ]\ \ [\ F\ (VP)\ ]]$

Here XP is the complement of V, and X incorporates to V, forming a prefix, while all XPs "roll up" in the usual head-final way. In terms of the above proposals concerning the categorial structure of Extended Projections, X cannot be part of the same EP as V; instead it is presumably in a high position in its own EP and therefore has either disjoint features in relation to V or a superset of V's features. Either way, incorporation of X is impossible on our assumptions and so (9b) is not found. For example, D and C have more/disjoint features in relation to V and so do not incorporate; this is an empirically correct conclusion, as far as I am aware.

We have now derived FOFC in a novel and interesting way, but we are faced with a different problem: how is complement-head order possible where incorporation is impossible? This problem arises from the fact that we have allowed XP-movement for linearization only where incorporation takes place. Incorporation is always an option

as we build an Extended Projection, as we have seen, but is not possible "across" Extended-Projection boundaries, since either the relevant categories are disjoint or the lower head has more features than the higher one. For example, how can we derive OV order in a language like German, where it is clear that DP is head-initial and that D does not incorporate into V?

Here we have two options, and I will not choose between them (in fact, I suspect different languages choose among them). The first option is to reinstate the Head Parameter, but in a more restricted form than the traditional formulations, e.g. in Hawkins (1983). Rather, along the lines of Richards (2004), it is relevant only for the relation between a lexical head and its complement; in fact, here a still narrower class of cases is relevant: the relation between a lexical head and a categorically-distinct complement; in all other cases word order is determined purely by movement. Thus, like Richards, we adopt both the LCA and (a version of) the Head Parameter.

The second option is to modify the proposal above regarding the featural make-up of categories in the EP and allow, perhaps as a parametric option, that the "higher" positions in certain EPs are either absent or have fewer formal features than we have been assuming up to now. Such a hypothesis seems implausible for a language like German, which clearly has initial C and D, along with final V, and so here the Head Parameter may have to be invoked. On the other hand, Japanese, for example, has no clear examples of D and few really clear Cs (see Watanabe (2008) for some discussion of the Japanese DP), so perhaps the second option is at work in this language. More generally, given the relative paucity of clear D-final and C-final languages, it may be worth considering the possibility that the second option is found in the more harmonically head-final languages, with the Head Parameter at work only in disharmonic ones.

5. Conclusion

In this chapter, the main theoretical question has been the extent to which FOFC applies to word-formation. We have seen clear evidence that it applies to inflection and compounding, with the situation regarding derivational morphology unclear. These conclusions do not differ significantly from those of Myler (2009), and, as Myler notes, are consistent with the Single Engine Hypothesis for morphosyntax; it's syntax all the way down.

The main empirical issue has been accounting for Hawkins & Gilligan's suffixing preference. We saw that FOFC, combined with the LCA, achieves this. Finally, we speculated about how incorporation combined with pied-piping might give a new explanation for FOFC itself. This led to the possible reintroduction of a version of the Head Parameter of the kind envisaged by Richards (2004).