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Much ado about nothing: features and zeroes in Germanic noun phrases*

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Abstract

In this paper, we argue for a severely restricted use of zero morphemes and against the use of features which are not strictly motivated by the distribution of the element with which the feature is assumed to be associated. We consider an element to have a particular value for a feature only if the element in question can occur exclusively in environments where that feature value is present on some other element and never in environments where that feature has another value. We apply this definition of features and feature values to noun phrases in Germanic, particularly to Dutch and Danish. We use Optimality Theory in conjunction with our approach to features and values and show that in this way, the distribution of features relating to definiteness, number and gender can be correctly predicted for these languages. We then consider the consequences this view of features has for the choice of an approach to morphology.

1 Economy, features and morphology

Most modern theories of syntax avow some principle of economy. The way in which such a principle is put into practice varies a fair bit between frameworks. We are mainly interested here in the aspect of economy which relates to zero morphemes. Our assumption is that a principle of economy should rule out zero elements unless any other approach to the same phenomenon would turn out to be

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more costly. We shall quickly consider here how the principles of economy as stated in two syntactic theories — Minimalism and Lexical-Functional Grammar — interact with zero morphology and then consider an approach formulated outside any particular theoretical framework.

1.1 Minimalism

Minimalism is a framework whose major goal is to reduce the theoretical machinery required to analyse language correctly (Chomsky 1995: especially Chapter 4). Radford (1997:515) describes Minimalism as:

> A theory of grammar (developed in Chomsky 1995: Chapter 4) whose core assumption is that grammars should be described in terms of the minimal set of theoretical and descriptive apparatus necessary.

The Principle of Economy is formulated as follows (Radford 1997:505):

> Economy Principle:
> A principle which requires that (all other things being equal) syntactic representations should contain as few constituents and syntactic derivations involve as few grammatical operations as possible.

Zero elements must be assumed to be part of the theoretical or descriptive machinery and should hence be used only if necessary to describe the grammar. The concept of 'necessary' is, of course, a difficult one here, since what is necessary will depend on the other assumptions made within the theory and how one ranks the economy of different aspects of the apparatus. The requirement that syntactic representations should contain as few constituents as possible also appears to militate against zero elements generally, but again, not if the principle of economy requires them as an alternative to a more costly solution.

In most work which claims to be 'within the spirit of the Minimalist Program', the syntactic relevance of a feature, such as agreement features (ϕ-features), tends automatically to generate a syntactic node in the structure describing the construction (see for instance the use of the G(ender) P(hrase) and Num(ber)

P(hrase) at the level of the clause in Coopmans (1994:76–78)). Chomsky (1995:275) does, however, state about the same kind of features within the noun phrase that '…taking Case or ϕ-features of N to be separate lexical categories with their own positions in phrase markers would cause no slight complication.'

However, our main interest here is in the status of putative features which appear not to have any overt manifestation. In approaches where a feature is assumed to create a syntactic projection, the projection will be there regardless of whether or not there is an overt filler. The head position can then often be filled by a zero element, representing a particular feature. Within Minimalism, a distinction is made between STRONG and WEAK features; whereas all features need to be checked for convergence at some stage of the derivation, only strong features must be checked before Spell-Out. In practice this means that strong features are those which force overt movement. Chomsky (1995:277) states that 'there is at least a tendency for ϕ-features to be overtly manifested when raising to a checking domain is overt rather than covert'. Even though it is clearly desirable for the theory to make strength correspond to morphological overtness, this position does not seem tenable. Instead, whether or not a feature is strong is decided on the basis of whether or not there is overt movement. Radford's (1997:226–230) discussion of the possibility in Early Modern English (EME) to invert non-auxiliary verbs with the subject and the failure in Modern Standard English (MSE) to do so may serve as an illustration. As illustrated by questions like (1a), EME permitted non-auxiliary verbs to invert with the subject to form a question, but as the ungrammaticality of (1b) shows MSE does not allow this.

(1) a. Speakest though in sober meaning?
(Orlando, *As you like it*, V.ii, from Radford (1997:225))
b. *Speak you the truth?

Radford aims to explain this in terms of EME non-auxiliary verbs carrying strong agreement features which force overt movement to I, whereas the same features in

MSE are assumed to be weak. This difference in strength is then linked to the slightly richer present tense agreement morphology found in EME; Radford implies that EME had four agreement forms in the present tense — the *-s* form, the form without overt marking and two other forms *-st* (2SG) and *-th* (3SG) — as opposed to the two present tense forms of MSE. The paradigm in the past tense appears to have been equally poor in the two stages of the language. However, in EME, it is not appropriate to consider *-s* and the *-th* two separate inflections in this way.[1] Rather, EME had three forms in present tense against MSE's two forms. It is then still true to say that the inflectional system has weakened, and one might want to link this with the strength of the agreement features. However, as a guideline for linking the strength of a feature with overt morphology it is not helpful; if the presence of two distinct forms means a weak feature and the use of three distinct forms means a strong feature it is still the case that the relation between strength and overtness is tenuous.

If we compare now with another Germanic language, like Swedish, where non-auxiliary verbs still invert with the subject, as in (2), we find that the relation becomes even less obvious, given that Swedish finite verbs show no agreement morphology at all.

(2) Talar du sanning? Swedish
speak you truth
'Are you speaking the truth?'

1 We are grateful to Richard Hogg and Linda van Bergen for their help with older forms of English. Richard Hogg pointed out the following quote from Burnley (1992:200) :

> Verbal endings in *-es* of the third-person singular present tense can be found in London texts from the early fourteenth century, but seem to have been avoided by writers before Elizabethan times. They then begin to displace the earlier *-eth* ending. Queen Elizabeth herself used them [*-es*: KEB/MD] increasingly in her letters; nevertheless the words *hath* and *doth* are usually written in this [*-th* : KEB/MD] form, and may have preserved the pronunciation longer. Appearances may, however, be deceptive, since Richard Hodges comments in his *A Special Help to Orthographie* (1643) that in his time, although *-eth* was written, this was pronounced [əs], at least in multisyllabic words.

In an analysis similar to that of Radford (1997) discussed above, the fact that non-auxiliary verbs still move into I, would imply that they have strong agreement features, even though there is no overt agreement morphology at all on verbs (for alternative analyses, see for instance Holmberg and Platzack (1995) and references there).

Also, in spite of what Radford says about the correspondence between strength and morphological overtness in relation to agreement, in a later discussion about *wh*-questions (1997:267ff) , an 'affix Q' is assumed to fill the C position. It is the fact that this (non-overt) affix is strong which forces I-to-C movement in *wh*-questions. However, in questions involving *wh*-elements in subject position, the *wh*-element is assumed not to have moved out of its subject position, and since the verb is on its right, this means no I-to-C movement can have taken place. The lack of verb movement in this case is assumed to be due to the fact 'that Q is only a strong affix when the CP headed by Q has an interrogative operator-specifier of its own.' (Radford 1997:293). Hence we have here a phonologically null affix which can be weak **or** strong.

The feeling appears then to exist within the Minimalist Program that the strength of a feature should correspond to overt marking, but still overt marking is not considered to be of crucial importance. In the most advanced version of Minimalism (Chomsky 1995: Chapter 4) a distinction is made between 'Morphology', which deals with the abstract features with syntactic or semantic relevance, and 'morphology' which deals with actual phonological exponents of abstract features, and of these, Morphology is given the prominent role; as Ramchand (1997:4) puts it: 'For Chomsky, surface effects and surface 'm'orphology are largely irrelevant and uninteresting.'

Even though this discussion of the notion of economy within Minimalism as it relates to morphological zeroes and features is inconclusive and the practice

seems to vary from the theory, the presence of zero elements in morphology to represent syntactically relevant feature is certainly not strongly militated against.

1.2 Lexical-Functional Grammar

If we turn now to Lexical-Functional Grammar (LFG), we find a framework based on X-bar theory (albeit a slightly unorthodox version), recognising the functional categories C, I and D (Bresnan 1995: §5.2.1), so in this sense the two frameworks are quite similar. LFG also has a principle of Economy of Expression, but in interaction with other principles, it produces results quite different from those in Minimalism.

The Principle of Economy of Expression is formulated as follows (Bresnan 1995:13):

> Economy of expression:
> all c-structure nodes are optional, and are not used unless required for expressivity or completeness

All nodes in the syntactic representation as generated by phrase structure rules are then optional, and are only present if there is some other principle (expressivity or completeness) that requires them. From this follows that many nodes which dominate zero elements in Minimalist analyses are simply not present in an LFG analysis.

In addition to this, LFG has adopted a Principle of Lexical Integrity (Bresnan 1995):

> Lexical integrity:
> morphologically complete words are leaves of the c-structure tree and each leaf belongs to one and only one c-structure node

This means that features like the agreement features discussed above do not have their own syntactic structure unless they can be shown to have independent syntactic status. Even though neither of these principles totally rules out all uses of morphological zeroes, together they certainly reduce the number of possible

instances of phonologically null elements and make sure that they will not project syntactic structure. Furthermore, if we assume that LFG works with a feature-based realisational theory of morphology (e.g. Anderson (1992) or Beard (1995)), rather than an incremental one, — and this does appear the most obvious choice — then zero morphemes will not occur.

1.3 Traditional analyses

Zero elements do not only occur in theoretical analyses where the assumptions underlying the theoretical framework forces the use of such elements. Many theory independent analyses assume that a phonologically zero morpheme may exist when it forms part of a paradigm and contrasts with phonologically overt members. Plank and Schellinger (1997) is an example of such an approach.[2] In their discussion of Danish noun phrases, they give the glosses in (3) (Plank and Schellinger 1997:254–5).[3]

(3) a. Ø stor-e elefant-er (P&S (4a))
INDEF.PL big-PL elephant-PL
'big elephants'

b. en stor-Ø elefant (P&S (3a))
INDEF.SG.C big-INDEF.SG.C elephant
'a big elephant'

c. Elefant-en er stor-Ø. (P&S (1a))
elephant-DEF.SG.C is big-SG.C
'The elephant is big.'

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2 Though it should be pointed out here that Plank and Schellinger (1997) do not set out to discuss or motivate the use of zero morphemes, but they do make use of them in their examples and glossings.

3 In all essential aspects, we follow Plank and Schellinger's (1997) glossings here, but we use different abbreviations to fit in with the ones used throughout this article:

DEF/D	definite	INDEF	indefinite
SG	singular	PL	plural
NT	neuter	C	common
M	masculine	N	number
G	gender	ART	article
NOM	nominative	FIN	finite
PPART	past participle		

The glossing in (3) represents a traditional way of viewing the data and while the authors may not have set out to impinge on theoretical morphology and its view of zero morphemes, it still leads to conceptual problems. The main one of these is the fact that there are three elements Ø in Danish which serve three different functions and which partly belong to different categories. This is illustrated in (4), based on (3).

(4) Ø: article INDEF.PL (COMMON OR NEUTER)
attributive adjectival agreement INDEF.SG.COMMON
adjectival agreement SG.COMMON (DEF OR INDEF)

In a theoretical and more formal approach to the use of features in Danish noun phrases, this use of zero elements should be avoided under any approach to economy. We will now turn to a radical approach to feature and form economy.

2 The lack of features in part of a paradigm

If an element — be it a bound morpheme or an independent word — co-occurs only with elements bearing certain values for certain features, then we would want to say that the element in question is also marked for those feature values. Let us consider now a system in which we have an element Ω and two features α and β — with the values 'A' or 'a' and 'B' or 'b', respectively. We consider first the distribution in (5).

(5)

		β	
		B	b
α	A	Ω	
	a		

If the element Ω can occur only with elements with the feature values A and B, and never with elements with feature value a or b, then we can say that Ω is marked for the feature values A and B, and this predicts correctly that any construction in which Ω co-occurs with an element marked for a or b will be ungrammatical. We then get the feature matrix in (6) for Ω (5).

(6) $\begin{bmatrix} \alpha & A \\ \beta & B \end{bmatrix}$

Consider now the distributions in (7) and (8).

(7)

		β	
		B	b
α	A	Ω	
	a	Ω	

(8)

		β	
		B	b
α	A	Ω	Ω
	a		

In (7), Ω can co-occur with B, but not with b, and can hence be assumed to have the value B for the feature β. The same element can, however, occur both in A and a environments. A number of options suggest themselves and can indeed be found in the literature. One option would be to say that there are two elements Ω in (7), one with the value [α A] and one with the value [α a]; another one would be to say that either a or A is marked by a zero morpheme. Here we will take a different approach and assume that Ω does not have a value for the feature α in (7). With a similar approach to Ω in (8) we get the two feature matrices in (7') and (8') where we use *u* for 'unmarked'. This underspecification view is also taken of verb forms in Andrews (1990) and of German noun phrase elements in Blevins (1995), compare also with Bresnan's (In press) approach to negation in dialects of English.

(7') $\begin{bmatrix} \alpha & u \\ \beta & B \end{bmatrix}$

(8') $\begin{bmatrix} \alpha & A \\ \beta & u \end{bmatrix}$

Let us consider now the distribution in (9).

(9)

		β	
		B	b
α	A		Ω
	a	Ω	Ω

Under the approach we are proposing here, Ω could not be marked for either value of α and β in (9) since it can occur in environments with either value for both features. In situations like these it is especially tempting to assume homonymy or a zero morpheme. However, in the radical approach we are proposing here we will assume that there is only one element Ω in (9) and that it is unspecified for both features and hence has the feature matrix in (9').

(9') $\begin{bmatrix} \alpha & u \\ \beta & u \end{bmatrix}$

If Ω in (9) has the specification in (9'), one question arises: what prevents Ω from occurring in the unshaded cell [A,B] in (9)? If it really is unspecified for the two features, there may appear to be nothing to stop it from doing so. Here we appeal to the well-motivated Morphological Blocking Principle. We quote here from the LFG approach taken by Andrews (1990), but see also the blocking conditions stated in terms of Head-driven Phrase Structure Grammar by Blevins (1995), the notion of narrowness as defined by Stump (1997) and an Optimality Theoretical account of similar phenomena provided in Bresnan (In press).

> Morphological Blocking Principle (within the framework of LFG):
> If a lexical item L appears in a c-structure position P corresponding to an f-structure F, and there is another lexical item L' whose specifications are subsumed by those of L but subsume those of F, then the structure is blocked (Andrews 1990: 507)

Informally we can say that the most highly specified element which can be used for a specific purpose will be used. In the case of the non-shaded cell in (9), we can assume that there is an element which can fill that cell and only that cell (except in defective paradigms), and which is hence marked as in (10).

(10) $\begin{bmatrix} \alpha & A \\ \beta & B \end{bmatrix}$

Given the Morphological Blocking Principle, this element will always be chosen to fill this cell in preference to the one with the specification in (9'), despite the fact that the feature values defined by (9) are not unsuitable for this cell give their

underspecifaction. This approach to features and values will be applied to noun phrase internal feature distribution mainly in Dutch and Danish, but we will also comment on other Germanic languages. Our aim is to show that the approach we have chosen here can make accurate predictions and may lead to some rather surprising results. Our aim is not to provide a complete analysis of all aspects of noun phrases in the two languages.

3 Optimality Theory

In the sections which follow, we will use Optimality Theory (OT) to encode our view of feature distribution and we will therefore provide a brief overview here of how OT is used in syntax. Optimality Theory is in fact a meta-theory rather than a theory in the sense that you need a theory before you can use it. Within syntactic theory, OT has been used extensively with two such fundamentally different approaches as Minimalism and Lexical-Functional Grammar.

The assumption is that there is a mechanism GEN which takes an INPUT and generates a candidate set. There is then a universal set of constraints, whose ranking determines which of the candidates is optimal, i.e. grammatical. The exact shape of GEN will vary depending on the theoretical framework with which OT is used. It is, however, usually assumed to consist of at least some version of X-bar syntax. In fact, given that under standard assumptions all constraints are violable, anything that is thought to be absolutely universally inviolable must form part of GEN. Assumptions about the form which the INPUT should take also varies between theoretical frameworks; in LFG it is assumed to be the f-structure (Bresnan 1997a:8–9), within Minimalism the assumptions vary slightly, but for a verb it is assumed to be the lexical head with its argument structure and specifications of tense and aspect (Grimshaw 1997:375–6). In the simple examples we shall deal with here, we will just use lexical elements and the features associated with those

elements or the phrase the elements form. The candidate set is assumed in principle to be infinite, but can be constrained by increasing GEN's power. There is then a mechanism EVAL which selects from the candidate set the optimal form. It does so by checking each candidate against the ranked set of constraints. In OT, the set of constraints is assumed to be universal, a specific grammar is then a particular ranking of the constraints. Two ranking systems form different grammars if there is some constraint which is ranked differently in the two systems. The crucial difference between the traditional notion of constraint and the term as it is used in OT is that the latter assumes that all constraints are violable. In particular, a candidate will violate a constraint if the consequence of the violation is that a higher ranked constraint is satisfied. Some of the commonly used constraints which will be of importance to our analysis are (cf Prince and Smolensky (1993), Grimshaw (1997) and Bresnan (1997a)):

PARSE	features present in the INPUT must have identical values in OUTPUT
FILL	features present in the OUTPUT must have some value compatible with the INPUT
AVOID	avoid structure

The first two of these belong to a set of what is usually referred to as FAITHFULLNESS constraints. There will thus be a tension between PARSE and AVOID; PARSE requires features from the INPUT to have some instantiation in the output, but this instantion will occur in the form of either morphological or syntactic structure, both of which are militated against by AVOID. A highly agreeing language would then have PARSE ranked higher than AVOID.

We imagine further that the scope of PARSE may vary, or put differently, that there are two types of features, resulting in the possibility that, for some features, in order to satisfy PARSE the feature should be represented on as many of the elements within the phrase as possible, and that for other features, PARSE is satisfied as long as the feature is manifested once within the phrase. The two types

of features can be referred to as agreement features, FEATURE$_{ag}$, and phrasal features, FEATURE$_{ph}$, respectively. It is then possible that within one particular phrase type in a language we can find examples of both types of features. This would be the case in a language in which, say, determiners and any modifying elements ideally must show overt agreement with the head noun for number and gender, but where definiteness need only be marked once in the phrase. In the case of FEATURE$_{ph}$, AVOID would militate against more than one instantiation of the feature, unless such an instantiation satisfied some other constraint, for instance if the element instantiating FEATURE$_{ph}$ also instantiated FEATURE$_{ag}$ and therefore satisfied PARSE for that feature. A second "pure" instantiation of FEATURE$_{ph}$, on the other hand, would be dispreferred. We shall see that this kind of distinction does indeed exist within the constructions with which we are concerned in this article.

AVOID may actually consist of two different constraints; AVOID-SYNT and AVOID-MORPH, since there are languages which require that morphological structure be as limited as possible even at the cost of introducing syntactic structure. We could think of isolating languages this way. Fusional or agglutinative languages, on the other hand, would rank AVOID-SYNT highly and in order to satisfy this constraint would permit violations of AVOID-MORPH.[4] We shall see examples where this distinction needs to be made in the languages dealt with here. We will also introduce some more specific constraints.

4 This would, of course, not hold in a theory within which all syntactically relevant features are assumed to generate a syntactic projection even if the feature is manifested by what one would normally refer to as a morphological element.

4 Dutch

Dutch, like many Western Germanic languages, displays gender and number agreement within the NP, both on determiners and prenominal modifiers. Here we will consider articles and adjectives, both attributive and predicative.

4.1 Articles

There are two forms of the definite articles in Dutch, *de* and *het*. The distribution of the two may be gauged by examining the data in (11). We gloss both *de* and *het* simply as DEF.ART for the moment, to avoid pre-judging the data. The gender C 'common' or NT 'neuter' is indicated in each case. We have used parentheses around features for which there is no overt marking, but where the element can be assumed to have inherent marking for this feature; for instance *kat* is a common gender singular noun, but does not show overt marking for either of these two features, *katten*, on the other hand, has overt marking for plural.

(11) a. de kat Dutch
DEF.ART cat(C.SG)
'the cat'

b. het paard
DEF.ART horse(NT.SG)
'the horse'

c. de katten
DEF.ART cat(C).PL
'the cats'

d. de paarden
DEF.ART horse(NT).PL
'the horses'

Based on the phrases in (11), it is clear that *de* is used in a wider range of contexts than *het*. We can see that *de* appears not only with singular common nouns, but with all plural nouns regardless of their gender. The other article, *het*, is used only in combination with nouns which are singular and neuter. We can summarise the data concerning the two definite articles in Dutch as in (12):

(12)

	definite	
	common	neuter
SG	*de*	*het*
PL	*de*	*de*

Following the approach defined in section 2, we can infer from the table in (12) that the two different articles represent the following sets of features:

(13) a. *het* $\begin{bmatrix} \text{DEF} & + \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$ b. *de* $\begin{bmatrix} \text{DEF} & + \end{bmatrix}$

As a result of the Morphological Blocking Principle, *het* will then be used in singular neuter definite environments, since this is the most specific form which can fill that cell. The other article, *de*, is the 'elsewhere' element; it can be used with both gender values and both number values because it does not have any feature specifications which clash with either of these features values. In terms of Optimality Theory, *de* does not PARSE the gender and number features of the input, but on the other hand it is not itself marked for any feature which would bring about a FILL violation.

We can now construct the OT tableaux, using the constraints FILL, PARSE and AVOID. Definiteness is a phrasal feature in Dutch, so that PARSE(D) will be satisfied as long as one element in the phrase manifests the feature. Gender and number, on the other hand, are both agreement features in Dutch and hence any lexical element which does not carry the feature involves a PARSE violation. The nouns themselves, even though they have no overt marking for gender, given the distributional criteria we have used here to establish the presence of a particular feature value, nouns must be assumed to carry marking for gender. Similarly, a singular count noun can only occur in singular environments and hence are assumed to have the feature [NUM *sg*]. We shall assume that a violation of a FEATURE$_{ph}$ is more offensive than a violation of a FEATURE$_{ag}$ so that PARSE(D$_{ph}$) ranks higher than the other PARSE constraints. This seems reasonable, since a

violation of PARSE(FEATURE$_{ph}$) would leave the phrase totally unmarked for that feature, whereas in a complex phrase, one violation of PARSE(FEATURE$_{ag}$) is likely to leave the phrase with some marking for that feature on another constituent. PARSE(FEATURE$_{ag}$) can really be thought of as one constraint — in this case PARSE(G$_{ag}$, D$_{ag}$) — but for ease of display, we indicate for PARSE whether the offending feature is G(ender) or N(umber). Similarly, there is only one FILL constraint — FILL(D, N, G) —, but for purely expository reasons we set it out in three columns, not separated by a vertical line.

(14)

	FILL			PARSE			AVOID
cat(C), DEF, SG	D	G	N	D$_{ph}$	G$_{ag}$	N$_{ag}$	
de kat ☚					*	*	*
kat				*!			
het kat		*!			*		*

The noun in all these examples is correctly marked for N and G and hence it incurs neither a FILL nor a PARSE violation with respect to those features. It is not marked for DEF, but given that DEF is a phrasal, rather than agreement, feature, there will not be a PARSE violation as long as the candidate contains some other element marked as [DEF +]. The determiner in the first candidate is not marked for any feature except definiteness, for which it has the correct value, and hence incurs no FILL violation. Definiteness is parsed once in the first candidate, and there is no PARSE(D$_{ph}$) violation. *De* is not marked for G and N and therefore incurs two PARSE(FEATURE$_{ag}$) violations. The second candidate violates PARSE(D$_{ph}$), since the candidate phrase is completely unmarked for this feature. Given that D is a phrasal feature, this violation is fatal. The third candidate incurs a FILL violation and an accompanying PARSE violation, since the article has the value [GDR *nt*], it is however correctly specified for N. Tableau (14) shows that FILL ranks above PARSE, i.e. it is worse for a candidate to be marked for a feature which is incompatible with the INPUT feature values than for a candidate not to parse features

present in the INPUT. If this was not the ranking, the third candidate, *het kat*, would be wrongly predicted to be the optimal candidate. It follows from our approach here that a FILL(FEATURE$_{ag}$) violation is always paralleled by a PARSE(FEATURE$_{ag}$) violation, if an element is marked for a value other than that given in the input, then it does not parse that feature correctly, and for an agreement feature, every lexical element is required to parse the feature.

In (14), we see how *de kat* is the optimal output not because it parses all the relevant features, but because the closest competitors either have more serious PARSE violations — as with *kat* — or violate FILL in that the output has some feature value which is incompatible with the features of the INPUT — in the case of *het kat*, the offending feature value is NT. The Tableau in (14) then captures the "elsewhere status" of *de*, it is optimal because there is no more specific form which does parse the relevant features. The Tableau in (14) also illustrates how a form with more structure — i.e. with AVOID violations — can still be optimal since it is the violation of AVOID which allows the candidate to satisfy the PARSE constraint.

(15)

	FILL			PARSE			AVOID
horse(NT), DEF, SG	D	G	N	D$_{ph}$	G$_{ag}$	N$_{ag}$	
de paard					*	*!	*
paard				*!			
het paard ☞							*

There are no FILL violations in (15) since the candidates are either correctly specified, or underspecified for the relevant features. The first candidate does not violate PARSE(D$_{ph}$), but does incur two violations of PARSE(G$_{ag}$, N$_{ag}$), since *de* is unspecified for gender and number.[5] The second candidate fatally violates the PARSE(D$_{ph}$) constraint. In (15), *het paard* is optimal since *het* contains realisations

5 The exclamation mark which marks failure will be placed at the far right under FILL and PARSE(FEATURE$_{ag}$), rather by the offending feature, since we are viewing FILL and PARSE(FEATURE$_{ag}$) as just two constraints. The separate columns for these features are there for expository clarity only.

of all the relevant features, and hence shows no violation of PARSE. This is then a representation within OT of the workings of morphological blocking; *het* is that specific form which prevents the general *de* from being optimal.

(16)

cat(C), DEF, PL	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
de katten ☞					*	*	* *
katten				*!			*
het katten		*	*!		*	*	**

In (16), *de katten* does not violate FILL and correctly parses D_{ph} through the article. It incurs two PARSE(G_{ag}, N_{ag}) violations due to the drastic underspecification of *de*, but it is the optimal candidate because there is no more specific form that does not incur FILL violations. Note that the same candidate incurs two violations of AVOID since we have extra syntactic structure in the form of the determiner, and extra morphological structure through the ending on the noun. The final candidate in (16) violates FILL for both G and N — both violations are caused by the article. Since both N and G are agreement features and must be marked on every element in a candidate, there are corresponding PARSE violations. Tableau (16) illustrates again how a less specific candidate with more structure may still be optimal because there is no more specific candidate which does not violate FILL, nor is there a form with less structure which satisfies PARSE as well.

(17)

horse(NT), DEF, PL	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
de paarden ☞					*	*	* *
paarden				*!	*		*
het paarden			*!		*		*

In (17), *de* as usual fails to parse the agreement features, but is optimal because the competitors incur either a FILL violation — *het* in the third candidate is specified as [NUM *sg*] — or a violation of PARSE.

We turn now to indefinite noun phrases. The singular indefinite article in Dutch is *een*, regardless of gender and it would hence have the specification in (18).

(18) *een* $\begin{bmatrix} \text{DEF} & \pm \\ \text{NUM} & sg \end{bmatrix}$

With plural count nouns (and singular mass nouns) Dutch does not appear to require a syntactic determiner in all environments, but there are a couple of elements which correspond to the English unstressed *some* [sm̩], e.g. *wat* (lit. 'what') and *een paar* (lit. 'a pair'). The choice between these elements is determined by the properties of the noun; mass nouns for instance can only occur with *wat*. We assume that there is a semantic difference between the use of noun phrases like *studenten* and *boeken* on the one hand and *een paar studenten* and *wat boeken* on the other. The distinction between the parallel phrases in English is referred to as a difference between 'referring' use (with *some*) and descriptive use (without any determiner) by Quirk et al (1985:274–6). A similar distinction is made by Geerts et al (1984:113–120) in their terms 'onbepaald' (indefinite) and 'categoriaal' (categorial), even though they do not discuss any plural indefinite determiners. We shall assume that of the two kinds, only the former is fully referential and parallel to the kind of noun phrase we have been dealing with so far. We will hence assume that Dutch has an overt indefinite determiner in full referential plural noun phrases, just like Hawkins (1978: Chapter 4) consistently uses *some* in his examples of plural indefinite noun phrases. There may be arguments for assuming that 'descriptive' noun phrases like predicatively used noun phrases, are not "full noun phrases" in the sense that the constraints on their functional and syntactic structure are different and such analyses have indeed been proposed for Scandinavian noun phrases by e.g. Delsing (1993) and Holmberg (1992). Once the subtle distinctions between these uses have been defined, the INPUT can contain information referring to the difference between fully referential noun phrases, requiring a determiner, and

the descriptive noun phrases. Examples which force a referring reading, and hence do not allow the absence of a determiner are provided in (19).

(19) a. Na de lezing heb ik — Dutch
after the lecture have.1SG I
?studenten / OKeen paar studenten gesproken.
students some students speak.PPART
'After the lecture I spoke to some students.'

b. Ik heb net ?boeken / wat boeken gekocht.
I have.1SG just books some books buy.PPART
'I have just bought some books.'

As in the case of the English [sm̩], *wat* and even more clearly *een paar* do have some number restrictions. If in (19) the speaker addressed a group of several hundreds of students, *een paar* could not be used. We can assume then that in indefinite plurals in Dutch, the INPUT must always be associated with some vague indication of number, corresponding to the distinctions made by the different indefinite plural determiners. Disregarding the numeral feature, a determiner like *een paar* would have the feature specification in (20).

(20) *een paar* $\begin{bmatrix} \text{DEF} & \pm \\ \text{NUM} & pl \end{bmatrix}$

Assuming that both singular and plural indefinite noun phrases in Dutch require a determiner in order to function as full referential noun phrases, we get the tableaux in (21) and (22).

(21)

cat(C), INDEF, SG	FILL			PARSE			AVOID
	D	G	N	D*ph*	G*ag*	N*ag*	
kat				*!			
een kat ☚					*		*
de kat	*!			*	*	*	*

(22)

cat(C), INDEF, PL	FILL			PARSE			AVOID
	D	G	N	D*ph*	G*ag*	N*ag*	
kat			*!	*		*	
katten				*!			*
een katten			*!		*	*	**
een paar katten ☚					*		**

In Tableau (21), even though *een* fails to parse gender it still forms part of the optimal candidate since there is no alternative element which can contribute the crucial phrasal feature without violating the more highly ranked FILL. In (22), *kat* and *een katten* are sub-optimal because they both cause fatal FILL violations. *Katten* incurs no FILL violation, but unlike *een paar katten*, it fails to parse D_{ph}.

4.2 Adjectives

In Dutch, the adjectives, like the determiners, can appear in two distinct forms: with or without a final schwa (*-e* orthographically). The distribution of these forms is illustrated in (23), where we do not gloss the adjectival ending in terms of particular features in order not to prejudge the issue.

(23) a. een zwart-e kat
INDEF.ART black-ə cat(C.SG)
'a black cat'

b. een zwart paard
INDEF.ART black horse(NT.SG)
'a black horse'

c. de zwarte kat
DEF.ART black-ə cat(C.SG)
'the black cat'

d. het zwarte paard
DEF.SG.NEUT.ART black-ə horse(NT.SG)
'the black horse'

e. de zwarte katten / paarden
DEF.ART black-ə cat(C)PL horse(NT)PL
'the black cats / horses'

f. een paar zwarte katten / paarden
some black-ə kat(C).PL horse(NT).PL
'some black cats / horses'

As with the definite article *de*, we cannot simply assign one group of features to the forms with schwa. As the table in (24) shows, the schwa-less form is much more restricted in its distribution.

(24)

	indefinite		definite	
	common	neuter	common	neuter
SG	*zwarte*	*zwart*	*zwarte*	*zwarte*
PL	*zwarte*	*zwarte*	*zwarte*	*zwarte*

The form with the schwa can occur in both definite and indefinite environments, with both common and neuter nominals and both with plural and singular ones. The schwa-less form, on the other hand, occurs only with singular indefinite neuter nouns. Given our assumptions, we can conclude from this distribution that the two forms of an adjective have the feature values in (25), where we continue to use ZWART as an example.

(25) a. *zwart* $\begin{bmatrix} \text{DEF} & - \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$ b. *zwarte* [ ]

The fact that the phonologically and presumably therefore also morphologically less marked form *zwart*, is the more marked form in terms of features is an interesting fact to which we will return in section 6. The values in (25) give the tableaux in (26) to (30).

(26)

black horse(NT), DEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
zwart paard	*!			*			
zwarte paard				*!	*	*	*
het zwart paard	*!						*
de zwart paard	*!				*	*	*
het zwarte paard ☞					*	*	**
de zwarte paard					**	**!	**

Tableau (26) shows again that AVOID does indeed rank below the other two constraints in Dutch, since the optimal candidate *het zwarte paard* incurs two violations (one morphological and one syntactic), and there are candidates with fewer AVOID violations. However, these violations of AVOID are necessary in order to satisfy the two higher ranked constraints, given the material available in the language. Any candidate involving *zwart* will incur a FILL(D) violation since it has the feature value [DEF –]. Given that D is a phrasal feature, whether or not there is a corresponding PARSE(D_{ph}) violation depends on whether the candidate contains another element which has the appropriate value. Candidates containing highly

underspecified elements, like *de* and *zwarte*, do not incur FILL violations, but do cause multiple violations of PARSE(G_{ag}, N_{ag}). Since there is a compatible form of the determiner which is more specific than *de*, this will be part of the optimal candidate. However, there is no adjectival form which satisfies PARSE(G_{ag}, N_{ag}) without violating the higher ranked PARSE(D_{ph}), and hence the underspecified form *zwarte* is used.

(27)

black cat(C), DEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
zwart kat	*	*!		*	*		
zwarte kat				*	*	*!	*
de zwarte kat ☚					**	**	**
het zwarte kat		*!			**	*	**

In (27), the presence of the form *zwart* in the input incurs a FILL violation, not only for DEFINITE, but also for GENDER. Given the number of underspecified elements available in Dutch noun phrases such a candidate will not survive and hence we have only included one example here. Any candidate containing *het* will incur a FILL(G) violation here since it is incorrectly specified as [GDR *nt*]. Even though the third candidate violates the PARSE(FEATURE$_{ag}$) constraint twice, it is the optimal candidate. This is because there is no more specific form in Dutch which corresponds to the feature specification of the INPUT.

(28)

black cat(C), INDEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
zwart kat		*!			*		
zwarte kat				*!	*	*	*
een zwart kat		*!			*		*
een zwarte kat ☚					**	*	**

Again in Tableau (28), any form involving the specific form *zwart* incurs a FILL violation and given that there are less specific forms which do not violate FILL, there will be more successful candidates. Even though the article *een* does not parse GENDER, it is marked correctly for the crucial phrasal feature DEFINITE — and also

for NUMBER — and therefore incurs less important violations than the determinerless form. The tableaux for indefinite plural noun phrases containing adjectives are given in (29) and (30).

(29)

black horse(NT), INDEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
zwart paarden			*!			*	*
zwarte paarden				*!	*	*	**
een zwarte paarden			*!		**	**	***
een paar zwarte paarden ☚					**	*	***

(30)

black cat(C), INDEF, PL	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
zwart katten		*	*!		*	*	*
zwarte katten				*!	*	*	**
een zwarte katten			*!		**	**	***
een paar zwarte katten ☚					**	*	***

In (30) and (29), we see further examples of how a very general form, incurring PARSE violations, is still the optimal one given the absence of appropriate more specific forms.

The examples in (31) illustrate the distribution of the adjective forms within predicative APs.

(31) a. De kat is zwart / *zwarte.
DEF.ART cat(C) is black black-ə
'The cat is black.'

b. Het paard is zwart / *zwarte.
DEF.ART horse is black black-ə
'The horse is black.'

c. Een kat / paard is zwart / *zwarte.
INDEF.ART cat horse is black black-ə
'A cat/horse is black.'

d. De katten / paarden zijn zwart / *zwarte.
DEF.ART cat.PL horse.PL are black black-ə
'The cats/horses are black.'

Regardless of the subject's value for DEFINITE, GENDER and NUMBER, the predicative adjective occurs in its schwa-less form. Given that forms like *zwart* can occur either attributively or predicatively, and *zwarte* can only occur attributively,

we will assume that *zwarte* has the feature value [PRD –], whereas *zwart* is unspecified for this feature. *Zwarte* would then incur a FILL violation in predicative position which would make *zwart* a more optimal candidate regardless of the features of the subject.

5 Danish

Danish has number and gender agreement within the noun phrase, like Dutch, but the situation is made more complex in Danish by the fact that not only determiners and adjectives, but also nouns can be marked for definiteness. This means that the determiner system must be considered in conjunction with the definiteness feature associated with the noun itself.

5.1 Basic noun phrases

Danish possesses a set of suffixes that are used to indicate definiteness on a noun; there are no corresponding affixes which indicate indefiniteness. As in all the Scandinavian languages, a definite noun may be used as a full noun phrase in Danish, with the meaning 'the N'. A noun lacking the definite ending may not function as a full noun phrase unless it is accompanied by some syntactic determiner. Examples are provided in (32), where we use the singular neuter forms (*det, -et*) for illustration.

(32) a. æble-t
apple(NT)-NT.SG.DEF
'the apple'

b. *æble
apple(NT)
'an apple'

c. *det æble
DEF.ART.NT.SG apple(NT)
'the apple'

d. det æble
DEM.NT.SG apple(NT)
'that apple'

e. *det æble-et
DEF.ART/DEM.NT.SG apple(NT)-NT.SG.DEF
'the/that apple'

f. et æble
INDEF.ART.NT.SG apple(NT)
'a apple'

As (32d) and (32e) show, when a noun phrase contains a (syntactic) definite determiner — and this holds also for demonstratives and possessive pronouns — the form of the noun without the definite ending is used. This is then a clear indication that D is indeed a phrasal feature in Danish; definiteness needs to be marked only once in the phrase. Its closest relatives, Norwegian and Swedish, differ from Danish in this respect. As the data in (33) indicate, D is an agreement feature in these languages.[6]

(33) a. den bilen Norwegian & Swedish
that car.DEF
'that car'

b. denne bilen Norwegian
this car.DEF
'this car'

c. den här bilen Swedish
this car.DEF
'this car'

The fact that the clearly morphological element which represents [DEF +] appears to fill the same semantic function in the Scandinavian languages as the syntactic article in other Germanic languages has lead to a host of analyses of Scandinavian noun phrases in which the definite element is assumed to be a syntactic determiner (Delsing 1989, Delsing 1991a, Delsing 1992, Santelmann 1992, Taraldsen 1990, Taraldsen 1991). Such analyses cause problems especially for Norwegian and Swedish, where the definite ending may co-occur with what appears to be a syntactic determiner. In some of the analyses, this is solved by

6 For arguments in favour of treating *den här* as an unanalysable determiner, see Börjars (1998: §2.2.3). The phenomenon of a definite article and a distal or proximal adverbial grammaticalising into a demonstrative determiner is, of course, a common one. For instance, the English demonstrative *this* appears to be the result of grammaticalisation in a similar way of the Germanic simple demonstrative in its neuter form *ƒƒat* and the deictic particle *se* or *si* (Haspelmath, 1993).

assuming that the syntactic determiners are in fact not determiners, but rather adverbial in nature (Delsing 1993). We feel, however, that there is nothing in the behaviour of the definite ending which indicates that it should be assigned independent syntactic status, nor indeed are the arguments for the adverbial status of the determining elements strong (Börjars 1998: Chapter 2). The definite ending is an integral part of the noun; the part which instantiates the feature [DEF +].[7] What we have here then is a case of morphology competing with syntax; the semantic function of definite determiner can be mapped from either a syntactic element or a morphological one. This view is in line which much current research within Lexical-Functional Grammar (Andrews 1996, Bresnan 1997b, Bresnan In press, Nordlinger 1997) . For our purposes here, we can express this as the definiteness feature having to be specified somewhere within the noun phrase, but it does not matter where or how it is realised. As we have already seen, the OT approach provides a convenient way of conceptualising this; the Danish definiteness feature is a phrasal feature just like in Dutch. The main difference between Dutch and Danish in this respect lies in whether or not nouns can be marked for [DEF +]. The idea that it is the presence of certain features and not the presence of certain syntactic structure that matters for the completeness of a noun phrase has been developed within a Categorial Grammar framework for English (Payne 1993b) and for Swedish (Payne and Börjars 1994).

The distribution of nouns and determiners in Danish as illustrated by (32) gives the feature matrices in (34).

7 This terminology is used for convenience; we do not wish this terminology to imply an incremental approach to morphology.

(34) a. *æble* $\begin{bmatrix} \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$ b. *æblet* $\begin{bmatrix} \text{DEF} & + \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$

c. *det* $\begin{bmatrix} \text{DEF} & + \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$ d. *et* $\begin{bmatrix} \text{DEF} & - \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$

Corresponding forms exist for the definite ending and the articles with different gender and number specifications. Unlike the corresponding form in Dutch, the definite article occurring in Danish plural noun phrases is unique to plural environments and is therefore specified as in (35).

(35) *de* $\begin{bmatrix} \text{DEF} & + \\ \text{NUM} & pl \end{bmatrix}$

From the fact that a noun like *æble* can occur in both definite and indefinite environments, our approach forces us to conclude that a noun like *æble* is unmarked for definiteness, rather than specified as [DEF –], cf (34a). This view of the same types of nouns in Swedish has been argued for in Börjars (1998).[8] Under the approach taken here, the ability of a nominal to function as a full referential noun phrase depends not on syntactic structure, but on feature instantiation; in Danish fully referential noun phrases must be specified as [DEF ±]. Hence the fact that *æble* is not marked for [DEF] explains why a non-definite noun cannot function as a full noun phrase, i.e. why (32b) is not a grammatical noun phrase. If *æble* carried the value [DEF –] this would be puzzling.

We will now consider how an OT analysis of the type we applied to Dutch can work as a model for Danish, given the specifications in (34). Firstly, we can show that for Danish, as for Dutch, AVOID ranks lower than FILL and PARSE. Consider an input like ‘apple(NT), DEF, SG’, with the two sample candidates in Tableau (36).

8 Börjars (1994b, 1998) contains a discussion of different approaches to non-definite nouns in the Scandinavian languages, some of which do analyse a noun like *hus* as indefinite, e.g. Svenonius (1992a, 1992c).

(36)

apple(NT), DEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
æble				*!			
æblet ☜							*

If AVOID was ranked higher than PARSE, *æble* would wrongly be predicted to be the optimal candidate since it is morphologically less complex than *æblet*. However, in Danish — as in Dutch — violations of AVOID are permitted as long as this is in order to satisfy the higher ranked faithfullness constraints. Note also that since *æble* is not marked as [DEF –] it does not incur a FILL violation, but becomes sub-optimal through its PARSE violation.

If we now expand the set of candidates, as in Tableau (36'), we find that we need to reconsider our assumptions about AVOID.

(36')

apple(NT), DEF, SG	FILL			PARSE			AVOID
	D	G	N	D_{ph}	G_{ag}	N_{ag}	
æble				*!			
æblet ☜							*
det æble * ☜							*
det æblet							**!

Tableau (36') predicts that there are two equally optimal candidates for this INPUT. Not only is this an undesirable outcome within OT (for discussions of the problems associated with optionality and variation in OT, see for instance Grimshaw (1997:409–13); Sells, Rickford and Wasow (1997) and Speas (1997:191–2)), it is an incorrect prediction for Danish; the form indicated by the starred thumbs-up sign is an ungrammatical representation of this input. It is, however, optimal in case the determiner is the demonstrative *det* and the INPUT has the feature DEM associated with it. We can then assume that in Danish, avoiding syntactic structure is more important than avoiding morphological structure. This could in principle be implemented in different ways; either we could assume that morphological structure does not violate AVOID — so that AVOID really means AVOID-SYNTAX — or we can

separate AVOID into two distinct constraints; AVOID-S(YNTAX) and AVOID-M(ORPHOLOGY). So far, we have not got any evidence that Danish ranks AVOID-M highly, but we shall see that this constraint is relevant for the distribution of pre-nominal adjectives and we will therefore maintain both aspects of AVOID, with AVOID-S ranked higher to account for (36'). This then gives the Tableau in (36''), where the right prediction is made.

(36'')

apple(NT), DEF, SG	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
æble				*!				
æblet ☚								*
det æble							*!	
det æblet							*!	*

Tableau (37) gives the OT derivation of a minimal indefinite singular noun phrase in Danish. The obligatory presence of a syntactic determiner here — violating AVOID-S — is forced by the absence of a noun form defined as [DEF –] in Danish.

(37)

apple(NT), INDEF, SG	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
æble				*!				
æblet	*!			*				*
et æble ☚							*	

Turning now to plural indefinites, the conclusions we draw are very similar to those we drew for Dutch. In fully referential indefinite plural noun phrases, a determiner will be used. Compare (38) with the Dutch equivalents in (19).[9]

(38) a. Efter forelæsningen talte jeg med ?studenter / nogle studenter.
after lecture.DEF spoke I with students some students
'After the lecture I spoke to some students.'

b. Jeg har lige købt ?bøger / nogle bøger.
I have just bought books some books
'I have just bought some books.'

9 We are grateful to Anne Anker and Merethe Sørensen for their help with the Danish data.

We can then define *nogle* as in (39).

(39) *nogle* $\begin{bmatrix} \text{DEF} & \pm \\ \text{NUM} & pl \end{bmatrix}$

This leads to the tableau in (40).

(40)

apple(NT), INDEF, PL	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
æbler				*!				
☞ nogle æbler					*		*	

For Danish — as for Dutch — we will assume that what we have referred to as descriptively used noun phrases have special status which is indicated in the INPUT.

5.2 Noun phrases with adjectives

Adjectives occur in three forms in Danish. Here we shall only exemplify the variation with adjectives in attributive position, but — unlike Dutch — Danish shows the same distribution predicatively, implying that none of the general Danish adjectival forms are marked [PRD –], though there are a few adjectives which inherently have this specification. The attributive distribution of the three forms is illustrated in (41)

(41) a. et stort æble
INDEF.ART.NT.SG big apple(NT.SG)
'a big apple'

b. en stor elefant
INDEF.ART.C.SG big elephant(C.SG)
'a big elephant'

c. det store æble
DEF.ART.NT.SG big apple(NT.SG)
'the big apple'

d. den store elefant
DEF.ART.C.SG big elephant(C.SG)
'the big elephant'

e. *store æblet
big apple.DEF

f. de store æbler / elefanter
DEF.ART.PL big apple(NT).PL / elephant(C).PL
'the big apples / elephants'

g. nogle store æbler / elefanter
some big apple.PL elephant.PL
'some big apples / elephants.'

The distribution of the three forms can be captured by the table in (42).

(42)

	indefinite		definite	
	common	neuter	common	neuter
SG	*stor*	*stort*	*store*	*store*
PL	*store*	*store*	*store*	*store*

Given that *store* can occur in environments of either value for all three features (DEFINITE, GENDER and NUMBER), following our assumptions, it must be unspecified for these features. The distribution of *stor* and *stort*, on the other hand, is very limited and hence the feature matrices associated with them are specific. This is illustrated in (43).

(43) a. stor $\begin{bmatrix} \text{DEF} & \pm \\ \text{NUM} & sg \\ \text{GDR} & c \end{bmatrix}$ b. stort $\begin{bmatrix} \text{DEF} & \pm \\ \text{NUM} & sg \\ \text{GDR} & nt \end{bmatrix}$

c. store [ ]

The tableaux in (44) and (45) illustrate how the most appropriate form of the adjective will be correctly chosen in definite noun phrases by the constraints we have already introduced. The nominal forms used are defined as follows; *elefant* 'elephant', *elefanter* 'elephant.PL' and *elefanterne* 'elephant.PL.DEF'.

(44)

big elephant (C), DEF, PL	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
de stor elefanter	*		*!		*	*	*	*
de stort elefanter	*	*	*!		**	*	*	**
de store elefanter ☚					**	*	*	**
de store elefanterne					**	*	*	***!
den store elefanter			*!		*	**	*	**

In Tableau (44), any candidate containing *stor* or *stort* will incur a FILL violation, at least with respect to definiteness and number, *stort* also violates FILL(G). In all cases there is a corresponding PARSE violation of the agreement features since the element will also fail to parse the correct feature value. Only the underspecified

elements *de* and *store* do not violate FILL, but given their underspecification, they do violate PARSE(G_{ag}, N_{ag}). Since FILL ranks higher than PARSE this does not rule out the candidates from being optimal. The third and the fourth candidates are then tied first with respect to FILL and PARSE. The optimal candidate is selected on the basis of AVOID violations, which means that the form which only violates the two aspects of AVOID once — the form with less structure — wins.

(45)

	FILL			PARSE			AVOID	
big apple(NT), DEF, SG	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
det stor æble	*	*!			*		*	
det stort æble	*!						*	
det store æble ☚					*	*	*	*
den store æble		*!			**	*		
de store æble			*!		**	**	*	*
det store æblet							*	**!

In (45), the forms *stor* and *stort* do not incur FILL(N) violations, but they do violate FILL(D) and in the case of *stor* also FILL(G). Since the latter is an agreement feature, which should be marked on every element, there is also a corresponding PARSE(G_{ag}) violation for any candidate containing *stor*. Since the input in (45) is specified as NT and SG, any candidate containing either *den* or *de* will have a FILL(G) or a FILL(N) violation, respectively, and a corresponding PARSE(G_{ag}, N_{ag}) violation. Danish does have a determiner available which incurs neither PARSE nor FILL violations, namely *det*. As in (44), *store* — by virtue of being underspecified — incurs PARSE violations, but since there is no more specific adjectival form available in Danish which does not incur a FILL violation for a definite INPUT, the winning candidate will still contain the underspecified form. Finally, since PARSE(D_{ph}) is satisfied by the determiner, AVOID will rule out the final candidate which at the cost of increased structure marks definiteness once more.

A major problem arises at this point, however. If we compare the optimal candidate from (45) with another plausible candidate, as in (45'), the candidate

indicated by a starred hand is predicted to be optimal. A parallel problem arises if we add *store elefanterne* in (44).

(45')

big apple(NT), DEF, SG	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
det store æble					*	*	*!	*
store æblet ☞					*	*		**

As the examples in (46) show, this prediction is incorrect.

(46) a. Det store æble var godt.
the big apple was tasty
b. *Store æblet var godt.
big house.DEF have tasty
'The big apple was tasty.'

A similar problem arises in our approach with indefinite singular noun phrases, as in (47).

(47)

big apple(NT), INDEF, SG	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
et stort æble							*!	*
stort æble ☞								**

The assumption that AVOID-M does in fact rank above AVOID-S would solve this problem, but as we saw in §5.1, Danish does prefer the definiteness to be marked morphologically, and hence AVOID-S must be ranked higher of the two.

The fact that definite noun phrases containing prenominal modification require the presence of a syntactic determiner in the Mainland Scandinavian languages has been discussed extensively in the literature, and all modern analyses of which we are aware attempt to deal with this (Börjars 1998, Delsing 1993, Holmberg 1987, Kester 1992, Svenonius 1992a, Svenonius 1992c). The requirement for a syntactic determiner is present in all the Mainland Scandinavian languages, but not in Icelandic. In the case of Faroese, the status of 'adjective+definite noun' combinations appears not to be entirely clear (Barnes 1994). The difference between the mainland Scandinavian languages then does not lie in the need for a syntactic determiner, but whether or not the definite ending on

the noun is required when a syntactic determiner is present; in Danish, the definite ending is not present, whereas in Norwegian and Swedish, the definite ending is usually kept, giving rise to so-called ‘double definiteness’. In our terms: DEFINITE is an agreement feature in Norwegian and Swedish, whereas it is a phrasal feature in Danish.

In all the mainland Scandinavian languages, the requirement for a syntactic determiner is restricted to prenominal modification, so that the noun phrases in (48) are grammatical referential noun phrases.

(48) a. Æblet på bordet var godt.
apple.DEF on table.DEF was tasty

b. Äpplet på bordet var gott. Swedish
apple.DEF on table.DEF was tasty
‘The apple on the table was tasty.’

Even though the requirement for a syntactic determiner in definite noun phrases containing prenominal modifiers has been discussed frequently in the literature, the fact that the same restriction appears to hold for singular indefinite noun phrases has been ignored as far as we are aware. The reason for this is presumably that non-definite singular count nouns normally require a determiner to form a noun phrase anyway. In our analysis this is because there are no nouns marked [DEF –] and hence a determiner is always required to supply the definiteness feature crucial to a referential noun phrase. However, it can be shown that there are actually two separate constraints having the same effect, namely that of requiring the presence of the indefinite determiner. In predicative positions in certain constructions, singular count nouns can occur without a determiner, this gives rise to what is usually referred to as a “role reading” of the noun phrase. An example from Swedish is given in (49a), parallel data can be found in all the Mainland Scandinavian languages. However, if an adjective is added, an indefinite determiner is required, as (49b) and (49c) illustrate.

(49) a. Sture är lärare. Swedish
Sture is teacher(C)
'Sture is a teacher.'

b. *Sture är fantastisk lärare.
Sture is fantastic.C teacher(C)
'Sture is a fantastic teacher.'

c. Sture är en fantastisk lärare.
Sture is a.C fantasticC teacher(C)
'Sture is a fantastic teacher.'

As in the case of definite noun phrases, a determiner is not required when only postmodification is present, as the examples in (50) show.

(50) Sture är lärare i kemi. Swedish
Sture is teacher in chemistry
'Sture is a chemistry teacher.'

It could be objected here that being 'a fantastic teacher' is too unlikely to be considered a "role" for the determinerless construction to be possible, so that the problem with (49b) is not syntactic, but relates to semantico-pragmatic factors. However, the construction type illustrated in (49a) can force a role reading even when it is far fetched. Hence the example in (51) conjures up a fancy dress party setting, and a man dressed in a white cardboard box with some fridge magnets stuck to it. The sentence would not be considered ungrammatical.

(51) Sture var kylskåp Swedish
Sture was refrigerator
'Sture was a refrigerator.'

The same does not hold true for nouns with premodification. The example in (52) is ungrammatical, it cannot be rescued by the hearer imagining someone dressed up as an old teacher.

(52) *Sture var gammal lärare. Swedish
Sture was old teacher

Why is (52) always ungrammatical, even though (51) is grammatical as long as one can picture Sture dressed up as a fridge? We conclude that the difference lies in the fact that the lack of determiner preceding the prenominal modification in (52) leads to a violation of the syntax of Swedish, whereas an example like (51) only stretches

the hearer's imagination. The requirement for a syntactic determiner to be present whenever the noun phrase contains prenominal modification is then a general one, and does not hold only for definite noun phrases. The fact that in our analysis the requirement for a determiner to be present when the noun phrase contains a prenominal adjective surfaces for both definite and indefinite noun phrases then turns out to be an advantage.

The question now is how to capture the relation between prenominal modification and the obligatory presence of a syntactic determiner. In the literature, which deals mainly with Swedish, it has been suggested that the adjectives occurring in definite noun phrases need to have some feature assigned to them by an element. The feature can not be dependent on the definiteness of the noun phrase as a whole, since there are definite noun phrases which do not permit adjectives, namely those without a syntactic determiner. It is then assumed that the determiner is inserted as an assigner of the required feature. There are a number of problems with such analyses.

Firstly, it is not clear what the feature should be, the proposals include the same feature as the determiner — DEF —, a separate adjectival feature — WEAK with a corresponding STRONG form in indefinite noun phrases — and Case. The most obviously problematic choice of feature is Case, as argued for Swedish, and presumably by extrapolation to the other Mainland Scandinavian languages, in Delsing's early work (1988). Delsing motivates his assumption with the claim that weak adjectives are "more noun-like" than strong ones. Historically, there is indeed a relation between the morphology on weak adjectives and that on weak nouns. However, Delsing (1988:65) claims that weak adjectives are more nominal in present-day Swedish in that 'they may constitute a noun phrase together with the definite article'. However, as discussed in Börjars (1998: §5.4.2.1) there is no indication that weak adjectives are more nominal than strong ones (cf also Thorell

(1973:72)). Strong adjectives can be used independently as noun phrases both with and without an indefinite article, but in the latter case they are not fully referential. Examples are provided in (53), where we have used the features STRONG and WEAK, even though in the analysis we have provided here — as in Börjars (1998) — the assumption is that a separate feature is not necessary.

(53) a. Jag valde **en** **blå**. Swedish
I chose a blue.STR
'I chose a blue one.'

b. **Rika** skall betala mer skatt än fattiga.
rich.STR shall pay more tax than poor.STR
'Rich people ought to pay more tax than poor people.'

c. Det står **några** **kalla** i kylskåpet.
there stand some cold.STR in refrigerator.DEF
'There are some cold ones in the refrigerator.'

d. De har fått **en** **liten**.
they have received a little.STR
'They have had a baby.'

In any fetaure assignment analysis, the other two features — DEF and WEAK — cause problems with respect to configuration; how can the feature be assigned to the adjective, but not to the noun. Regardless of which feature is used, we do not want it to be assigned to the noun as well. If the feature is indeed [DEF], the Danish noun phrases in which the adjective is weak (i.e. in this account [DEF +]) but the noun is non-definite would cause difficulties. Even though Netter (1994) argues that in German all nouns should be marked as weak or strong, Börjars (1998: §5.4.3.2) shows that these arguments cannot be transferred to Swedish and therefore also not to the other Mainland Scandinavian languages. In analyses where there is assumed to be an assignment relation between the determiner and the adjective phrase, a number of possible configurations have been suggested. All of them involve the determiner being the head, and all of them involve problems. If the complement of the determiner is an NP in which the AP is either a specifier, attached at N', or adjoined, then standard assumptions about feature percolation makes it impossible to get the feature to the AP without getting it

to the head noun. If the adjectival morphology is assumed to be distributed through a Specifier-Head relationship, then the adjective would be expected to carry the same feature as the determiner and this is not justified for either DEF or WEAK. Finally, if the complement of the determiner is headed by the adjective (as proposed by Delsing (1989, 1992)), then unconventional assumptions about feature percolation needs to be made in order for the feature to be assigned to all adjectives in a string of prenominal APs.

There are then arguments against an analysis in which the presence of the determiner is required in order for some feature to be assigned to the adjective phrase. On the other hand, the adjective form cannot be made dependent on the (in)definiteness of the noun phrase as a whole. The generalisation seems to be that if an adjective phrase is added to a nominal which did not previously require a syntactic determiner then the result is a nominal which does require a syntactic determiner. If another adjective phrase is added to the resulting nominal nothing changes since the nominal already required a syntactic determiner. This intuition has been captured within Categorial Grammar by Payne and Börjars (1994) and in a Head-driven Phrase Structure Grammar analysis by Börjars (1998).

Within the type of analysis we have proposed here, there are different ways of solving the problem. One approach is to assume that a full referential noun phrase can be either of the category NP or the category DP, as long as the phrase is marked for [DEF ±]. This idea is in line with work using the notion of extended categories (Bresnan 1995, Grimshaw 1991) in which DP is the extended projection of NP. In a theory, like Lexical-Functional Grammar, in which selection is defined functionally rather than categorially, the fact that a noun phrase can be either NP or DP causes no problems. If we accept recent LFG proposals (Bresnan 1995) to the effect that all elements introduced by phrase structure rules (i.e. c-structure rules) are optional unless required by some other principle (e.g. expressivity and

completeness), then if a noun phrase contains no element other than a noun, and where the requirements on a noun phrase are satisfied by that noun — that is, it is marked for definiteness — then there is no D-projection. We can then assume that adjective phrases are attached outside of the NP, thus forcing a D-projection. One standard assumption within work on OT syntax, regardless of whether it is based on LFG or Minimalism, is a constraint which requires a projection to have a head. This is expressed in the OB-HD constraint, defined as follows (Bresnan (1997a:21), but see also Grimshaw (1997:374)):

OB-HD: every projected category (X', X'') has a lexically filled head

Given these assumptions; that the addition of an AP forces a DP projection, and that this projection must have a lexically filled head, as long as the OB-HD constraint is relatively highly ranked, we predict that when a pre-nominal adjective occurs, a determiner must fill the D position.

Another related approach which can be expressed in terms of LFG is to assume that a full referential noun phrase is always a DP, and that a definite noun by virtue of the inflection may fill the head position of the nominal functional projection, viz D.[10] This special property of an inflected noun could then be said to parallel the special status of an inflected verb in analyses in which an inflected verb may occur in I, the corresponding verbal functional category (Bresnan 1995, King 1995, Kroeger 1993).[11] Given the LFG assumptions about the optionality of c-structure nodes discussed above, when the noun occurs in D, its NP complement is pruned. If we now pursue a different approach to adjective placement, and assume that the AP is adjoined at some level of the NP, then the presence of an AP requires an N projection, and OB-HD would require the head of that projection to be filled.

10 This approach owes much to a discussion which KEB had with Joan Bresnan, Louisa Sadler and Peter Sells.

11 This type of analysis share certain properties with so-called head-to-head movement, but also differs crucially from it, see the references quoted for further details.

Hence, when an adjective is present, the noun must occur in the N slot. If all full referential noun phrases are DPs, then the D must also have a filler and from this follows that a determiner must always be present when a noun is pre-modified by an AP. Similarly, a non-definite noun would not be able to occur in D, in the way that non-finite verbs are assumed not to be able to fill I.[12] Hence in the case of non-definite nouns, in order for it to function as a full referential noun phrase, a determiner must always be present to satisfy OB-HD. Non-referential noun phrases, such as those exemplified in (49a) can then be assumed to have a different categorial status.

Leaving the details of the analysis open, but assuming that the distribution of determiners can be accounted for in terms of a constraint OB-HD, which for Danish must be ranked between PARSE and AVOID-S, we can revise Tableau (45') for a singular definite noun phrase as in Tableau (45'').

(45'')

big apple(NT), DEF, SG	FILL			PARSE			OB-HD	AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}		S	M
det store æble ☚					*	*		*	*
store æblet					*	*	*!		**

If we consider indefinite noun phrases now, given the introduction of the OB-HD criterion, we get the tableau in (54) for neuter nouns.

(54)

big apple (NT), INDEF, SG	FILL			PARSE			OB-HD	AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}		S	M
et stort æble ☚								*	*
et store æble					*	*!		*	*
et stor æble		*!			*			*	
stort æble							*!		*
store æble				*!	*	*	*		*
stor æble		*!			*		*		

In Tableau (54), we see clearly the need for a determiner; the fourth candidate, *stort æble*, does not incur any FILL violations, it does not violate PARSE(D_{ph}) since *stort*

12 There is at least one exception, since the special properties of a non-finite form of the verb 'be' in Welsh (*bod*) point towards it being able to fill I (Sadler 1997).

carries the feature [DEF –], and neither element violates PARSE(G_{ag}, N_{ag}). It is only the fairly low ranked constraint OB-HD which separates this candidate from the optimal one. The distinction between phrasal and agreement features also shows up clearly in Tableau (54). Compare the optimal candidate, *et stort æble*, with the suboptimal *et store æble*; if GENDER and NUMBER were assumed not to be agreement features, but just required one off marking within the noun phrase, then there would be no way of distinguishing these two candidates. However, under the assumption that agreement features should be marked on every element if possible, *et store æble* violates PARSE(G_{ag}, N_{ag}) whereas *et stort æble* incurs no PARSE violation.

Under our assumptions about indefinite plural noun phrases and the specification of *nogle* in (39), we get the tableau in (55) for plural indefinite noun phrases containing adjectives.

(55)

big apple (NT), INDEF, PL	FILL			PARSE			OB-HD	AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}		S	M
store æbler				*!	*	*	*		*
☞ nogle store æbler					**	*		*	*
nogle stort æbler			*!		*	*		*	*

Having introduced the use of the OB-HD constraint, we can now return to Dutch and a problem which we skipped over in §4.2. Let us return to Tableau (28), but this time use a neuter noun like *paard* instead of the common gender *kat*. The result is Tableau (56).

(56)

black horse(NT), INDEF, SG	FILL			PARSE			AVOID	
	D	G	N	D_{ph}	G_{ag}	N_{ag}	S	M
zwarte paard				*!	*	*		*
* ☞ zwart paard								
een zwart paard					*!		*	
een zwarte paard					**	*!	*	*

Since the determiner and adjective forms in all the candidates in (56) are either underspecified or correctly specified for the features, there are no FILL

violations. In Tableau (28), because there is no specific adjective form in Dutch which is marked as [DEF –] for common gender nouns like *kat*, PARSE(D_{ph}) is violated by all the candidates without a determiner. However, in Tableau (56), given that *zwart* is marked as [DEF –], there is no PARSE(D_{ph}) violation in the determiner-less second candidate. Hence Tableau (56) wrongly predicts that this candidate, rather than the correct *een zwart paard*, is optimal. If we now introduce OB-HD into Tableau (56), we get (57).

(57)

black horse(NT), INDEF, SG	FILL			OB-HD	PARSE			AVOID	
	D	G	N		D_{ph}	G_{ag}	N_{ag}	S	M
zwarte paard				*!	*	*	*		*
zwart paard				*!					
een zwart paard ☚						*		*	
een zwarte paard						**	*!	*	*

Note that in Dutch, OB-HD must rank above PARSE. The difference between Danish and Dutch in this respect lies in the degree of specification of the indefinite article. The Danish indefinite article is fully specified for both NUMBER and GENDER and hence will never incur PARSE violations. Its Dutch counterpart, on the other hand, is not specified for GENDER and its presence in a candidate will therefore violate PARSE so that if OB-HD was ranked below PARSE, even though *een* would satisfy OB-HD, it would cause a higher ranked violation, leading to the incorrect choice of **zwart paard* as the optimal candidate. The reader can check that the ranking of OB-HD yields the same result in all tableaux in §4.

The ranking of OB-HD between FILL and PARSE, then makes the correct prediction for Dutch. However, we would prefer to find independent motivation for the high relevance of this constraint in Dutch, similar to that presented for the Mainland Scandinavian languages in (46) and (49). Dutch does not have definite nouns, so that we would not expect to find evidence similar to (46). It does turn out, however, that the restriction illustrated in (49) holds for Dutch as well. Relevant data is provided in (58) and (59).

(58) a. Jaap is leraar.
Jaap is teacher(C)
'Jaap is a teacher.'

b. *Jaap is goede leraar.
Jaap is good teacher(C)

c. Jaap is een goede leraar.
Jaap is a good teacher(C)
'Jaap is a good teacher.'

(59) a. Jaap is hoofd van de vakgroep.
Jaap is head(NT) of the department
'Jaap is the head of the department.'

b. *Jaap is goed hoofd van de vakgroep.
Jaap is good.NT.SG head(NT) of the department

c. Jaap is een goed hoofd van de vakgroep.
Jaap is a good.NT.SG head(NT) of the department
'Jaap is a good head of department.'

We conclude that the relatively high ranking of OB-HD is common to the Mainland Scandinavian languages, Dutch and German. It is clearly not relevant to Icelandic, where the most common usage is for an adjective in a definite noun phrase not to be preceded by a determiner, as in (60). As the glossing shows, Icelandic is a highly agreeing language so that GENDER, NUMBER and CASE are certainly all agreement features. In fact, it seems to us that DEFINITE may well be an agreement feature, rather than a phrasal feature, in Icelandic, but only a very detailed study of the morphologically complex inflection system of Icelandic determiners, adjectives and nouns could establish this for sure.

(60) gamli hestur-inn
old.DEF.M.SG.NOM horse.NOM-DEF.M.SG.NOM/ACC
'the old horse'

In Icelandic, the definiteness of the noun satisfies PARSE(D), and since OB-HD is ranked too low to be of relevance, the noun phrase in (60) is optimal. The syntactic definite article is used, but only in literary style, and we can then assume that there must be some stylistic information in the input which forces the presence of the syntactic article in such noun phrases. In Icelandic, there is no indefinite article, so that a noun lacking the definite article, with or without an (appropriate form of the) adjective, can function as a full referential noun phrase. Within the

system we have proposed here, this would mean that these nouns in Icelandic are, in fact, marked as [DEF –], unlike the corresponding noun forms in the other Germanic languages. Hence a noun like *hestur* satisfies PARSE(D) and can combine with adjectives to form grammatical referential noun phrases such as the one in (61).

(61) gamall hestur
old.INDEF.M.SG.NOM horse.INDEF.M.SG.NOM
'an old horse'

Facts like these confirm the irrelevance of OB-HD for Icelandic noun phrases; given the low ranking of OB-HD in this language, the presence of a syntactic determiner is not required by this constraint.

6 Conclusions

In this paper, we have shown that the morphological alternations involved in some Germanic noun phrase internal agreement can be modelled without any reference to zero morphemes. This is made possible through radical underspecification; an element is only specified for features which uniquely define the environment in which that element can occur. We have used Optimality Theory to model restrictions that produce the correct linguistic strings given the radically underspecified lexical entries. Our aim has not, however, been to argue in favour of OT, but rather to show that the distribution of the forms involved in these agreement patterns can be modelled without having to make recourse to zero morphemenes.

We are not taking the extreme position claiming that there are no phonologically null morphemes whatsoever, but rather adopting the position that the use of phonologically null morphemes in paradigms is not always necessary, and should be reduced as far as possible. The reduction in the use of zero elements is not universally recognised as an important goal in linguistics. Indeed, there are

many analyses of data similar to these which make extensive use of zero forms. We believe, however, that our type of approach brings with it several advantages.

One of the advantages to our solution is that it implies a realisational rather than incremental approach to morphology. In a realisational approach morphological forms are viewed as the realisation of feature bundles associated with a lexical item. In an incremental theory of morphology, each feature is added to a bare form by the addition of a morpheme. If there is no obvious overt form associated with a feature, then the existence of a zero morpheme can be assumed. The Dutch adjective forms lay bare a drawback of the incremental approach in that this approach would force us into some uncomfortable choices. One could assume that in *zwart*, there is a morpheme ∅ which instantiates the feature bundle [NUM *sg*, GEND *neut*, DEF –] and that there are a number — maybe as many as seven — of morphemes /ə/ each being the realisation of a different feature bundle. The alternative is underspecification, which given the distribution of the forms leads to the conclusion we have drawn here, namely that *zwart* is specified for more features that *zwarte*. However, in an incremental model this would mean that features were added through the subtraction of phonological material. This clearly is an uncomfortable conclusion to have to draw in any theory of morphology. Still, the combination of underspecification and an incremental theory leaves us caught between the devil and the deep blue sea since the only obvious alternative would be to assume that the schwaless form is underlying and that the addition of phonological material leads to the subtraction of features. Alternatively, we can assume that morphological alternations are means of realising feature bundles rather than providing features themselves. We can then simply say that Dutch has two means of realising the adjective ZWART, depending on the features that are found in the environment in which the adjective occurs. The advantage of such a realisational

model has been shown in analyses provided for instance in Anderson (1992), Beard (1995) and Stump (1997).

Apart from leading us towards an realisational approach to morphology, the adoption of principles of underspecification also allows us to eliminate a large number of putative morphemes that have zero realisation. While the use of zero morphemes has been common in many analyses, if take seriously, it raises some disturbing questions. Firstly, why is this particular morpheme so prevalent in languages? Secondly, why is this particular morpheme so often polysemous in a language? These are questions which disappear if we assume the underspecification analysis adopted here.

At a typological level, the admission of zero morphemes into paradigms creates a number of problems. Once zero morphemes are admitted, the debate as to the alignment of a language is made less easy to hold at a concrete level; might English not have a phonologically null ergative case prefix? The notion of the least marked member of a paradigm is made more complex; we could allow -$Ø_1$, -$Ø_2$, -*s*, -$Ø_3$, -$Ø_4$, and -$Ø_5$ to be the exponents of verbal agreement in the present tense in English, for first to third persons in singular and plural, respectively.

Finally this approach to underspecification points towards paradigms being specified in terms of an intersecting set of properties that characterise word-forms rather than a set of related forms of a lexeme. Rules of referral or some similar concept then provide the right forms. The definition of a paradigm in terms of intersecting properties is to be preferred, since it brings out the important sense in which the concept of paradigm establishes a grid of expected possibilities such that one can ask questions not only about attested forms but also unattested ones, situations such as suppletion, defectiveness and periphrasis can be captured with the same tools, for an example, see Vincent and Börjars (1996) and Börjars, Vincent and Chapman (1997).

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