Morphology at a Distance: Marking, Economy, and the structure of certain Scandinavian Noun Phrases*

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How tightly do units at one level of representation map onto units of representation at another level? For nouns, verbs, and other lexical elements, the answer seems to be: fairly tightly. The mapping between syntax and semantics is largely governed by compositionality, and morphology tends to realize each argument that is syntactically present. With function elements things are more complicated. Focusing on the mapping between syntax and semantics, Carlson (1983, 78–79) notes three problems for treating function morphemes compositionally: "First, if they bear meanings, they appear 'lower' in the tree than they should; secondly, function morphemes may appear in different places in the structure and still make the same semantic interpretation in each place. Finally, they give rise to difficulties in deciding what to assign meanings to. Similar problems do not arise for lexical items." Somewhere between the representation of meaning and the phonological string, then, compositionality breaks down for function elements in a way that seems quite different from lexical elements. Carlson argues that these problems have architectural significance: differently from lexical morphemes, function morphemes make no direct contribution to meaning; rather, they are used as indirect markers, signaling that a meaning-bearing operation (or feature assignment) has taken place.

If we could get function morphemes out of the way, the mapping between syntax and semantics would be greatly simplified. Of course, we will only be able to get function morphemes out of the way if we can find a non-compositional account of their distribution. If Carlson's proposal is on the right track, this task can be accomplished without architectural complications that would offset the gains in the syntax-semantics mapping. The current paper explores this direction. Through a detailed examination of a particular empirical domain, that of nominal morphology in Danish and Icelandic, I

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will try to show that, at least in some cases, treating function morphemes as meaningless markers, and relegating their distribution to an external component of the grammar can lead to a simple, predictive account of a complex data pattern.

1 Introduction

The empirical domain of this paper involves two morphological patterns that are found in Danish noun phrases, in which the possibility of attaching an affix in one position depends on the presence or absence of a similar affix in a different position. The first pattern is definiteness marking. Danish has both a nominal suffix, shown schematically in (1a), and a pre-nominal definite article (1b). Both markers are glossed as DEF in the current schematic examples, though their actual forms are slightly different, as we will shortly see.

(1) a. [N-DEF]
b. [DEF ... N]

The second pattern is that of gender marking. Danish marks the neuter singular (glossed as Nt below) on adjectives in indefinite noun phrases (2a), as well as on DEF in definite noun phrases (2b,2c):

(2) a. [(*indef.*) A-Nt ... N]
b. [DEF-Nt ... N]
c. [N-DEF-Nt]

In terms of semantic interpretation, DEF and Nt raise compositionality issues of the kind that led Carlson to suggest that function morphemes are not interpreted. We will encounter some of the issues as we proceed, but I will spend little time on them: our goal is to find the right account for the distribution of DEF and Nt, independently of their semantics. And in terms of distribution, the two patterns above share two properties that are of interest. One is *form identity*: the same affix, DEF in (1) and Nt in (2), can appear in two distinct positions. The second is *distributional dependency*: the ability of an affix to appear in one position depends on whether or not it appears in another position. While DEF is obligatory on a noun in the absence of a definite article, it does not appear if the article is used (1b). Similarly, while Nt is obligatory on an adjective that modifies an indefinite noun, it does not appear if Nt is used on the definite article.

I will argue that both the form-identity and the distributional properties in the patterns above arise from the ability of certain affixes, such as DEF and Nt, to act at a distance. Specifically, I will argue for something like the following:

(3) The role of certain affixes is to license features within a structurally-defined domain

From the perspective of Carlson's proposal, licensing can be thought of as one way in which a function morpheme can signal that a meaning-bearing operation, in this case

feature assignment, has taken place. As to the notion of domain, I will try to show that the structural relation that defines licensing domains is c-command. We will examine instances of this process in detail below.

The precise formulation of this mechanism will occupy us in much of what follows, but here is a rough sketch of the main idea. Starting with definiteness marking, I will say that DEF is an affix of the kind mentioned in (3). That is, DEF is used to license instances of a feature, call it F_{DEF}, within its c-command domain. DEF has two attachment sites, one on the noun and one as part of the definite article.[1] The head noun and certain other modifiers in a definite noun phrase carry instances of F_{DEF}, which need to be licensed. In the absence of any modifiers, F_{DEF} on the noun is licensed by attaching DEF as a nominal suffix:

(4) [N[F_{DEF}]-DEF]

When other elements that carry F_{DEF} appear within the noun phrase, such as adjectives and certain relative clauses, the nominal suffix does not c-command them (5), and the unlicensed instances of F_{DEF} give rise to ungrammaticality:

(5) Bad: F_{DEF} on A not licensed by DEF
[A[F_{DEF}] N[F_{DEF}]-DEF]

A different attachment site for DEF is needed in order to license the adjectival F_{DEF}. The definite article provides such an attachment site. Here there are two potential configurations to consider, though only one of them will apply to Danish. If the definite article c-commands only the adjective but not the noun, as in the bracketing [[D A] [N]], attaching DEF to the article will license F_{DEF} on A but not on N. As before, attaching DEF as a nominal suffix will license F_{DEF} on N but not on A. The only way to license both features is by having two instances of DEF, one on the article and one on the noun:

(6) Hypothetical bracketing (not Danish) leads to double definiteness:
[[D-DEF A] [N-DEF]]

As mentioned above, however, Danish does not allow such cases of double definiteness (Swedish does, perhaps because it has this bracketing, though the full pattern in that language is complex, and I will not attempt an analysis here). In Danish a single occurrence of DEF is used with adjectival modification, and this occurrence is obligatorily the one on the definite article. I take this to indicate that Danish has the bracketing [D [A N]], allowing DEF to c-command both A and N, licensing their F_{DEF}:

(7) Good: higher DEF licenses both occurrences of F_{DEF}
[DEF [A[F_{DEF}] N[F_{DEF}]]]

The ability of DEF to c-command everything else within the noun phrase will account for why Danish does not require double definiteness. It will not, on its own, explain

[1] I keep using the term *definite article* for the pre-nominal attachment site of DEF, but only for ease presentation; the current approach suggests a much more indirect interaction of this position with the semantics of definiteness.

why double definiteness is impossible in this language. I will claim that the impossibility of keeping the low position of DEF when the high one is used is the result of *structural economy*: a morpheme cannot be used superfluously. In (8) the low occurrence of DEF is unnecessary, since the high occurrence of DEF already licenses both instances of F_{DEF}. Consequently, only (7) above is possible.

(8) Bad: more occurrences of DEF than needed
[DEF $[A[F_{DEF}]$ $N[F_{DEF}$-DEF]]]

Phrase structure and economy, then, explain why the pattern of DEF is one of hopping rather than doubling (or spreading). Turning to gender marking, we will see that Nt participates in both kinds of interactions, depending on the other elements involved. As mentioned above, an adjective in an indefinite neuter singular noun phrase is marked by Nt: $[\ldots [A\text{-Nt}]\ N]$. In the current framework, this will mean that the adjective carries a feature, F_{Nt}, that can be licensed by a c-commanding instance of Nt. If another adjective is added, each will have its own Nt marker: $[\ldots [A\text{-Nt}]\ [A\text{-Nt}]\ N]$. I will take this to mean that an occurrence of Nt on one adjective cannot c-command another adjective. If the noun is definite, however, Nt must appear on DEF, indicating that DEF, too, carries an instance of F_{Nt} that has to be licensed. Since we already know that the definite article c-commands the adjective in the Danish noun phrase, we predict that Nt on the definite article will make Nt marking on the adjective impossible. The instance of Nt on DEF licenses all occurrences of F_{Nt} within the noun phrase, and economy will prevent any other occurrences from appearing.

(9) Good: Nt on DEF licenses the occurrences of F_{Nt} on DEF and on A:
$[[D\text{-DEF}[F_{Nt}]\text{-Nt}]\ [A[F_{Nt}]\ A[F_{Nt}]\ \ldots\ N]]$

In other words, we predict that Nt spreads in indefinite noun phrases but appears only on the article in definite noun phrases. As we will see, this prediction is borne out.

In the following section we will take a closer look both at the data and at the details of the system. Spelling out these details will lead us to certain conclusions with respect to the structure of the Danish noun phrase, some of which have been outlined above. Along the way I will try to show that the proposed account provides a handle on the notion of wordhood within a syntactic framework.

Of the conclusions we will reach with respect to phrase structure, at least one will look like an arbitrary decision of Danish, raising the question of whether there are languages that have made the opposite choice. In section 3 I present evidence that Icelandic is such a language. The current proposal then will make very clear predictions for the affixation pattern in Icelandic. At first sight, these predictions will appear to be wrong. However, I will show that once a small set of independently motivated phonological processes is taken into account, the complex Icelandic pattern is predicted in its entirety.

Both in Danish and in Icelandic the two patterns under discussion are superficially very different. Definiteness hopping bears a similarity to the English phenomenon

of *do*-support, while gender spreading is an instance of the more general Germanic phenomenon of weak/strong inflection. The proposed unified account for these seemingly unrelated phenomena is made possible by the use of three ideas: (a) that an affix can have more than one attachment site; (b) that economy rules out superfluous structure; and (c) that certain affixes are used to license features via c-command. Of these assumptions, the first two are not new, as we will briefly discuss, though to my knowledge they have never been combined. It is the third assumption that will allow us to put them together and derive the distributional pattern. This assumption, while in line with a syntactic view of morphology, will suggest that the inventory of affixes should be modified. In particular, the emerging picture will be one in which certain morphemes, such as DEF and Nt, are neither the (possibly dislocated) realization of syntactic function heads nor the realization of features on terminal nodes but of a third kind that interacts with structure and interpretation only indirectly through the features that they license.

2 Danish

2.1 Overview: two marking patterns

Danish distinguishes between definite and indefinite noun phrases, and between two genders: the common gender and the neuter. Danish also distinguishes between singular and plural, though we will mostly ignore the latter in what follows. The distinction between definite and indefinite is kept in both the singular and the plural. The distinction between the two genders is only visible in the singular.

2.1.1 Definiteness

As is common among Scandinavian languages, and as already mentioned in the introduction, Danish has both a nominal definiteness suffix and a pre-nominal definite article. The form of the definiteness suffix is *-en* in the common gender and *-et* in the neuter. The form of the definite article is *den* in the common gender and *det* in the neuter. For most of the definiteness paradigm both genders have the same behavior, and I will use the common gender for most of the relevant examples.

The main empirical generalization regarding the distribution of the suffix and the article in definite noun phrases is this:[2]

(10) The definite article is required if the noun is modified by an adjective and is disallowed with unmodified nouns.

The following examples from (Hankamer and Mikkelsen, 2005, pp. 87–88) illustrate the generalization:

[2]The statement of (10) does not tell us anything about nouns that are modified by elements other than adjectives. See Hankamer and Mikkelsen (2005) for a discussion of how relative clauses and PPs affect definiteness marking. The account developed below generalizes straightforwardly to those cases.

(11) a. hest-en
horse-DEF
'the horse'

b. * den hest
DEF horse

(12) a. * gamle hest-en
old horse-DEF

b. den gamle hest
DEF old horse
'the old horse'

2.1.2 Gender

We noted that the definiteness markers in Danish reflect the distinction between common gender and neuter. The same gender distinction is reflected in the form of the Danish indefinite article: *en* for the common gender, and *et* for the neuter. The indefinite article is similar in form to the definiteness suffix (and to the definite article), a similarity to which we will return. The indefinite article is also identical to the form of the numeral 1.[3] In what follows I will gloss both the indefinite article and the numeral as 1.

The distinction between common gender (glossed CG below) and neuter (glossed Nt) is reflected also in the form of adjectives in indefinite noun phrases. Common gender adjectives appear in their base (unsuffixed) form in indefinite noun phrases, as in (13). Neuter adjectives, on the other hand, take the suffix *-t* (14).

(13) en stor gammel hest
1-CG big old horse
'a big old horse'

(14) et stor-t gammel-t hus
1-Nt big-t old-t house
'a big old house'

The contrast between the two adjectival forms is neutralized in definite noun phrases: adjectives of both genders have the same form, usually obtained from the base form by adding an *-e*.

(15) den store gamle hest
DEF-CG big old horse
'the big old horse'

[3]Danish makes an orthographic distinction between the indefinite article and the numeral, marking the latter with an accent: *én* for the common gender, and *ét* for the neuter.

(16) det store gamle hus
DEF-Nt big old house
'the big old house'

2.1.3 Suffix decomposition and the interaction of definiteness and gender

The way in which the data we just saw will fit into the general discussion in the introduction is through a morphological decomposition. I will claim that the definiteness and gender markers in Danish are decomposable into independent building blocks. Specifically, I will say that Danish marks definiteness with the suffix *-en* and the neuter gender with the suffix *-t*. There are no markers for indefiniteness or common gender: indefiniteness will be treated as the absence of definiteness, and the common gender as the absence of the neuter. The neuter definiteness suffix *-et* will be treated as the combination of the definiteness suffix and the neuter suffix:

(17)

	$-$	def
$-$	$\emptyset$	*-en*
$Neut$	*-t*	*-en+-t*

In addition to their role as nominal suffixes, I will claim that *-en* and *-et* (= *-en* + *-t*) are also part of the definite article, which I will analyze as the result of attaching a definiteness suffix to a base *d*:[4]

(18) a. *den = d + -en*
b. *det = d + -et (= d + -en + -t)*

In all of their attachment sites, the suffixes *-en* and *-t* will be used to license definiteness and neuter features respectively on other elements within their scope, along the lines of the schematic discussion in the introduction. As mentioned above, licensing will require c-command to hold between licensor and feature. Much of what follows, then, will depend on the ability of affixes to c-command the relevant feature-bearing elements from their attachment sites.[5]

2.2 Account: the basic ingredients

The introduction mentioned two principles that are involved in determining the distribution of affixes:

(19) Marking: affixes license features on elements in their c-command domain

[4]The suffixes *-en* and *-t* will play a significant role in what follows. On the other hand, I will have very little to say about the morpheme *d*.

[5]While c-command is a necessary condition, it is not sufficient, and other factors also play a role. For example, in the data that we will be looking at, affixes are related to one head noun and cannot license features that are related to another head noun, even if the correct c-command relation holds. Specifically, definiteness marking on one noun cannot license a definiteness feature on another noun that is embedded in a PP or a relative clause. The characterization of such additional constraints on marking domains falls outside the scope of this paper.

(20) Economy: overt structure is avoided where possible

If we want to use these principles to derive the actual distribution, we should state how they interact with each other and with the rest of the grammar. One possibility, implicitly assumed in the informal discussion in the introduction and which I will adopt in what follows, is to think about these principles as filters that apply to the output of the grammar. That is, of all the structures that can be generated by the grammar, those that fail to satisfy the licensing of features are either ruled out or dispreferred with respect to similar structures that satisfy licensing. Similarly, of the structures that are generated, those that have more overt structure than others are dispreferred. To make this more concrete, I will formulate the two principles as constraints, MARK and *MORPH, that interact with the rest of the grammar, SYNTAX, in an OT fashion:[6]

(21) Constraints:
   a. SYNTAX: Avoid ungrammatical structures
   b. MARK: Each occurrence of a feature F_α must be licensed by a c-commanding α-licensor
   c. *MORPH: Avoid overt structure

As for the ranking of these constraints, I will assume that structural economy is never a sufficient reason to leave a feature unlicensed, and that licensing a feature is never a sufficient reason to generate an otherwise ungrammatical structure. In other words, I will assume the following ranking:[7]

(22) Constraint ranking: SYNTAX$\gg$MARK$\gg$*MORPH

Apart from stating MARK and *MORPH I will have little to say about these constraints. Their statement and their ranking will remain the same throughout our discussion. Most of the action will happen in the details of SYNTAX. An example of an element of SYNTAX is our claim that Danish marks definiteness with *-en* and the neuter gender with *-t*:

(23) a. *-en, -t* are suffixes
   b. *-en* licenses F_{DEF}
   c. *-t* licenses F_{Nt}[8]

[6] Alternatively, one can think of SYNTAX as the GEN function that determines the inputs for evaluation by the other two constraints. Since SYNTAX is always the highest ranking constraint the two formulations are equivalent.

[7] The ranking of *MORPH below the other two constraints will be crucial for the analysis, and we will see ample evidence for it. The internal ranking of SYNTAX and MARK, on the other hand, will not play a role. Suggestive evidence that MARK is indeed outranked by SYNTAX comes from cases where marking is violated, at least superficially. For example, adjectives such as *dansk* 'danish' and *lille* 'small' do not take the *-t* ending, and yet they can modify an indefinite Nt noun. I will not go into the details of such cases here since the relevance of the question for the main points of this paper is minimal.

[8] As mentioned, gender distinctions are lost in the plural. It might perhaps be more transparent to write $F_{Nt,SG}$ to reflect the fact that neuter marking applies only in the singular, but I will stick to the shorter F_{Nt}.

Other elements of SYNTAX that will be relevant are selectional restrictions, such as those that guarantee that *-en* can attach to nouns and to *d* but not to adjectives. Relatedly, SYNTAX is also responsible for the affixal decomposition mentioned above:

(24) a. *den* = *d* + *-en, det* = *d* + *-et*
b. *et* = *en* + *-t*

We will encounter a few more phrase-structure SYNTAX constraints below.

2.3 Definiteness

Let us now return to the basic pattern of definiteness marking in (11) and (12), repeated here:

(25) a. hest-en
horse-DEF
'the horse'
b. * den hest
DEF horse

(26) a. * gamle hest-en
old horse-DEF
b. den gamle hest
DEF old horse
'the old horse'

The definitions in section 2.2 allow us to describe the definiteness pattern in slightly more precise terms than before. The head noun and all modifying adjectives in a definite noun phrase must be c-commanded by the definiteness suffix *-en*. For an unmodified noun, this requirement can be satisfied by adjoining *-en* to the noun itself, as in (25a). If the noun is modified by an adjective, however, the nominal suffix *-en* will not be able to c-command the adjective from its attachment site, leading to a MARK violation for (26a). On the other hand, if *-en* attaches to the morpheme *d* of the definite article, as in (26b), it will c-command both the noun and the adjective. Finally, attaching *-en* to *d* with an unmodified noun, as in (25b), gives rise to a structure that is less economical than that obtained by attaching *-en* directly to the noun (25a), the former structure containing the additional morpheme *d*. By structural economy, then, (25b) will be ungrammatical.[9]

[9]Economy will only be relevant if *d* is indeed a dummy morpheme, as I assume here. If it turns out that the incompatibility of *d* with bare nouns, as in (25b), has more substantial reasons, those would be part of SYNTAX. In that case *MORPH will be irrelevant for (25b), though it will still be operative in ruling out double-definiteness forms like **d-en gamle hest-en*, as well as in the account of gender marking discussed below. Evidence that could bear on the role of *d* comes from lexical exceptions to the affixation of *-en*, discussed at length by Mikkelsen (1998) and Hankamer and Mikkelsen (2005). The relevance of this question to the current proposal is minimal, the only change being the additional SYNTAX constraint just mentioned, and so I avoid presenting the details here.

Stating that the noun and the adjectives should be c-commanded by *-en* is done by specifying where the definiteness feature licensed by *-en* appears:[10]

(27) Definiteness feature: the head noun in a noun phrase and all modifying adjectives have the feature $[F_{DEF}]$ *iff* the noun phrase is definite

We can now evaluate some of the candidates for a definite noun phrase with an unmodified head noun:

(28)

hest[F$_{DEF}$]	SYNTAX	MARK	*MORPH
en-hest[F$_{DEF}$]	*!		*
hest[]	*!		
hest[F$_{DEF}$]		*!	
☞ hest-en[F$_{DEF}$]			*
d-en hest[F$_{DEF}$]			**!

The candidate *en-hest*$[F_{DEF}]$ in (28) is ruled out by SYNTAX: *-en* is a suffix, not a prefix. The second candidate, *hest*[], does not have the feature $[F_{DEF}]$. This is a violation of (27), which is a SYNTAX constraint. Notice that this form would be well-formed with respect to an indefinite input. The next candidate in (28), *hest*$[F_{DEF}]$, is syntactically well-formed but is ruled out by MARK: its $[F_{DEF}]$ is not licensed by a c-commanding *-en*. The last two candidates in (28), *hest*$[F_{DEF}]$*-en* and *den hest*$[F_{DEF}]$ are well-formed both with respect to SYNTAX and with respect to MARK, and so the winner is determined by *MORPH: *hest*$[F_{DEF}]$*-en* wins because it contains one morpheme less than *den hest*$[F_{DEF}]$.

Turning to the case of adjectival modification, we will have at least the following candidates to consider (shown here together with the intended constraint violations, which we will attempt to derive immediately below):

(29)

gamel[F$_{DEF}$] hest[F$_{DEF}$]	SYN.	MARK	*MORPH
gaml[F$_{DEF}$]-en hest[F$_{DEF}$]	*!	*	*
gamle[F$_{DEF}$] hest[F$_{DEF}$]-en		*!	*
d-en gamle[F$_{DEF}$] hest[F$_{DEF}$]-en			***!
☞ d-en gamle[F$_{DEF}$] hest			**

We rule out the first candidate, *gaml*$[F_{DEF}]$*-en hest*, by appeal to a syntactic constraint that prevents the definiteness suffix from attaching to adjectives. Some such restriction

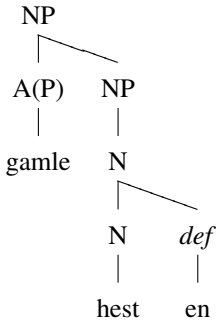
[10]The reference to definiteness that is made in (27) can be implemented in several different ways. One possibility is that definite noun phrases in Danish always contain a definite article, sometimes covert, which provides both the compositional contribution of definiteness and the source of F_{DEF} for the noun and the adjectives. Under this view (27) is just a statement of agreement between the article and the other elements. An alternative that follows Carlson (1983) and is more natural within the current framework is to bypass the question of whether a definite article is present and interpret either the highest occurrence of F_{DEF} or the application of (27) itself. A direction that seems unappealing from the current perspective is to assign lexical content to the affix *-en*. For affixes of this kind the number of occurrences and their positions are determined solely by the interaction of marking requirements, phrase structure, and economy. I do not wish to claim that it is impossible to assign a compositional contribution to these occurrences, but the approach as a whole does not seem promising.

seems to hold in most Germanic languages.[11] For the remaining candidates in (29) we would like to say something like the following: *gamle*$[F_{DEF}]$ *hest*$[F_{DEF}]$*-en* violates MARK because *-en* does not c-command the adjective from its post-nominal attachment site, and therefore cannot license $[F_{DEF}]$ on the adjective;[12] in *d-en gamle hest-en* and *d-en gamle hest* MARK is satisfied, and so the winner is the more economical *d-en gamle hest*. The structural relations that we need, then, are the following:

(30) a. Post-nominal *-en* does not c-command the adjective
b. Definite-article *-en* c-commands both the noun and the adjective

Though perhaps not entirely without its problems, requirement (30a) will turn out to be fairly straightforward. To satisfy it we will mainly have to ensure that the adjective is not (contained within) a sister of the head noun.[13][14] Under the assumptions that we will end up adopting, this can be accomplished if $A(P)$ is an NP adjunct:[15]

(31) Bad: post-nominal *-en* does not c-command the adjective[16]



[11] If one assumed, as we will eventually end up doing, that the adjective does not c-command the noun, then this candidate could also be ruled out by MARK. The reason is that *-en* on the adjective will not suffice to license F_{DEF} on the noun, even if the affixation is syntactically well-formed. This approach will not generalize to other cases, though, and I will not pursue it here.

[12] From here on I will usually avoid writing the features explicitly on morphemes. In most cases no confusion is likely to arise: as mentioned above, candidates that fail to have the correct feature will incur a SYNTAX violation, leading to their ungrammaticality.

[13] In section 3 we will see what happens when the opposite choice is made.

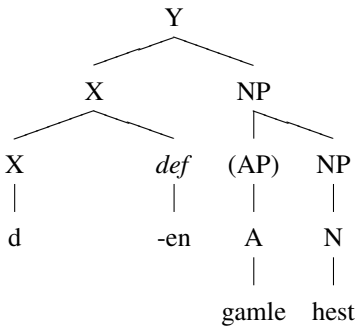
[14] I ignore for the time being the question of whether it is a bare adjective or an adjective phrase that attaches. The distinction will only matter once we get to gender marking in section 2.5 below. Until then I will usually use $A(P)$ as the category label of the adjective (phrase).

[15] Any higher attachment site for $A(P)$ will also prevent the post-nominal *-en* from c-commanding the adjective. It is not clear what such an attachment site might be, though, so I will keep assuming that $A(P)$ is adjoined to NP. Svenonius (1993) arrives at a similar structure in his analysis of the Scandinavian noun phrase, though the general framework in which his account is couched is very different from the current one.

[16] Here and elsewhere I allow structures to have unary branching. For example, the lowest NP node in (31) has the top N node as its unique daughter. Such structures will make the discussion of c-command more transparent, but they are at odds with the syntactic assumptions of Bare Phrase Structure (Chomsky, 1995). Modifying the current representations so as to avoid unary branching while maintaining the c-command relations relevant for licensing is fairly straightforward. The main step involves changing the daughter's label to that of its mother, followed by identifying the two nodes. In (31), for example, N will combine with *-en* to form NP, which is the sister of $A(P)$. Note that this means that an affixation will now sometimes have an effect on the labeling of its attachment site. A more detailed comparison of the two representations is beyond the scope of this paper.

Satisfying the second structural requirement, (30b), will turn out to be slightly more involved. Recall that we want *-en* to c-command both the noun and the adjective from its attachment site on the definite article. In other words, we want the following to be good, where X and Y are placeholders for actual category labels.[17]

(32)



If c-command is defined in terms of first (branching) node up, (32) will not have the desired c-command relations. The first (branching) node above the definiteness suffix is X, which dominates neither the adjective nor the noun. For (32) to provide the right kind of licensing, then, we need a somewhat looser notion of c-command, ensuring that something like the following holds:

(33) An affix c-commands everything its attachment site does

If (33) is guaranteed, we obtain the licensing of F_{DEF} on the adjective and the noun by the definite article. This licensing is what we needed in order to derive the adjectival pattern in table (29), thus completing our account of definiteness marking in the cases that we have looked at. Below we will see that (33) gives us the right results also for other affixation patterns and their interaction, both in Danish and elsewhere.

Principle (33) could be added as a stipulation to our system, and in most of what follows it will be treated as such.[18] Still, it would be reassuring if we could show that it can be derived rather than just stipulated. The following section is a short detour through an attempt to do that.

[17] Once we see that the required c-command relations can be satisfied by (32) it might be convenient to give X and Y more meaning names. I will assume that X is the determiner, D, and that Y is either NP or DP.

[18] If one prefers, one can add a domain restriction to (33) so that the principle will apply only to some affixes and to some configurations, as long as the affixes that we will look at and their relevant configurations will be in this domain.

2.4 Deriving condition (33)

2.4.1 First attempt: c-command through wordhood

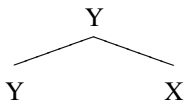
Considerations of wordhood suggest an approach we might explore for deriving (33). We will look at this approach very briefly and then reject it in favor of a more syntactic alternative.

Affixes combine with their attachment sites to form one word. Perhaps we could say, then, that each element inside a word c-commands everything that the containing word c-commands. For an affix that does not take scope over another element (in the sense relevant for syntax above the word level), wordhood will be provide a special way to be considered as c-commanding that other element. This would build an asymmetry between scope relations above and below the word level, a direction that might make sense within a framework that assigns a special status to the notion of word.[19] From the perspective of our framework so far, however, the opposite direction seems more promising. We have been developing a syntactic account of affixation. It would seem more natural to look for a way to relate (33) to other syntactic phenomena, and to try to obtain the notion of wordhood as a derived notion.

2.4.2 Second attempt: c-command and labels

A definition of c-command that derives (33) was already provided and used for a variety of purposes by May (1985) and Kayne (1994). This definition makes use of a distinction between *categories* and *segments* (cf. Chomsky, 1986). A category is a maximal set of contiguous nodes that have the same label. The individual nodes in a category are its segments. In (34), for example, there are two categories. One is composed of the single segment labeled X, while the other is composed of the two segments labeled Y.

(34)



Following May (1985) and Kayne (1994) we will assume that the notion of dominance that is relevant for c-command is sensitive to the distinction between category and segment: a category X will be said to dominate a node n *iff* every segment of X dominates n.[20] In (34), for example, the category Y does not dominate X, since only the higher segment of Y dominates X, while the lower segment of Y does not. The definition of c-command will now look like this:

[19] A possible concern is that in such frameworks, word-parts do not usually interact with sentence-level syntax, making the notion of c-command by word-parts for the purposes of licensing an exception.

[20] Segments are individual nodes, and for them I assume the usual definition of dominance as the transitive closure of the *mother-of* relation among nodes in the tree.

(35) X *c-commands* Y *iff*

a. X and Y are categories

b. $X \neq Y$

c. Every category that dominates X dominates Y

A consequence of definition (35) is that adjuncts, such as our definiteness suffix, now c-command outside of their attachment sites. A simple adjunction structure has the schematic form of (34) above. As we just saw, the category Y does not dominate X (only one segment of Y does). Consequently, every category that dominates X also dominates Y.[21] If (34) is embedded inside a bigger structure, definition (35) guarantees that X will c-command everything inside the sister of the highest segment of Y. In other words, X will c-command everything that its attachment site does, which is precisely what is needed for (33).

2.4.3 Wordhood within a syntactic framework

With the help of definition (35) we now have a reasonably principled way to derive the scopal relations of those elements within the Danish noun phrase that we have looked at. Moreover, our account is uniformly syntactic: all the relevant relations are defined in terms of dominance and labeling within the tree. In particular, no reference is made to the notion of word. Of course, some things are words and others are not, at least as far as speaker intuitions and certain phonological processes are concerned. For example, *-en* combines with the element to its left to form a single word, while the noun and the adjective do not. One could say, perhaps, that *-en* is specified as an affix, and that this forces it to surface as part of a bigger word more or less independently of its syntactic configuration. This would hardly be a predictive theory, though. Fortunately, we can do better. Using the definition of c-command in (35), we can define a derived notion of wordhood as follows:

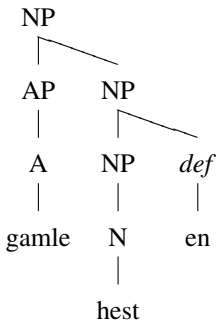
(36) Two different *terminal* categories u and v will be said to belong to the same *word iff* (a) u c-commands v and (b) v c-commands u

When *-en* adjoins to *hest*, for example, the first category dominating either is NP. The affix and the noun, then, c-command each other and therefore belong to the same word. When *-en* adjoins to *d* the first category that dominates either is DP, and again we predict the two to be part of the same word. On the other hand, the first category dominating the adjective *gamle* is AP, so it does not c-command the noun, the affix, or *d*, and we correctly predict that the adjective will form an independent word.

Definition (36) allows us to impose further constraints on phrase structure. Consider the following structure (the relevance of this example was pointed out to me by Sabine Iatridou, p.c.):

[21] This is not necessarily true if multiple-dominance is allowed, a possibility that I will ignore here.

(37) Bad:



Like (31), the structure in (37) is an analysis of the ungrammatical *gamle hest-en*. As opposed to (31), however, our system would predict (37) to satisfy all the marking constraints: *-en* is adjoined to NP rather than dominated by it, and every category that dominates *-en* also dominates the adjective *gamle*. Until now we had no independent reason to rule out (37) as a possible analysis for *gamle hest-en*. Wordhood provides a reason to reject this structure. By (23a) *-en* must form part of the same word as the element that precedes is, in this case the noun *hest*. Consequently, using (36), the two have to c-command each other. In (37), however, the first category dominating *hest* is NP, which does not c-command *-en*, ruling out the structure.

Using definition (35) we have derived the ability of affixes to c-command everything their attachment site does, as required by our account of licensing. The same definition also provided us with a derived notion of wordhood that accounts for the mapping from those structures that we saw into words and provides some further constraints on possible phrase structures. We can now return to our affixation patterns and examine the pattern of gender marking and its interaction with definiteness.

2.5 *-t* marking

In the outline of Danish nominal morphology above (section 2.1.3) I suggested that Danish marks the neuter gender with the suffix *-t* in a similar way to the way it marks definiteness with *-en*, giving rise to the following decomposition:

(38)

	$-$	def
$-$	$\emptyset$	*-en*
$Neut$	*-t*	*-en+-t*

The neuter suffix *-t* appears on the neuter forms of the singular definite article (*det*), definiteness suffix (*-et*), indefinite article (*et*) and the numeral 1 (*ét*). In addition it appears on attributive adjectives in singular indefinite neuter noun phrases (39a) and on predicative singular neuter adjectives (39b).

(39) a. et stor-t hus
1-Nt big-t house

'a big house'

b. hus-et er stor-t
house-DEF is big-t
'the house is big'

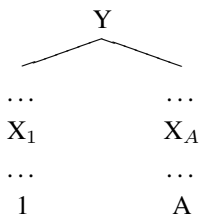
Using the same idea as for definiteness marking, we can say that in the neuter singular, the morpheme *en* and all adjectives must be marked by *-t*. As in the case of definiteness marking, we will state this in terms of features and licensing:

(40) The morpheme *en* and all modifying and attributive adjectives have the feature $[F_{Nt}]$ *iff* the noun is neuter singular

(41) The suffix *-t* licenses $[F_{Nt}]$

The fact that *-t* appears both on 1 and on the adjective indicates, under our earlier assumptions, that each occurrence of *-t* licenses only the $[F_{Nt}]$ in its immediate attachment site. This, in turn, means that 1 and the adjective do not c-command each other: if one of them could c-command the other, only one occurrence of *-t* would be required to license both features. If no c-command relations hold between 1 and the adjective, the following schematic configuration holds, where X_1 has a label that is distinct from 1, and X_A has a label that is distinct from A:

(42)

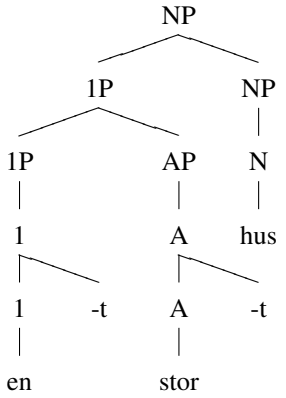


In other words, going up in the tree from 1 and A towards the first node that dominates both, we will encounter a label change on each branch. In the absence of any better candidates, I will assume that this label change is the transition from head to phrase: 1 becomes 1P, and A becomes AP.[22] Either of the following would be compatible with our discussion so far:[23]

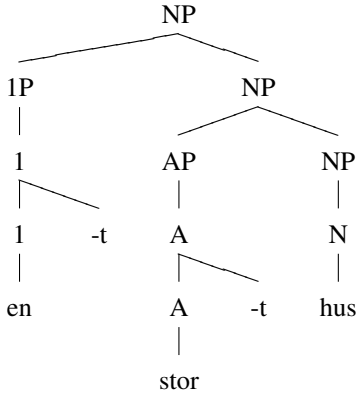
[22]Evidence that adjectives are at least sometimes phrasal in Danish comes from the fact that, as in other Mainland Scandinavian languages, Danish adjectives can sometimes take complements (cf. Delsing, 1993, p. 82). Independent evidence for the label change along both branches in (42) is provided by considerations of wordhood of the kind discussed in section 2.4. I will not dwell on these matters here.

[23]The unary branching is again used for ease of exposition and can be eliminated in the manner described in fn. 16. Accounting for the wordhood facts may require some further modifications.

(43) a. AP adjoined to $1P$



b. AP adjoined to NP



2.6 Some further interactions

Our assumptions regarding the mechanisms of feature licensing and structural economy have driven us to adopt the phrase structure described above. This phrase structure, in turn, makes further predictions, which we now examine. The first concerns multiple adjectives: since adjectives are phrasal, no adjective can c-command another adjective. This means that no *-t* on one adjective can license $[F_{Nt}]$ on another adjective. We therefore correctly predict the first half of the pattern of *-t* spreading mentioned in section 2.1.2 above: when more than one adjective modifies an indefinite neuter noun, each receives its own *-t* suffix:

(44) a. et stor-t hvid-t hus
1-t big-t white-t house
'a big, white house'

b. * et stor hvid-t hus
1-t big white-t house

c. * et stor-t hvid hus
1-t big-t white house

Next, consider what happens when we add a definite article. As we have argued above, the definiteness affix *-en* must c-command all adjectives. We have also argued that the neuter singular *-en* bears F_{Nt}, which must be licensed by *-t*. But if *-en* c-commands the adjectives then any instance of *-t* that c-commands *-en* will also c-command the adjectives and will license their F_{Nt} features. Consequently, repeating *-t* on the adjectives will be unnecessary. By *MORPH it will be ungrammatical. Again, this prediction is borne out:

(45) a. det store hvide hus
DEF-t big white house
'the big, white house'

b. * det store hvid-t hus
DEF-t big white-t house

c. * det stor-t hvide hus
DEF-t big-t white house

One final prediction concerns the interaction of definiteness with 1,[24] pointed out to me by Torben Thrane (p.c.). It is possible in Danish to use what looks like the combination of a definite article and an indefinite article:

(46) Den ene kop er forsvundet
DEF 1 cup is disappeared
'One of the cups has disappeared'

I will ignore the semantics of this construction, which I do not understand, and will focus only on the morphology. (46) suggests that definiteness is higher than 1 in the Danish noun phrase. For neuter noun phrases, this means that the *-t* that licenses F_{Nt} on *-en* will c-command everything else in the structure, licensing any F_{Nt} on 1 or on adjectives. That is, despite the presence of 1, which in earlier examples occurred together with *-t* spreading, and despite the fact that the noun phrase has an indefinite interpretation, we predict that there would be no *-t* in the structure except for the one on the definiteness marker. This prediction is borne out:

(47) a. det ene hvide krus er forsvundet
DEF 1 white mug is disappeared
'One of the white mugs has disappeared'

b. * det ete/et hvide krus er forsvundet
DEF 1 white mug is disappeared

c. * det ene hvidt krus er forsvundet
DEF 1 white mug is disappeared

[24] As noted above, the indefinite article and the numeral 1 have the same form in Danish. I will not try to distinguish between them here.

2.7 Interim summary

We have looked at the patterns of definiteness marking and gender marking in Danish and at their interaction. Both patterns showed dependencies that went beyond the locality of strict sisterhood. The non-locality for each of the marking patterns has two aspects that deserve special attention: the complementary distribution of the marking possibilities, and the form identity of the markers.

(48) Complementarity:

a. In definite noun phrases, definiteness is expressed on either *d* or N, and never on both

b. In neuter noun phrases, gender is expressed on either *-en* or A, and never on both

(49) Form identity:

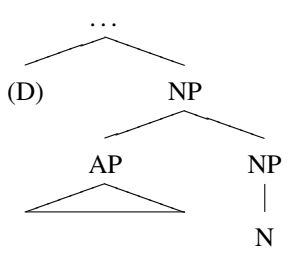
a. The form of definiteness when expressed on *d* is identical to its form when expressed on N

b. The form of the neuter when expressed on *-en* is identical to its form when expressed on A

We derived the marking pattern from the interaction of three components: feature licensing, structural economy, and independent syntactic requirements. Two features played a role, along with the conventions for their distribution on elements within the noun phrase. The features we used were the definiteness feature F_{DEF} and the neuter (singular) feature F_{Nt}. Each feature had a unique licensor, *-en* for F_{DEF} and *-t* for F_{Nt}. Crucially, feature licensing was taken to depend on structural configurations that did not require strict sisterhood. This allowed an affix on one element to license a feature also on other elements within the noun phrase. For example, definiteness on the definite article licensed definiteness on the adjective and on the noun. This meant that if the definite article is used, nothing is gained by using also the definiteness suffix on the noun. By structural economy, the definite article made the definiteness suffix on the noun impossible. In a similar way the rest of the distributional pattern was accounted for. Form identity followed from the use of the same affix for licensing a feature, with several possible attachment sites.

We saw that these considerations had implications for phrase structure. In particular, we have been forced to assume something like the following:

(50)



Though there is no consensus in the literature about the structure of noun phrases in general and the Danish noun phrase in particular, most aspects of the structure in (50) are fairly standard. A potential exception is the analysis of AP as an NP adjunct. We have analyzed AP as sister to NP simply in order to get the affix distribution right, but we have seen no other, more general reasons to assume this structure. Since the sisterhood of AP and NP is crucial for the current account, I will have to conclude either that this phrasal construction is a deep fact about language or that it is just an arbitrary choice that Danish has made. As we will soon see, the empirical data appear to support the latter option. If the label of the sister of AP is an arbitrary choice of Danish, we may expect to find a language Danish$'$ where the label of the sister of AP is not NP, but other than that everything that matters remains the same. In section 3 I will argue that Icelandic is a Danish$'$ in which the sister of AP is N rather than NP, while the rest of the phrase structure remains unchanged. This will allow us to make sense of a rich inflectional paradigm that is otherwise quite complex.

Before we move on, it might be useful to see where the current account stands with respect to other approaches. The combination of form identity and complementary distribution in the definiteness pattern has often been taken to support an analysis in terms of *movement*, where the same element can have two (or more) distinct positions in the structure. In the case of the definiteness pattern, plausible candidates for the moving element are the head noun (moving from its base position to D, as in the proposals of Delsing, 1993 and Embick and Noyer, 2001) and the definiteness morpheme (moving to N, as in the proposal of Embick and Marantz, 2007). Movement accounts typically rely on constraints on the different attachment sites of the moving element, and in particular on dependencies between the sites and the rest of the structure, to ensure the distributional pattern. As it turns out, the characterization of these constraints for the Danish definiteness data is quite complex (see Hankamer and Mikkelsen, 2005 for an extensive discussion of the problems that arise with one such proposal). Moreover, it is far from clear how such accounts can extend to capture the pattern of gender marking.[25] I will not try to argue that a movement account is in principle incapable of accounting for the Danish data. I will only point out that it might make sense to take the one component of movement that seems suitable for the data, namely the availability of multiple attachment sites, and avoid placing constraints on the attachment sites, leaving the distributional pattern to an independent mechanism. The current approach, as we saw above, does precisely that.

A different family of accounts attempts to provide the kind of independent distributional mechanism just mentioned. Such accounts are often referred to as *blocking* approaches, since they typically rely on multiple structures being generated and compared, with better structures blocking suboptimal ones from surfacing. For example, Börjars and Donohue (2000) offer an evaluation that prefers smaller structures to big-

[25] Analogous issues arise for movement accounts, such as Leu (2007), that start from the gender data. Characterizing the constraints for a neuter noun modified by a single adjective is easier for such an approach than it is for approaches that start from the definiteness pattern, but extending it to multiple adjectives is much less straightforward, as is the account of the definiteness data.

ger ones, and Hankamer and Mikkelsen (2002) propose a preference of words over phrases, along the lines of Poser (1992). For a blocking approach, the two definiteness possibilities in the Danish noun phrase are not directly related to each other. This simplifies the task of characterizing some syntactic aspects, but form identity becomes more difficult to capture.[26] Extending the blocking account to cover also the gender marking facts poses a further challenge.[27] Again, I will not try to argue that a blocking approach is in principle incapable of accounting for the Danish data, and only point out that adopting the distributional idea of comparing structures, and particularly the preference for smaller structures, might be a more attractive direction.[28]

The current proposal, then, is in a sense a hybrid of movement and blocking. From movement it adopts the idea of multiple attachment sites, but not the distributional idea of dependencies between these sites, and from the blocking approach it adopts the notion of comparing structures. To these it adds only the idea of licensing by c-command, which allows higher attachment sites to have an effect on low attachment sites, making it possible to account both for the form-identity effects and for the distribution, and making possible a unified account of definiteness marking, gender marking, and their interaction.

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[26]Despite the delegation of the distribution to an external mechanism, some structural aspects remain difficult to capture also for blocking accounts. See Hankamer and Mikkelsen (2005) and Embick and Marantz (2007) for discussion.

[27]Though see Börjars and Donohue (2000) for a proposal, where the absence of *-t* in definite noun phrases is obtained by specifying the *-t* forms as indefinite.

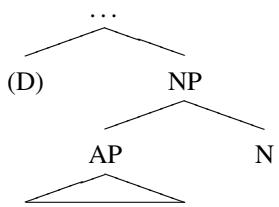
[28]Like other principles of structural economy, *MORPH has the appearance of a pragmatic principle of minimizing effort. As noted by Poser (1992), there are non-trivial challenges in applying such principles to morphological blocking phenomena. The challenges concern both the candidates that participate in the comparison and the fate of the losers. The candidates, Poser observes, have to be restricted in terms of size and relatedness. Thus, while *John is smarter than Tom* can be said to block **John is more smart than Tom* (though see Embick and Marantz, 2007 for reasons for skepticism), it does not seem to be relevant to the evaluation of *John's intelligence exceeds Tom's* or *John has more intelligence than Tom*. As to the fate of the losing candidates, Poser notes that pragmatic inferences usually result in relatively mild forms of infelicity; the losing candidates in blocking phenomena, on the other hand, are strictly ungrammatical. I believe that the problems that Poser notes are quite serious. The restriction of the set of candidates suggests that, if blocking is a real phenomenon at all, it cannot make use of anything beyond a very limited amount of semantic information. Non-local information, world knowledge, and complex inferences appear to be beyond the reach of the relevant computation. The strict ungrammaticality of the losers in blocking further argues for a grammatical source rather than a general-purpose pragmatic one. This seems to be in line with work by Fox (2000), Gajewski (2002), and Magri (2006) providing evidence for a modular architecture, where early stages in the computation have only a limited amount of semantic information. Turning to our licensors, a framework in which these morphemes are assigned meanings will have to explain what makes the computations in which these meanings are involved accessible for economy. On the other hand, if these morphemes are analyzed as meaningless pieces of structure, as Carlson proposes, the answer is straightforward: adding or removing a licensor can *never* affect meaning, so the relevant comparison involves no computation beyond counting licensors. Moreover, since no world knowledge or inference is involved, comparison can be done at an early stage of the computation, giving rise to actual ungrammaticality rather than pragmatic infelicity.

3 Icelandic

3.1 Changing the lower segment in the Danish NP

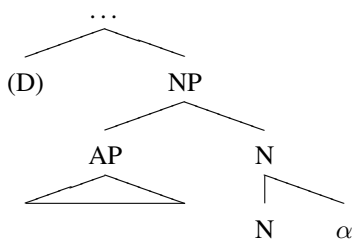
The account developed in the first part relied crucially on the labeling of the sister of AP as NP, rather than, say N, and yet, as we discussed in the context of (50), we did not have any reason to think that this labeling stems from a more general fact about language. I concluded my account of Danish with a promise to show that this is indeed an arbitrary choice, and that Icelandic will be Danish′, a variant of Danish in which this choice is made differently. Before presenting the actual paradigm for Icelandic nominal inflection, let us first consider in the abstract what the implications of a change of labeling would be. Here is what the tree would look like:

(51) Danish′ (= Icelandic)



In (51) the sister of AP is N and not NP. This means that an affix α that is adjoined to N, as in (52), will c-command AP. As before, only one segment of N dominates the affix, so the first category that dominates it will be NP. The difference is that NP now dominates AP. By definition, then, the affix c-commands AP and everything inside it.

(52)



Keeping everything else the same as before, the new structure will allow a definiteness suffix to license F_{DEF} on the adjective. This will make adjectival modification compatible with the definiteness suffix, in contrast to the pattern we have seen in Danish.[29] We also predict that any further affix that is adjoined to the definiteness suffix will c-command both the suffix and everything else within NP. Finally, we predict that *MORPH will rule out as redundant any further instance of definiteness, and that

[29]If licensors were to be interpreted directly, a compositionality issue would arise at this point. If licensors can be ignored and if definiteness can be attributed to the assignment of F_{DEF}, no such problem arises.

the same will apply to any marking that corresponds to the Danish *-t* marking in c-commanding definiteness. Let us now take a look at the facts.

3.2 Overview

Icelandic marks the following distinctions in its nominal morphology:

(53) a. Gender: Masc., Fem., Neut.
b. Case: Nom., Acc., Dat., Gen.
c. Number: Sg., Pl.
d. Definiteness: Def., Indef.

The distinctions are marked both on nouns and on adjectives, though in different ways, as we will shortly see. The morphological pattern is further complicated by various phonological processes, which we will discuss as we proceed, as well as by the existence of several inflectional paradigms, which I will ignore. Consider first the masculine singular paradigm:

(54) *hest* 'horse' (masc.)

	-DEF	+DEF
Nom.	hestur	hesturinn
Acc.	hest	hestinn
Dat.	hesti	hestinum
Gen.	hests	hestsins

The string *in* appears in all the definite forms and only there. No other string has this property, so let us tentatively assume that *in* is the form of the definiteness marker in Icelandic. This gives us the following preliminary morpheme decomposition:

(55) Masc. Sg.

	-DEF	+DEF
Nom.	-ur	-ur-in-n
Acc.	-	-in-n
Dat.	-i	-in-um
Gen.	-s	-s-in-s

We will revise these entries slightly in a moment, but for now notice that definiteness is positioned between two case-dependent markings. I will treat these as two separate affixes:

(56) a. $C1$ immediately follows the noun stem
b. $C2$ follows *-in* in the definite

Adjectival modification provides a hint as to what $C1$ and $C2$ are.

(57) *gul* + *hest* 'yellow horse' (masc.)

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gulur	hestur	guli	hesturinn
Acc.	gulan	hest	gula	hestinn
Dat.	gulum	hesti	gula	hestinum
Gen.	guls	hests	gula	hestsins

The suffix decomposition, still in preliminary form, is the following:

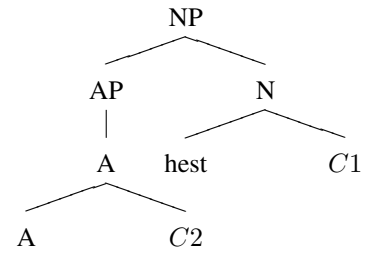
(58) *gul* + *hest* 'yellow horse' (masc.)

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	-ur	-ur	-i	-ur-in-n
Acc.	-an	-	-a	-in-n
Dat.	-um	-i	-a	-in-um
Gen.	-s	-s	-a	-s-in-s

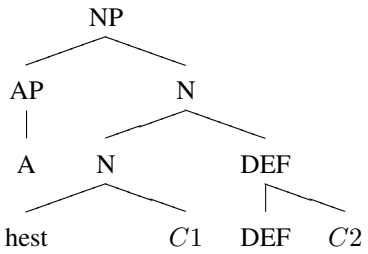
The adjectival stem in the indefinite is always followed by a case-dependent suffix. For the dative and genitive, the indefinite adjectival suffix is identical to $C2$, the affix that follows *-in* in the definite: *-um* in the dative and *-s* in the genitive. This makes $C2$ in these two cases similar to the Danish neuter marker *-t*, which appeared on the adjective in indefinite noun phrases and on the definite marker in definite noun phrases. Assuming our abstract discussion of Icelandic as Danish′, this behavior of $C2$ is exactly what we would expect from a counterpart of the Danish *-t* given the structures in (51) and (52). However, the identity of the adjectival ending and the post-definiteness ending does not seem to hold in the nominative and the accusative, the former having *-ur* for the adjective and *-n* for the post-definiteness suffix, and the latter having *-an* for the adjective and *-n* for the post-definiteness. Nonetheless, I will claim that at the relevant level of representation identity of the two endings holds also for these cases, and that the way in which the surface forms diverge from this pattern is predicted given independently needed phonological processes for Icelandic. In other words, I will argue that at the input to phonology the basic pattern is exactly as we expect given our structural claims regarding Danish′. The schematic generalization will be (59) and the structures for indefinite and definite noun phrases are as in (60).

(59) a. Indefinite: $[Adj + C2]\ [N + C1]$
b. Definite: $[Adj]\ [N + C1 + -in + C2]$

(60) a. Indefinite:



b. Definite:



As before, the actual implementation will involve the licensing of features by c-commanding affixes in a system where the output of the grammar is filtered by marking, which in turn is filtered by structural economy: SYNTAX≫MARK≫*MORPH.

Apart from the difference in phrase structure, Icelandic case markings will differ from Danish only in the variety of features and affixes. Both languages mark F_{DEF}, but while Danish had only one other feature to license, corresponding to the combination of neuter and singular, Icelandic will have a feature for any combination of gender, number, and case.[30] For each such combination α we will have a feature $F_{(\alpha,C1)}$ that appears on the noun and a feature $F_{(\alpha,C2)}$ that appears on the definiteness suffix and on all attributive adjectives. The various forms of the suffixes $C1$ and $C2$ license their respective features. As with Danish, we will require that the head noun, the definiteness suffix, and all attributive adjectives have agreeing features. In other words, the value of α for $F_{(\alpha,C1)}$ on the noun and $F_{(\alpha,C2)}$ on the definiteness suffix and on the adjectives must be the same. We state this by adding the following condition to SYNTAX:[31]

(61) For any combination $\alpha =< g, n, c >$ of gender, number, and case,
   a. the head noun has $F_{(\alpha,C1)}$ *iff* any modifying adjective, and the suffix *-in* if present, have $F_{(\alpha,C2)}$
   b. the $C1$ suffix for α licenses $F_{(\alpha,C1)}$
   c. the $C2$ suffix for α licenses $F_{(\alpha,C2)}$

[30] There are various cases of syncretism in the paradigm, and there are only 13 distinct suffixes and not the full 24 that might be expected. For ease of presentation I will treat the syncretism as accidental.

[31] As with Danish, it is the feature-assignment convention that provides the indirect link between licensors and semantic interpretation. See fn. 10 above.

In addition I assume that there are independent principles that tell us what the gender, number, and case of the head noun are. For example, in most cases it seems plausible that gender is determined in the lexicon, while case can be either assigned in syntax or read off the syntactic structure at a later stage. I will have nothing to say about the formulation of these principles. For current purposes it will be enough to say that they too are part of SYNTAX.

We can now use (61) to derive the correct forms for some noun phrases within our system. Take, for example, the indefinite masculine singular dative *gulum hesti* 'a yellow horse'. The feature combination is $\alpha =< masc., sg., dat. >$, which means that the adjective has $F_{(\alpha,C2)}$ and the noun has $F_{(\alpha,C1)}$. Table (62) shows the evaluation of some of the candidates.

(62)

	gul[F$_{(\alpha,C2)}$]	hest[F$_{(\alpha,C1)}$]	SYN.	MARK	*MORPH
	gul	hest		*!*	
	gul	hest-i		*!	*
	gul-um	hest		*!	*
☞	gul-um	hest-i			**

As with our discussion of the Danish cases, all the candidates are assumed to have the same features as indicated at the top of the table: the adjective has $F_{(\alpha,C2)}$ and the noun has $F_{(\alpha,C1)}$.[32] The first candidate, *gul hest*, has neither a $C1$ affix to license $F_{(\alpha,C1)}$ on the noun nor a $C2$ affix to license $F_{(\alpha,C2)}$ on the adjective, thus incurring two violations of MARK. The second candidate, *gul hest-i* satisfies MARK on the noun but violates it on the adjective. The third candidate, *gul-um hest* satisfies MARK on the adjective but not on the noun. Finally, *gul-um hest-i* satisfies MARK on both the adjective and the noun, and therefore wins.

And here are some of the candidates for the definite version of the same noun phrase, *gula hestinum* 'the yellow horse':

(63)

	gul[F$_{(\alpha,C2)}$]	hest[F$_{(\alpha,C1)}$]-in[F$_{(\alpha,C2)}$]	SYN.	MARK	*MORPH
	gul-um	hest-i-in		*!	**
	gul-um	hest-i-in-um			***!
☞	gul-a	hest-i-in-um			**

[32] As with Danish, it is unnecessary to consider candidates that do not have this property since those would violate SYNTAX. Assuming that the head noun is masculine, singular, and dative, assigning it a different F feature (or no feature at all) would be a violation of one of the independent feature assignment principles mentioned above. And since the head noun has this particular feature combination, not having the corresponding feature on the adjective will violate condition (61). This means that changing features in this way will never lead to a winning candidate, even if the result is more economical than the actual winner *gul-um hest-i*. So, for example, we can look at a candidate that has the same surface form as *gul hest-i* in the table, but in which the features are different in the following way: the noun has $F_{(\alpha,C1)}$ as before, but the adjective has no F feature at all. This candidate is more economical than *gul-um hest-i*, but the price of not assigning $F_{(\alpha,C2)}$ to the adjective is that (61a) is not satisfied, which in turn means that this new candidate incurs a fatal violation of SYNTAX.

An independent phonological rule causes the $C1 + DEF$ combination *i-in* to surface as *in* (cf. Orešnik, 1972). As before, I will assume that the candidates all satisfy (61). In particular, both the adjective and *-in* will be assumed to have $F_{(\alpha,C2)}$. I will also assume that the marking of definiteness works in the same way that it did in Danish, and focus only on the marking of gender, number, and case features.

The first candidate, *gul-um hest-i-in* violates MARK: the $F_{(\alpha,C2)}$ feature on the adjective is licensed by the appropriate $C2$ affix *-um*, but there is no such affix that could license $F_{(\alpha,C2)}$ on the definiteness suffix *-in*. In the second candidate, *gul-um hest-i-in-um*, all the F features are licensed, but there is redundancy: *-um* on the definiteness suffix c-commands the adjective, so there is no need for the instance of *-um* on the adjective. The more economical candidate *gul-a hest-i-in-um* is the winner.

Notice that the final vowel on the adjective is surprising given our discussion so far. The adjective stem is *gul*, and since all its features are licensed by *-um* on the definiteness suffix, we would expect that it would appear in its bare form, and that the winning candidate would be the impossible *gul hest-i-in-um*. We have seen something similar in Danish, where adjectives in definite noun phrases ended in *e* rather than surfacing in their base form. For current purposes it will suffice to treat these adjectival endings as default realizations of certain features. In the case of *gula*, I will assume that the final *a*, common to all three non-nominative cases, is the default realization of definiteness and non-nominative. For Danish I will assume that the final *e* is the default realization of definiteness. Endings that are default realizations of this kind will not be treated as proper affixes. In particular, they are not assigned their own nodes in syntax, and they do not count as violations of *MORPH. Other than that I will have nothing to say about these endings in this context.

3.3 Apparent exceptions: *-ur* and *-an*

We saw that the surface forms of the nominative and accusative suffixes looked like exceptions to (59): the surface form of the adjectival indefinite suffix was *-ur* in the nominative (*gul-ur*) and *-an* in the accusative (*gul-an*), but for both cases the post-definiteness suffix is *-n* (*hestur-in-n* and *hest-in-n*, respectively). Let us now see how these forms are derived. If we wish to maintain the position that the indefinite adjectival suffix and the post-definiteness suffix are identical even in these two cases, we must provide an explanation for the surface differences. As mentioned above, my claim will be that this explanation is phonological: the affix that surfaces as *-ur* after most adjectival stems surfaces as *-n* after the definiteness suffix *-in* because of the phonological context that *-in* provides. Similarly for the affix that surfaces as *-an*.

Even before getting into the phonological details of Icelandic, the claim that the *-n* form of the nominative and accusative suffixes after *-in* is phonologically determined makes a clear prediction: if we can find an adjectival stem that provides the same phonological

context, we predict that the case markers will surface as *-n* for both cases, rather than the normal *-ur* and *-an*. This prediction can be tested with adjectives that end with *in*, such as *heiðin* 'heathen' and *heppin* 'lucky'. Even though the *in* in these adjectives is unrelated to the definiteness suffix, their case ending in the indefinite is *-n* for both the nominative and the accusative (cf. Einarsson, 1945, p. 53). This confirms our prediction.

It will be helpful in some of what follows to have a better understanding of the phonological processes behind this change. There are three such processes here: *u*-epenthesis, *a*-deletion, and assimilation of *r* to *n*. The first process will require us to modify our suffix decomposition in (55) and (58). As has been argued by Orešnik (1972) (following a proposal by Anderson, 1969), the *u* in the suffix *-ur* is epenthetic. Orešnik provides a broad range of phenomena that argue against having *u* in the underlying form of the suffix. For example, stem-final *j* drops unless it is followed by a vowel. Thus, masculine singular forms of the adjective stem *miðj* 'in the middle' (Einarsson, 1945) surface as *miðj-an* in the accusative and *miðj-um* in the dative but as *miðs* in the genitive; crucially, the nominative form is *mið-ur*, suggesting that at some level of representation, the vowel *u* was absent. Other diagnostics include *v*-deletion and interaction with *u*-umlaut. Orešnik's diagnostics apply to occurrences of *-ur* post-nominally (our $C1$), post-adjectivally (our $C2$), as well as post-verbally (which we will ignore here).[33]

The diagnostics that show that *u* is epenthetic in *-ur* do not work for the accusative suffix *-an*. In fact, forms like *miðj-an*, mentioned above, suggest that *a* is present underlyingly. I will therefore tentatively conclude that *a* is deleted following *in* and before a word-final *n*. As far as I can tell, nothing in the remainder of this paper will bear on this question in any way.

The third process is the assimilation of *r* to *n* following *n* (cf. Anderson, 1974; Kenstowicz, 1994). We will see further instances of this assimilation pattern when we discuss the other parts of the paradigm. For deriving the nominative form, it is crucial that *u*-epenthesis (64a) be ordered after assimilation (64c). The three phonological rules are summarized below.

(64) a. $\emptyset \rightarrow\ u\ /C\_r\{C, \#\}$
b. $a \rightarrow \emptyset\ /Cin\_n\#$
c. $r \rightarrow\ n\ /n\_\_$

3.4 The rest of the paradigm

Let us now see how our system fares with respect to the other two genders as well as with the plural forms. First, the feminine singular (italics used for definiteness;

[33] Orešnik later revisited his original analysis and rejected it (Orešnik, 1978). This change does not seem to have resulted from new data or from a flaw in his earlier argument. Following subsequent work, and in particular Kiparsky (1984), I will continue to assume that the original analysis was correct.

boldface used for indefinite adjectival endings and for post-definiteness endings):

(65) *gul* + *kinn* 'yellow cheek' fem. sg.

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gul	kinn	gula	kinn-*in*
Acc.	gul-**a**	kinn	gulu	kinn-*in*-**a**
Dat.	gul-**ri**	kinn	gulu	kinn-*in*-**ni**
Gen.	gul-**rar**	kinn-ar	gulu	kinn-ar-*in*-**nar**

The indefinite adjectival endings and the post-definiteness endings are identical in the nominative and the accusative. In the dative and the genitive they are almost identical: the only difference is that where the indefinite adjectival ending begins with *r* the post-definiteness begins with *n*. We already know why this happens: the suffix-initial *r* assimilates to the *n* of the preceding definiteness suffix. As expected, this is a phonological effect, and the indefinite adjectival ending where the stem ends with *in* is similarly *n*-initial. Thus we are not surprised to find that the feminine singular forms of the adjective 'heathen' are *heiðin-ni* in the accusative and *heiðin-nar* in the genitive, rather than the usual *-ri* and *-rar* endings (Einarsson, 1945, p. 53).

For the neuter singular we will need one final phonological rule.

(66) *gul* + *barn* 'yellow child' neut. sg.

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gul-**t**	barn	gula	barn-i-**ð**
Acc.	gul-**t**	barn	gula	barn-i-**ð**
Dat.	gul-**u**	barn-i	gula	barn-i-*n*-**u**
Gen.	gul-**s**	barn-s	gula	barn-s-*in*-**s**

In the dative and the genitive, the indefinite adjectival ending is identical to the post-definiteness ending, as expected. In the nominative and accusative, however, we find the ending *-ið* instead of the predicted *-in-t*. As with the masculine nominative ending, what we want is a process of assimilation. I propose the following two rules, with (67a) preceding (67b):

(67) a. $t \rightarrow$ð $/Cin\_$
b. $n \rightarrow \emptyset$ /_ð#

As before, adjectives ending with *in* provide evidence that this is indeed a phonological process. And so for the adjective 'heathen' we find *heiðið* as the nominative and accusative forms of the neuter singular, and similarly for other adjectives ending with *in* (cf. Einarsson, 1945, p. 53).

Using the general morphological framework developed for Danish, as well as five independently motivated phonological rules for Icelandic, we have been able to predict

the entire correspondence between indefinite adjectival endings and post-definiteness endings in the singular part of the paradigm. As it turns out, we can already predict the correspondence in the plural part of the paradigm without further modification. Here are the forms:

(68) Masculine: *gul*+*hest*+Pl.

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gul-**ir**	hest-ar	gulu	hest-ar-*n*-**ir**
Acc.	gul-**a**	hest-a	gulu	hest-a-*n*-**a**
Dat.	gul-**um**	hest-um	gulu	hest-u-*n*-**um**
Gen.	gul-**ra**	hest-a	gulu	hest-a-*n*-**na**

(69) Feminine: *gul*+*kinn*+Pl.

	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gul-**ar**	kinn-ar	gulu	kinn-ar-*n*-**ar**
Acc.	gul-**ar**	kinn-ar	gulu	kinn-ar-*n*-**ar**
Dat.	gul-**um**	kinn-um	gulu	kinn-u-*n*-**um**
Gen.	gul-**ra**	kinn-a	gulu	kinn-a-*n*-**na**

(70) Neuter: *gul*+*barn*+Pl.

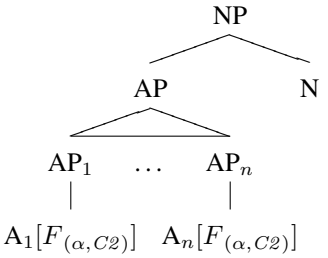
	-DEF		+DEF	
	Adj	*N*	Adj	*N*
Nom.	gul	börn	gulu	börn-*in*
Acc.	gul	börn	gulu	börn-*in*
Dat.	gul-**um**	börn-um	gulu	börn-u-*n*-**um**
Gen.	gul-**ra**	barn-a	gulu	barn-a-*n*-**na**

3.5 Further predictions

3.5.1 Multiple adjectives

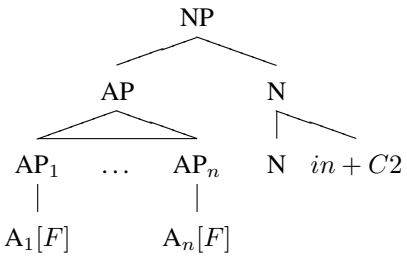
When a noun is modified by more than one adjective, each will have its own $F_{(\alpha, C2)}$, where α is determined by the gender, number, and case of the head noun. The schematic configuration is as follows:

(71)



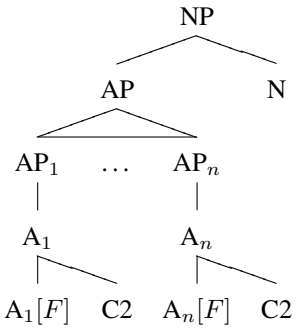
In order to avoid MARK violations, each occurrence of the feature $F_{(\alpha, C2)}$ will need to be licensed by a c-commanding $C2$ suffix of the appropriate kind. In the case of a definite noun phrase, the $C2$ attached to the definiteness suffix c-commands the adjectives, just like it did in the case of a single adjective. No other occurrence of $C2$ will be needed. By *MORPH, no other occurrence will be allowed, and we will predict the following (where $[F]$ is used as shorthand for $[F_{(\alpha, C2)}]$):

(72)



For an indefinite noun phrase, on the other hand, there is no independent occurrence of $C2$ that will c-command the adjectives. Consequently, we will expect $C2$ to attach within the adjectival complex. Moreover, since each A is dominated by an AP, no occurrence of $C2$ on one adjective will be able to license a feature on another adjective. We therefore predict that each adjective will require its own $C2$ affix:

(73)



Summing up, we predict a pattern of $C2$-spreading along the same lines as what we saw in Danish. That is, we predict that all attributive adjectives will appear without $C2$-affixes in the case of definite noun phrases and that all of them will appear with $C2$ in the case of indefinite noun phrases. This prediction is borne out:

(74) a. gul-an lat-an hest
yellow-$C2$ lazy-$C2$ horse
'a yellow, lazy horse'

b. gul-a lat-a hest-in-n
yellow lazy horse-DEF-$C2$
'the yellow, lazy horse'

3.5.2 The definite article

We saw that the structure of the Icelandic noun phrase makes it unnecessary to use a free definite article. Because of *MORPH, we expected that such a definite article will not be only unnecessary but actually impossible: we analyze definite articles as the adjunction of the definiteness suffix with a D morpheme, and the result is more complex than the suffix alone. Notice, however, that *MORPH was relevant only because we took it for granted that the definiteness suffix and the definite article make the same semantic contribution. Considerations of structural economy allow us to choose between candidates that are otherwise equally suitable. Once there are independent reasons to prefer one candidate over another, counting morphemes will not change this. We may expect, then, that if there is a D morpheme in Icelandic that can combine with the definiteness suffix to yield something that contributes more than just definiteness, the result will be grammatical. In such cases we predict that two further things will happen.

First, as in Danish, we may expect that the definiteness suffix on the article will make the post-nominal definiteness suffix superfluous (assuming that the definite article c-commands the noun). Due to *MORPH, we will expect that the article and the suffix cannot co-occur. Secondly, since the definiteness suffix has a $F_{(\alpha, C2)}$ feature to be licensed, we predict that a $C2$ suffix will be attached either on the definite article or above it. Furthermore, since $C2$ c-commands the definiteness suffix, and since the definiteness suffix c-commands the adjectives and the head noun, there will be no need for any other instances of $C2$ inside the noun phrase. We therefore predict that if the definite article is used, there will be $C2$ attached to it and that there will be no $C2$ below it.

Icelandic has a definite article that allows us to test these predictions. The article is sometimes described as belonging to a literary or elevated style, though some speakers, at least, have it as part of their grammar. The precise meaning of the Icelandic article is somewhat mysterious. In addition to definiteness it appears to add some emphatic or emotional value. Of more direct relevance to our concerns is its morphological composition. The base is *hin*, which I will analyze as bimorphemic: an *h* that roughly corresponds to the Danish *d*, and the definiteness suffix *-in*. As the tables in (75) show, the prediction that *-in* will have $C2$ suffixed onto it is borne out. Once the familiar set of phonological rules is taken into account, the entire paradigm is derived by attaching the $C2$ values that we have seen above to the base *h+in*.

(75) a. Singular:

	M.	F.	N.
Nom.	hin-**n**	hin	hi**ð**
Acc.	hin-**n**	hin-**a**	hi**ð**
Dat.	hin-**um**	hin-**ni**	hin-**u**
Gen.	hin-**s**	hin-**nar**	hin-**s**

b. Plural:

	M.	F.	N.
Nom.	hin-**ir**	hin-**ar**	hin
Acc.	hin-**a**	hin-**ar**	hin
Dat.	hin-**um**	hin-**um**	hin-**um**
Gen.	hin-**na**	hin-**na**	hin-**na**

And as predicted, if the definite article is used, the definiteness suffix cannot appear on the noun, and there are no occurrences of $C2$ either on the noun or on any modifying adjective:

(76) a. hinn góði hestur
the good horse

b. * hinn góði hestur-in-n
the good horse

c. * hinn góð-ur hestur
the good horse

4 Discussion

We are now in a position to return to the question we started with. The syntax-semantics mapping can be simplified if function morphemes are not interpreted and if meaning is assigned directly to operations. In our case, Icelandic noun phrases with adjectival modification have the surface bracketing [A [N-DEF]], while semantic considerations suggest the opposite bracketing. Worse, in both Icelandic and Danish post-nominal PPs do not trigger the definite article, and the order N-DEF PP poses a compositionality puzzle under standard assumptions.[34] If definiteness is assigned not to DEF but to the whole noun phrase, the question of compositionality does not arise. The concern was that accounting for the distribution of DEF would now be difficult. What our investigation taught us is that the opposite is true. By relegating the distribution of DEF to an external component we arrive at a simple, restrictive account that made correct predictions about a complex data pattern and its cross-linguistics variation.

Our account had the following components:

(77) a. Instances of the same element can have several distinct attachment sites
b. Economy rules out structures with more morphemes than needed
c. Affixes license features in a structurally defined domain that can be larger than the word or the sister of the affix

We used (77a) to account for the fact that the affixes expressing a particular feature have the same form regardless of where they appear within the phrase. For example,

[34] Similar problems, though with different examples, are familiar from the debate between Partee (1973) and Chomsky (1975). See Heim and Kratzer (1998, 82–3) for a discussion of the general problem and the significance of the Scandinavian facts.

the Danish singular neuter is expressed with *-t* on the definite article, on the definiteness suffix, and on any modifying adjective.

We used (77b) to derive the distribution of the various markers that we have been looking at. Marking requires that certain features be licensed by an appropriate affix. Sometimes it is possible for one affix to license a feature on more than one element. For example, *-t* on the definite article in Danish licenses the neuter singular feature both on the article and on any adjective modifying the noun. In such cases economy prevents the appearance of *-t* on any of the adjectives.

Each of the first two components of our account is shared with existing proposals in the literature: (77a) is part of the assumptions made by movement accounts, and (77b) comes from the blocking approach. In both cases there are typically additional assumptions that are made and that lead to difficulties, and we saw that it would be better to adopt the ideas of multiple attachment sites and of economy without those additional assumptions.

On their own, however, (77a) and (77b) were not able to derive the correct pattern. Our account relied on the ability of one affix to license features on more than one element. If, as is often assumed, affixes mark only their immediate environment (such as the word in which they appear, or their sister), multiple licensing by a single affix will never happen. For example, *-t* on the definite article will license the neuter on the article only, without having any effect on the adjectives. In order to derive the distribution we needed a less local notion of marking. We also saw that the domain in which an affix can license features should be defined structurally, so as to account for the differences between the definite article, which had both the adjectives and the noun in its domain, and the post-nominal suffix, which had only the noun. This notion of structurally-defined domains is expressed in (77c). Specifically, we saw that the adjunction-sensitive definition of c-command in May (1985) offers an adequate basis for the marking domains for the data that we have been looking at.

The three components in (77) provided the general framework for our account. For particular cases, certain additional assumptions had to be made. Those included assumptions about phrase structure and about labels for particular nodes; conditions on the assignment of various features; and phonological processes. I have tried to show that each of these assumptions is either independently motivated or at least makes further predictions within the current framework, which can then be tested.

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