

Class Features as Probes

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Abstract

In this article, we address (i) the form and (ii) the function of inflection class features in a minimalist grammar. The empirical evidence comes from noun inflection systems involving fusional markers in German, Greek, and Russian. As for (i), we argue (based on instances of trans-paradigmatic syncretism) that class features are not privative; rather, class information must be decomposed into more abstract, binary features. Concerning (ii), we propose that class features qualify as the very device that brings about fusional inflection: They are uninterpretable in syntax and act as probes on stems, with matching inflection markers as goals, and thus trigger morphological Agree operations that merge stem and inflection marker before syntax is reached.

1. Introduction

This article investigates the form and the function of inflection class features in a minimalist grammar; more specifically, we address the status of noun class features in three languages with fusional noun inflection systems, viz., Russian, Greek, and German.

As for the *form* of class features, we will argue that they are not to be viewed as privative features like [class I], [class II], etc. (as is standardly assumed), but as more abstract, binary features like $[\pm\alpha]$, $[\pm\beta]$, etc., that result from decomposing classic inflection classes, and whose cross-classification in turn yields these classes. Such a decomposition of inflection classes will be shown to offer a straightforward explanation of systematic instances of syncretism that hold across inflection classes. As for the *function* of class features, we propose that they qualify as the device that brings about fusional inflection in the first place: They act as probes on stems, with matching inflection markers as goals, and thus trigger morphological Agree operations that merge stem and inflection marker. This process will be argued to take place before syntax is reached. The underlying rationale is that whereas arbitrary class features emerge as indispensable in morphology (gender, phonological, or semantic features that are independently motivated on noun stems do not suffice to correctly predict the choice of

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inflection class), they are not visible in syntax and would in fact violate the Legibility Condition (see Chomsky (2000; 2001b)) if present in this component. Our conclusion is that class features need to be removed from linguistic expressions in a pre-syntactic morphological component, and this is achieved by morphological Agree (i.e., inflection) operations.

The analysis suggested here has repercussions on the organization of grammar, and particularly the question where, and how, morphological operations take place. We will compare the pre-syntactic approach to class-driven fusional inflection adopted here with inner- and post-syntactic approaches (like distributed morphology); and we will argue that these alternative conceptions are at variance with either the Legibility Condition (if class features are present in syntax) or the Inclusiveness Condition (if class features are added after syntax).

We will proceed as follows. In section 2, we address the systems of noun inflection in Russian, Greek, and German. We show that class features are needed in the morphological systems of all these languages, and that assuming inflection class information to be encoded on binary features of a highly abstract nature offers a simple account of many instances of syncretism. In section 3, we move from morphology to syntax and investigate the role of noun class features in syntax. We argue that class features are not visible in syntax, neither as heads of functional projections, nor as features on other heads. By putting the evidence from sections 2 (morphology) and 3 (syntax) together, we develop the main proposal in section 4. In section 5, we put the proposal in a wider context and discuss further issues raised by the analysis. Finally, section 6 contains concluding remarks.

2. Class Features in Morphology

The noun inflection systems of Russian, Greek, and German exhibit massive syncretism; the notion of syncretism is understood here in a broad sense, as identity of inflection marker forms in different paradigm cells.¹ Such syncretism comes in two varieties. First, syncretism can arise within an inflection class, with two (or more) cases being covered by the same inflection marker; we will refer to this (standard) instance of form identity as *intra-paradigmatic syncretism*. Second, syncretism can also show up across inflection classes, with two (or more) inflection classes sharing the same inflection marker (which then may or may not be for the same case specification); we will refer to this instance of form identity as *trans-paradigmatic syncretism*. The languages considered in this article exhibit both kinds of syncretism in abundance.²

¹ We assume that paradigms do not exist as genuine entities that, e.g., constraints can refer to (like, e.g., the Paradigm Economy Principle in Carstairs (1987), or the No Blur Principle in Carstairs-McCarthy (1994)). On the view adopted here, paradigms are epiphenomena (see Bobaljik (2002), Harley & Noyer (2003), and references cited there); they have the status of empirical generalizations that need to be derived.

² A cross-linguistic survey reveals that intra- and trans-paradigmatic instances of syncretism are pervasive in the class-driven, fusional noun inflection systems of Indo-European and other languages (see Plank (1991) and Baerman et al. (2002), among others).

The question arises to what extent syncretism should be considered systematic. We adopt the meta-grammatical principle in (1).

(1) *Syncretism Principle*:

Identity of form implies identity of function

(within a certain domain, and unless there is evidence to the contrary).

We take the Syncretism Principle to be the null hypothesis for the child acquiring a language as well as for the linguist investigating it. In both respects, it plays an important role outside morphology, e.g., in syntax and semantics. The two qualifications in (1) are minimal. First, the restriction to a certain empirical domain ensures that, e.g., an accidental homonymy of a verbal inflection marker and a nominal inflection marker in a given language (e.g., of *s* in *ask-s* and *s* in *cat-s*) does not imply an identity of function of the two markers. Any alternative to this would plainly be untenable. In other cases, the decision about the form of the domain in which all syncretism must be considered systematic may not be that uncontroversial. We will assume that different numbers (singular and plural) create different domains for the purposes of the Syncretism Principle, whereas different classes and cases do not. Consequently, we will try to derive syncretism across classes and cases, but not across numbers; i.e., “trans-number” syncretism is not assumed to be systematic (also cf. Baerman et al. (2002), and footnote 19 below). This difference between number on the one hand and case and class on the other may ultimately be traced back to whether or not a feature carries semantic information – number features do, whereas class features and case features (at least those of the languages under consideration in this paper, which do not exhibit ‘semantic cases’) do not.

The second qualification in (1) envisages the possibility that positive counter-evidence may make an analysis of a specific instance of syncretism as systematic impossible. This qualification is arguably also unavoidable, especially in inflectional morphology, where it seems clear that historical accidents play some role in shaping the form of paradigms. Still, we would like to contend that there is much less evidence against assuming instances of syncretism to be systematic than is sometimes made out (see, e.g., Carstairs (1987), Zwicky (1991), and Williams (1994)). More generally, the Syncretism Principle in (1) brings about a shift of perspective from much recent work in inflectional morphology, in that the burden of proof is not on considering a given instance of syncretism as systematic, but on considering it to be accidental.³

A final caveat before we turn to the noun inflection systems of Russian, Greek, and German: Throughout, we focus on the core systems of noun inflection in these languages. We disregard minor inflection classes, minor cases, stem alternations, stress patterns, pure lexical idiosyncrasies, etc. These issues are ultimately important in comprehensive morphological accounts of the respective systems. However, they do not significantly contribute to the issue of the nature of class features, and we believe that

³ The underlying assumption here is that given a proper level of abstraction, inflectional systems show much more regularity and systematicity than a superficial analysis can reveal; see Chomsky (2005, note 14).

the gist of the analyses of noun inflection in Russian, Greek, and German given below can be carried over into more comprehensive accounts without significant changes.

2.1. Noun Inflection in Russian

2.1.1. Data

Russian has six cases: nominative (nom), accusative (acc), dative (dat), genitive (gen), instrumental (inst), and locative (loc; also known as prepositional). We assume that there are four noun inflection classes in this language, which are here labelled I-IV.⁴

Consider first inflection class I, which contains only masculine stems. Focussing on the singular for now, three sample paradigms are given in table T₁. The variation in this class is conditioned by two factors: First, inanimate noun stems like *zavod* (‘factory’) take a nominative (null) marker /Ø/ in the accusative, whereas animate noun stems like *student-* (‘student’) take the genitive marker /a/ in the accusative.⁵ Second, there are systematic, morpho-phonologically predictable differences between nouns whose stem ends in a “hard” (i.e., [+back]) consonant and nouns whose stem ends in a “soft” (i.e., [–back]) consonant: compare *student* (‘student’) with *žitel’* (‘inhabitant’).⁶

T₁: Inflection class I, Sg.: masc

	I		
	<i>zavod_m</i> (‘factory’)	<i>student_m</i> (‘student’)	<i>žitel_m</i> (‘inhabitant’)
nom/sg	<i>zavod</i> -Ø	<i>student</i> -Ø	<i>žitel’</i> -Ø
acc/sg	<i>zavod</i> -Ø	<i>student</i> -a	<i>žitel</i> -ja
dat/sg	<i>zavod</i> -u	<i>student</i> -u	<i>žitel</i> -ju
gen/sg	<i>zavod</i> -a	<i>student</i> -a	<i>žitel</i> -ja
inst/sg	<i>zavod</i> -om	<i>student</i> -om	<i>žitel</i> -em
loc/sg	<i>zavod</i> -e	<i>student</i> -e	<i>žitel</i> -e

Inflection class II has mainly feminine stems; it is illustrated in table T₂. This time, there is no animacy effect in the accusative, which employs a uniform marker /u/ for, e.g., inanimate *komnat* (‘room’) and animate *učitel’nic* (‘female teacher’). However, as before, there is predictable morpho-phonological variation that depends on the nature

⁴ An alternative view recognizes three classes, with classes I and IV subclasses of a single class. Since we will suggest an explicit theory of what a “subclass” is, and will in fact argue for further “subclasses” in the system of Russian noun inflection, this question turns out to be mainly terminological. Relevant literature on Russian noun inflection that the material in this section is based on includes Jakobson (1962a;b), Isačenko (1975), Neidle (1988), Corbett & Fraser (1993), Fraser & Corbett (1994), Halle (1994), Franks (1995), Stump (2001), and Wiese (2004). Müller (2004) is an earlier (and, to some extent, different) version of the analysis of Russian in this section that discusses the empirical evidence in much more detail.

⁵ Here and henceforth, the / / notation will be used for markers and segments so as to indicate that these have the status of underlying representations that may undergo changes on the way to PF realization.

⁶ Note that softness of the final stem consonant /l/ in *žitel’* is represented by the so-called *mjagkij znak* (‘) in the nominative, and by the nature of the ending in the other cases. This is a matter of orthography that should not be taken to signal stem alternation, here and in the following paradigms.

of the stem ending as [\pm back]; compare, e.g., the markers attached to a stem ending in a hard consonant (like *komnat* ('room')), with the endings attached to a stem ending in a soft consonant (like *nedel'* ('week')). Furthermore, this inflection class turns out to be non-gender-specific: In addition to the feminine stems, some masculine stems also belong to this class (like *muščin* ('man')); i.e., they trigger masculine agreement but inflect according to the pattern in T_2 . Unlike the masculine stems in class I, masculine stems in class II exhibit no animacy effect in the accusative.

T_2 : *Inflection class II, Sg.: fem, masc*

	II			
	<i>komnat</i> _f ('room')	<i>učitel'nic</i> _f ('fem. teacher')	<i>nedel'</i> _f ('week')	<i>muščin</i> _m ('man')
nom/sg	komnat-a	učitel'nic-a	nedel-ja	muščin-a
acc/sg	komnat-u	učitel'nic-u	nedel-ju	muščin-u
dat/sg	komnat-e	učitel'nic-e	nedel-e	muščin-e
gen/sg	komnat-y	učitel'nic-y	nedel-i	muščin-y
inst/sg	komnat-oj(u)	učitel'nic-ej(u)	nedel-ej(u)	muščin-oj(u)
loc/sg	komnat-e	učitel'nic-e	nedel-e	muščin-e

Next, inflection class III is illustrated in table T_3 . Abstracting away from a few exceptions, this class contains only feminine stems. All stems in this class end in a soft consonant. Class III shows fewer case differentiations (consequently, more intraparadigmatic syncretism) than classes I and II; in the singular, it employs only the three markers / \emptyset /, /i/, and /ju/ for the six cases. Some (highly frequent) nouns in this class exhibit stem alternation (compare *doč'* ('daughter'), *mat'* ('mother')).

T_3 : *Inflection class III, Sg.: fem*

	III		
	<i>tetrad'</i> _f ('notebook')	<i>myš'</i> _f ('mouse')	<i>doč'</i> _f ('daughter')
nom/sg	tetrad'- \emptyset	myš'- \emptyset	doč'- \emptyset
acc/sg	tetrad'- \emptyset	myš'- \emptyset	doč'- \emptyset
dat/sg	tetrad-i	myš-i	doč-er-i
gen/sg	tetrad-i	myš-i	doč-er-i
inst/sg	tetrad'-ju	myš'-ju	doč-er'-ju
loc/sg	tetrad-i	myš-i	doč-er-i

Finally, inflection class IV contains only neuter stems; see table T_4 . This class is similar to class I but differs in the choice of markers for nominative and accusative in the singular (class IV also differs from class I in the plural; see below). There is no animacy effect in the singular (even though there are some animate stems belonging to this class, like *suščestv* ('creature')); but, as before, there is [\pm back]-governed morphophonological variation (compare *pol'* ('field')).

The question arises how class membership can be determined for a given stem. Ideally, one might hope that independently motivated features on noun stems suffice for this purpose. However, it turns out that this is not the case. We will briefly discuss three possible candidates in this context: gender features, phonological features, and semantic features. Let us address gender features first. There is a one-to-one

T_4 : Inflection class IV, Sg.: neut

	IV			
	<i>mest_n</i> ('place')	<i>jablok_n</i> ('apple')	<i>suščestv_n</i> ('creature')	<i>pol'_n</i> ('field')
nom/sg	mest-o	jablok-o	suščestv-o	pol-e
acc/sg	mest-o	jablok-o	suščestv-o	pol-e
dat/sg	mest-u	jablok-u	suščestv-u	pol-ju
gen/sg	mest-a	jablok-a	suščestv-a	pol-ja
inst/sg	mest-om	jablok-om	suščestv-om	pol-em
loc/sg	mest-e	jablok-e	suščestv-e	pol-e

correspondence between gender and inflection class in the case of class IV: Neuter stems belong to this class, and this class contains only neuter stems. Unfortunately, things are not as simple for masculine and feminine stems: Masculine stems can belong to class I or to class II (with the former option the unmarked case), and feminine stems can belong to class II or to class III. Hence, gender features on the stem do not suffice to predict inflection class (see Corbett & Fraser (1993), Fraser & Corbett (1994)).

Consider next phonological features. The first thing to note is that the nature of the stem ending does not reliably predict class membership. Thus, noun stems belonging to classes I, II, and IV may end in either a hard or a soft consonant; and whereas all noun stems in class III end in a soft consonant, this does not imply that class membership can be predicted for these nouns, not even if gender information is also taken into account: A feminine noun stem ending in a soft consonant can belong to class II or class III (compare *nedel'* ('week') with *tetrad'* ('notebook')). Similarly, there are no theme vowels in modern Russian that might encode inflection class.⁷

Third, semantic features on a noun stem do not suffice to predict its inflection class; i.e.: None of the four inflection classes correlates unambiguously with a semantic

⁷ From a diachronic point of view, theme vowels, as extensions of stems, are ultimately responsible for the creation of the modern inflection classes (historically, classes I and IV employ a theme vowel /o/, class II relies on a theme vowel /a/, and class III chooses a theme vowel /i/); and traces of these theme vowels (as items belonging to the stem rather than to the ending) can still be found in Old Church Slavonic (see, e.g., Leskien (1955)). However, it seems hard to maintain that there are theme vowels left in modern Russian (see Wurzel (1984), Corbett & Fraser (1993)), despite some claims to the contrary (see Wunderlich (1996; 2004)): If, e.g., class II had a theme vowel /a/, this would imply a structure like *komnat-a-Ø* (with a theme vowel and a null inflection marker for case and number) in the nominative singular, and a structure like *komnat-Ø-u* (with an empty theme vowel and an inflection marker /u/ for case and number) in the accusative singular (and similarly for all the remaining cases). Such an approach would clearly miss the simple generalization that /a/ and /u/ have exactly the same status in class II, as inflection markers that encode case and number. – Note that this reasoning does not inherently preclude attempts to break down inflection markers (especially segmentally complex markers) into parts, as long as it is acknowledged that choice of the parts is determined by case/number information throughout, and cannot be independent of this information (as the notion of theme vowel presupposes). Analyses that postulate such a fine structure of Russian inflection markers are developed by Halle (1994) and Wiese (2004), but the underlying hypothesis by necessity leads to extremely abstract analyses (because the positions postulated as available for inflection marker segments are then very often not actually used, given the sheer quantity of mono-segmental markers in T_1 – T_4), and we will not pursue it here.

property.⁸ Note finally that not even a combination of gender, phonological, and semantic information suffices to fully predict class membership. For instance, a feminine, inanimate noun stem ending in a soft consonant may belong to class II or class III; a masculine, animate noun stem ending in a hard consonant may belong to class I or class II; and so forth. We can conclude from this that arbitrary class features are needed in the system of noun inflection in Russian; these features must be inherently present on noun stems. However, so far it is not quite clear what form these features have. An analysis of instances of syncretism in Russian noun inflection will provide an answer.

2.1.2. Analysis

Abstracting away from the various interfering factors mentioned above, and assuming that at least the vast majority of variation conditioned by the ending of the stem (hard or soft) can and should be accounted for by morpho-phonological rules (see in particular Halle (1994)), we can extract the system of inflection markers in table T₅ from the paradigms illustrating the four Russian noun inflection classes in the singular in T₁–T₄. This system exhibits both intra-paradigmatic syncretism and trans-paradigmatic syncretism.

T₅: *Syncretism within and across inflection classes in Russian*

	I _m	II _{f,m}	III _f	IV _n
nom/sg	∅	a	∅	o
acc/sg	∅/a	u	∅	o
dat/sg	u	e	i	u
gen/sg	a	i	i	a
inst/sg	om	oj	ju	om
loc/sg	e	e	i	e

Examples of intra-paradigmatic syncretism include /o/ as the inflection marker for nominative and accusative singular in class IV; /i/ for dative, genitive, and locative in class III; /e/ for dative and locative in class II; and /∅/ for nominative and accusative (with inanimate stems) in class I. In addition, there are also many instances of trans-paradigmatic syncretism. For instance, /i/ is not confined to the dative, genitive, and locative of class III; this marker also shows up in the genitive of class II; similarly, /∅/ shows up in the nominative and accusative of both class I and class III; /om/ is the instrumental marker for class I and class IV; /u/ is an accusative marker for class II, but also a dative marker for classes I and IV; and so forth.

A simple and elegant method to account for intra-paradigmatic syncretism goes back to work by Roman Jakobson and Manfred Bierwisch. The central observation here is that intra-paradigmatic syncretism shows that cases can form natural classes, and the basic idea is that these natural classes of cases can be captured straightforwardly

⁸ Recall that this also holds for class IV: Neuter stems are typically inanimate, but there are some neuter stems which are animate, like *suščestv* ('being').

by decomposing the standard (privative) case features into more primitive binary case features: Full cross-classification of these features then yields the traditional cases (as they are relevant in syntax); and underspecification with respect to these primitive case features captures natural classes of cases. The primitive, underlying case features are mainly semantics-based in Jakobson (1962a;b) (and also in much work on Russian noun inflection that follows the Jakobsonian tradition; see in particular Neidle (1988) and Franks (1995)); in contrast, they are syntax-based in Bierwisch (1967) (and in some subsequent work on German nominal – i.e., pronominal or noun – inflection based on this tradition, like Wiese (1999), Blevins (2000), and Müller (2002)). We adopt the latter view here, and suggest that Russian cases are decomposed into combinations of the three privative features [\pm subject], [\pm governed], [\pm oblique], as shown in (2).⁹

(2) *Decomposition of cases in Russian:* [\pm subject], [\pm governed], [\pm oblique]

nominative:	[+subj,–gov,–obl]
accusative:	[–subj,+gov,–obl]
dative:	[–subj,+gov,+obl]
genitive:	[+subj,+gov,+obl]
instrumental:	[+subj,–gov,+obl]
locative:	[–subj,–gov,+obl]

It follows from (2) that nominative and accusative form a natural class characterized by the feature [–obl]; that accusative and dative form a natural class characterized by the feature combination [–subj,+gov]; that dative and locative form a natural class characterized by [–subj,+obl]; and so on. The choice of the correct inflection marker for any given context can then be determined by underspecified case information capturing a natural class of cases, rather than by fully specified case information that encodes a specific case; this derives instances of intra-paradigmatic syncretism.¹⁰

⁹ The features [\pm governed], [\pm oblique] go back to Bierwisch’s discussion of German; the feature [\pm subject] is introduced by Wiese (2001) for Latin. Note that the feature combinations that characterize the syntactic cases can to some extent be motivated independently: Nominative, genitive (in DPs), and instrumental (in passives) typically show up on “subject” DPs (with “subject” understood as “last-merged argument of a predicate”); hence, they qualify as [+subj], and the remaining cases as [–subj]. Accusative, dative, and genitive are the prototypical cases of internal arguments of verbs (i.e., arguments governed by V); hence, they are [+gov], and the remaining cases [–gov]. Finally, dative, genitive, instrumental, and locative are oblique cases, which are therefore characterized as [+obl], with nominative and accusative emerging as [–obl].

¹⁰ We take the feature decomposition approach to syncretism to be well-established and will not attempt to justify it here. However, it may be worth noting that many approaches to syncretism that purportedly do without feature decomposition do in fact rely on abstract features that capture the natural classes after all, but only by stipulation – see, e.g., the property [oblique] in Blevins (2004, 82) and Wiese (2004, 324), or the property [X] (comprising nom/sg and acc/sg) in Baerman (2005a, 812) (based on Zwicky (2000)). The main difference between this type of analysis and a feature decomposition approach then simply is that the former theory is less constrained than the latter.

That said, there *is* an open question raised by the feature decomposition approach since its earliest manifestations: Decomposed features like, e.g., the case features currently under consideration may be accessible in syntax (see the previous footnote), but *not* for case assignment; in other words, there are no case assigners that require an *underspecified* case on the assignee. A solution to this problem

We propose that trans-paradigmatic syncretism can be accounted for in the same way, by decomposing privative class features as they are standardly assumed (like [class I], [class II], etc.) into more primitive, binary class features. A cross-classification of primitive class features yields fully specified class information (i.e., the standard inflection classes); underspecification with respect to these features yields natural classes of inflection classes. More specifically, we suggest that the four noun inflection classes of Russian result from the cross-classification of two binary inflection class features, as in (3).¹¹ Inflection class features, whether decomposed or not, are not motivated independently, outside morphology (and, as we will argue in section 3, they are in fact uninterpretable in syntax).¹² Accordingly, the decomposed features are given the arbitrary names $[\pm\alpha]$, $[\pm\beta]$ in (3), so as to indicate that they have the same (i.e., purely formal, morphology-based) status as traditional class features like [I], [II], etc.

(3) *Decomposition of inflection classes in Russian:* $[\pm\alpha]$, $[\pm\beta]$

I:	$[+\alpha, -\beta]$	<i>zavod_m</i> ('factory')
II:	$[-\alpha, +\beta]$	<i>komnat_f</i> ('room?'), <i>muščin_m</i> ('man')
III:	$[-\alpha, -\beta]$	<i>tetrad'_f</i> ('notebook')
IV:	$[+\alpha, +\beta]$	<i>mest_n</i> ('place')

It follows from (3) that classes I and IV form a natural class (characterized by $[+\alpha]$); the same goes for classes I and III ($[-\beta]$), classes II and III ($[-\alpha]$), and classes II and IV ($[+\beta]$). However, classes I and II do not form a natural class, and classes III and IV do not form a natural class either. Thus, the prediction is that there can be instances of trans-paradigmatic syncretism that exclusively affect classes I and III, I

is beyond the scope of the present article.

¹¹ There are predecessors of this idea. Relying on standard, privative class features in their account of Russian noun inflection, Corbett & Fraser (1993) suggest a common additional fifth class feature [class 0] that co-occurs with inflection class features I and IV. This “meta-inflection class feature” is invoked in order to account for instances of trans-paradigmatic syncretism affecting inflection classes I and IV. However, this approach does not extend to other instances of trans-paradigmatic syncretism; moreover, the existence of a natural class comprising the inflection classes I and IV is simply stipulated (by assuming an additional feature 0), and not derived (by feature decomposition; see the previous footnote). More closely related to the present proposal are three analyses that envisage genuine class feature decomposition (and that all came to our knowledge only after the first draft of the present paper had been completed): First, Halle (1992, 38) employs the primitive, decomposed features $[\pm\text{marginal}]$, $[\pm\text{marked}]$ (in addition to the “standard” class features A, B) in his analysis of Latvian noun inflection, essentially so as to account for instances of trans-paradigmatic syncretism. Second, Nessel (1994, 229ff) develops an analysis of Russian noun inflection that uses $[\pm\text{nom-end}]$ and $[\alpha/\text{igen-end}]$ as primitive class features, again in order to account for instances of trans-paradigmatic syncretism. The analysis has a limited scope (involving only a few of the attested cases of trans-paradigmatic syncretism, and no cases of intra-paradigmatic syncretism), and stays somewhat informal (e.g., theoretical issues arising with underspecification and competition of inflection markers are not explored – more generally, no attempt is made to account for the whole system of noun inflection in a systematic way); nevertheless, it is clearly guided by the same underlying idea. Third, a decomposition of class features that is very similar to the one suggested here is proposed by Oltra Massuet (1999) in her approach to Catalan verb morphology. (Also see Trommer (2005b) for a more recent version of this idea, applied to Amharic verbs.)

¹² In particular, primitive inflection class features fail to strictly correlate with gender features just

and IV, II and III, and II and IV, but not classes I and II, and not classes III and IV. This prediction will be shown to be borne out.

As noted, underspecification with respect to case features and inflection class features encodes natural classes of cases and inflection classes, and thus acts as the key to intra-paradigmatic and trans-paradigmatic syncretism, respectively. At this point, the choice of a specific approach to inflectional morphology becomes necessary. We assume that inflection markers as they show up in T_5 are morphemes that are stored in the lexicon.¹³ As part of their lexical entry, inflection markers bear morpho-syntactic features. The inflection markers currently under consideration can be assumed to bear a categorial feature [+N] that ensures combination with a noun stem. In addition, they bear case and class features; crucially, case and class feature specifications on inflection markers may be – and typically are – underspecified. The inflection markers used in the singular of Russian noun inflection are listed in (4).

(4) *Russian inflection markers (singular):*

1. /oj/:	{[+N],[− α ,+ β],[+subj,−gov,+obl]}
2. /ju/:	{[+N],[− α ,− β],[+subj,−gov,+obl]}
3. /om/:	{[+N],[+ α],[+subj,−gov,+obl]}
4. /e/:	{[+N],[− α ,+ β],[−subj,+obl]}
5. /e/:	{[+N],[+ α],[−subj,−gov,+obl]}
6. /o/:	{[+N],[+ α ,+ β],[−obl]}
7. /Ø/:	{[+N],[− β],[−obl]}
8. /i/:	{[+N],[− α],[+obl]}
9. /u/:	{[+N],[−subj,+gov]}
10. /a/:	{[+N]}

like the standard inflection classes do. There is no correlation of [+ β] or [− β] with gender features at all; and even though [+ α] classes contain non-feminine stems, and [− α] classes contain predominantly feminine stems, the correlation is not complete because masculine stems may also show up in the [− α] class II. Hence, gender features cannot possibly play the role of primitive inflection class features in Russian. This conclusion will be enforced by evidence from Greek and German below. – That said, the situation might be slightly different in Icelandic. Icelandic has many noun inflection classes and exhibits trans-paradigmatic syncretism in abundance, which again supports a decomposition of inflection classes into combinations of primitive class features (see Müller (2005b)). Some of these primitive class features then do in fact seem to strictly correlate with gender information. However, others have no such grounding, so the main conclusion remains valid.

General questions concerning possible inventories of these primitive inflection class features and their status as universal or acquired on the basis of linguistic input (presumably by invoking general strategies of object perception and object categorization) arise under this view in the same way that they arise under the standard view based on class features like [I], [II], and we do not have any specific claims to make concerning this issue.

¹³ We will motivate this assumption in section 4 below. For the time being, the gist of our analysis could equally well be formulated in stem-/word-and-paradigm models in which inflection markers are introduced by rules or schemas (see Anderson (1992), Aronoff (1994), Stump (2001), and references cited in these works), or in a distributed morphology approach in which inflection markers are vocabulary items that are post-syntactically inserted into positions provided by designated functional heads (see Halle & Marantz (1993), Harley & Noyer (2003), and references cite there).

With the exception of the instrumental markers /oj/, /ju/, and /om/ in (4-1)–(4-3), all inflection markers in (4) are underspecified with respect to case. Moreover, many inflection markers are also underspecified with respect to class, viz.: /om/ in (4-3); /e/ in (4-5); the null marker /Ø/ in (4-7); and /i/ in (4-8) (here and in what follows, underspecified class information is underlined in inflection marker specifications). Indeed, two markers bear no class information at all: /u/ in (4-9), and the default (or elsewhere) marker /a/ in (4-10).

Suppose now that noun stems, in contrast to inflection markers, always bear fully specified case, class, number, and gender features; for now, we can assume that all these features are inherently present on a noun stem in the lexicon (we will modify this assumption slightly in section 4). In a language like Russian, a noun stem must (normally, i.e., unless it belongs to the class of indeclinables) combine with an inflection marker in morphology. The choice of inflection marker for a fully specified noun stem can be taken to follow from the Subset Principle, a version of which we have formulated in (5).¹⁴

(5) *Subset Principle:*

An inflection marker I is merged with a stem S iff (i) and (ii) hold:

- (i) The morpho-syntactic features of I are a subset of the morpho-syntactic features of S .
- (ii) I is the most specific marker that satisfies (i).

It follows from (5-i) that quite often, there is a priori more than one inflection marker which could be combined with a given noun stem. To see this, consider, as an extreme case, the following situation: A noun stem like *komnat* ('room') has been selected from the lexicon, bearing the inherent features [+N] (category: noun), $[-\alpha, +\beta]$ (class: II), $[-\text{subj}, +\text{gov}, +\text{obl}]$ (case: dative), $[-\text{pl}]$ (number: singular), and $[\text{+fem}]$ (gender: feminine). The inflection markers in (4) whose morpho-syntactic features are a subset of the morpho-syntactic features of this noun stem are /a/ in (4-10) – or, as we will write from now on, /a/₁₀ –, which has no morpho-syntactic case or class features and therefore fits with every noun stem; /u/₉, which, on the view adopted here, is a general marker for accusative and dative, without class restriction; /i/₈, which, under present assumptions, turns out to be a simple obliqueness marker for (the predominantly feminine) classes II and III; and /e/₄ (a dative/locative marker for class II). Such a competition is systematically resolved by requirement (5-ii), according to which the most specific marker of the competing items must be chosen (in the case at hand, this must be /e/). Specificity of inflection markers is defined in (6).

(6) *Specificity of inflection markers:*

An inflection marker I_i is more specific than an inflection marker I_j iff there is a set of features \mathbb{F} such that (i) and (ii) hold.

- (i) I_i bears more features in \mathbb{F} than I_j does.

¹⁴ See Kiparsky (1973), Lumsden (1992), Noyer (1992), Williams (1994), Halle (1997), Williams (1997), Gunkel (2003), and Zifonun (2003) for versions of this principle, sometimes under different names. The present formulation is closest to the one Halle (1997) gives.

(ii) There is no higher-ranked set of features \mathbb{F}' such that I_i and I_j have a different number of features in \mathbb{F}' .

(6) presupposes a hierarchy of different feature sets (or feature classes); see Lumsden (1992), Noyer (1992). For present purposes, the partial hierarchy in (7) is sufficient.

(7) *Hierarchy of feature classes:*

Number \gg class \gg case

Simplifying a bit, an inflection marker is more specific than another inflection marker if it has more and higher-ranked features, where quality of the features is more important than quantity.¹⁵ Going back to the above example of the competition among inflection markers in the case of the singular, dative-marked class II noun *komnat*, it is now clear that of the four competing markers $/a/_{10}$, $/u/_{9}$, $/i/_{8}$, and $/e/_{4}$, the last one is most specific: Class features outrank case features; therefore, $/a/_{10}$ and $/u/_{9}$, which have no class features, are less specific than $/i/_{8}$ and $/e/_{4}$, which bear class features. Of the latter two, $/i/_{8}$ bears fewer class features than $/e/_{4}$ (viz., $[-\alpha]$ vs. $[-\alpha, +\beta]$); hence, in the absence of any number features in (4), $/e/_{4}$ is chosen as the most specific marker that fits into the morpho-syntactic context provided by *komnat* in the case at hand.

More generally (at least as a strong tendency), specificity decreases from top to bottom in (4) – the fully specified instrumental markers $/oj/_{1}$ and $/ju/_{2}$ are most specific, and the radically underspecified marker $/a/_{10}$ is least specific. Table T₆ then illustrates how the assumptions about underspecified morpho-syntactic features on inflection markers in (4) and the specificity-based Subset Principle in (5) interact to derive the system of Russian noun inflection in T₅ (with the exception of the animacy effect in class I, to which we will turn shortly).¹⁶

T₆: *The interaction of inflection markers in the singular in Russian*

	I: $[\alpha, -\beta]$	II: $[-\alpha, +\beta]$	III: $[-\alpha, -\beta]$	IV: $[\alpha, +\beta]$
nom/sg: [+subj, -gov, -obl]	$/\emptyset/_{7}$ ($/a/_{10}$)	$/a/_{10}$	$/\emptyset/_{7}$ ($/a/_{10}$)	$/o/_{6}$ ($/a/_{10}$)
acc/sg: [-subj, +gov, -obl]	$/\emptyset/_{7}$ ($/u/_{9}, /a/_{10}$)	$/u/_{9}$ ($/a/_{10}$)	$/\emptyset/_{7}$ ($/u/_{9}, /a/_{10}$)	$/o/_{6}$ ($/u/_{9}, /a/_{10}$)
dat/sg: [-subj, +gov, +obl]	$/u/_{9}$ ($/a/_{10}$)	$/e/_{4}$ ($/i/_{8}, /u/_{9}, /a/_{10}$)	$/i/_{8}$ ($/u/_{9}, /a/_{10}$)	$/u/_{9}$ ($/a/_{10}$)
gen/sg: [+subj, +gov, +obl]	$/a/_{10}$	$/i/_{8}$ ($/a/_{10}$)	$/i/_{8}$ ($/a/_{10}$)	$/a/_{10}$
inst/sg: [+subj, -gov, +obl]	$/om/_{3}$ ($/a/_{10}$)	$/oj/_{1}$ ($/i/_{8}, /a/_{10}$)	$/ju/_{2}$ ($/i/_{8}, /a/_{10}$)	$/om/_{3}$ ($/a/_{10}$)
loc/sg: [-subj, -gov, +obl]	$/e/_{5}$ ($/a/_{10}$)	$/e/_{4}$ ($/i/_{8}, /a/_{10}$)	$/i/_{8}$ ($/a/_{10}$)	$/e/_{5}$ ($/a/_{10}$)

¹⁵ This is of course reminiscent of optimality theory, and responsible for the fact that the definition of specificity in (6) bears an uncanny resemblance to the definition of optimality in optimality theory.

¹⁶ Each paradigm cell contains all markers that fit into a given morpho-syntactic context provided by a noun stem. The most specific of competing markers that is chosen by the Subset Principle is given in bold face; the remaining markers are given in the line below, in parentheses.

As shown in T_6 , almost all instances of intra- and trans-paradigmatic syncretism are now accounted for systematically, in accordance with the meta-grammatical principle (1). Thus, there is only one lexical entry for /a/, viz., /a/₁₀; this marker’s distribution is not homogeneous (nominative of class II, genitive of classes I and IV), but this is solely due to the fact that /a/ is an extremely non-specific default marker that fits into every context but can actually emerge in a paradigm cell only if there is no more specific marker available – and this is the only property that unites the contexts in which /a/ does show up. Similarly, there is only one entry each for /u/, /i/, /Ø/, and /o/, as well as for the highly specific instrumental markers /oj/, /ju/, and /om/. The only exception is /e/, for which two entries must be assumed: /e/₄ is a dative/locative marker of class II, and /e/₅ is a locative marker for classes I and IV. At this point, we wish to leave open the question whether this reflects an imperfection of the analysis or an imperfection of the system as such.¹⁷

So far, we have not yet addressed the plural. Focussing again on the core cases, it turns out that the system of Russian noun inflection is much simpler in the plural than it is in the singular. Table T_7 lists the basic patterns of the four inflection classes (as with the discussion of class I in the singular, for now we abstract away from an animacy effect in accusative contexts).¹⁸

T_7 : *Inflection classes I-IV in the plural*

	I	II	III	IV
	<i>zavod_m</i> ('factory')	<i>komnat_f</i> ('room')	<i>tetrad'_f</i> ('notebook')	<i>mest_n</i> ('place')
nom/pl	zavod-y	komnat-y	tetrad-i	mest-a
acc/pl	zavod-y	komnat-y	tetrad-i	mest-a
dat/pl	zavod-am	komnat-am	tetrad-jam	mest-am
gen/pl	zavod-ov	komnat-Ø	tetrad-ej	mest-Ø
inst/pl	zavod-ami	komnat-ami	tetrad-jami	mest-ami
loc/pl	zavod-ax	komnat-ax	tetrad-jax	mest-ax

The inflection markers for dative, instrumental, and locative plural are invariant across inflection classes; in this respect, they resemble agglutinative markers. With respect to the nominative/accusative plural markers, there are two possibilities: The

¹⁷ Closer inspection reveals a further interesting property of the markers in (4): A decrease in specificity from top to bottom seems to go hand in hand with an increase in sonority; i.e., the system exhibits iconicity in the sense that similarity of form implies similarity of function. This tendency becomes even stronger when we follow Halle (1994) in analyzing the null marker /Ø/ as an abstract vowel (yer) /O/ that undergoes PF deletion, and also take into account the fact that /e/, unlike all the other vocalic markers, always has an initial glide, which in effect makes this marker quasi-consonantal, and at any rate less sonorous; see Müller (2004) for a detailed account along these lines, incorporating observations in Shapiro (1969, 14) and Plank (1979, 143). Note incidentally that this consideration might ultimately also shed new light on the special behaviour of /e/ just mentioned in the main text: /e/ differs from /i/, /u/, /a/, etc., both with respect to its function and its form.

¹⁸ As before, there is systematic morpho-phonological variation determined by the characterization of a stem-final consonant as [+back] or [-back]. Thus, /i/ is realized as *i* in [-back] environments, as *y* in [+back] environments; and so on. Note in particular that /ov/ is realized as *ej* after a [-back] consonant (i.e., always in class III, and sometimes in class I); see Halle (1994, 50).

first option is to assume that /i/ is a [-obl] marker not restricted by class information, and to treat /a/ as the special case that is confined to class IV (although there is a substantial drift of /a/ into class I as well). The second option is to assume that /a/ is the more general marker, as it is in the singular, and to treat /i/ as the more special case; this then necessitates the assumption that complements of natural classes can also figure in inflection marker entries (see Zwicky (1970)). Although considerations related to iconicity (see footnote 17) might ultimately favour the second option, we will adopt the first, more parsimonious option here, mainly for reasons of simplicity. This leaves the two genitive markers /ov/ (realized as *ov* or *ej*) and /Ø/: The former shows up in classes I and III, the latter in classes II and IV, and this is captured straightforwardly in the respective entries, given that class I and class III form a natural class defined by [-β], and that class II and class IV form a natural class defined by [+β].¹⁹ The list of markers for the plural of Russian noun inflection is given in (8) (as before, underspecified class information is underlined>, and specificity decreases from top to bottom among the markers that show interaction).

(8) *Russian inflection markers (plural):*

- | | |
|-----------|--|
| 1. /ax/: | {[+N],[+pl],[-subj,-gov,-+obl]} |
| 2. /ami/: | {[+N],[+pl],[+subj,-gov,+obl]} |
| 3. /am/: | {[+N],[+pl],[-subj,+gov,+obl]} |
| 4. /ov/: | {[+N],[+pl], <u>[-β]</u> ,[+subj,+gov,+obl]} |
| 5. /Ø/: | {[+N],[+pl],[+β],[+subj,+gov,+obl]} |
| 6. /a/: | {[+N],[+pl],[+α,+β], [-obl]} |
| 7. /i/: | {[+N],[+pl],[-obl]} |

The (minimal) interaction of plural markers is shown in table T₈. Note that there is no principled reason that would keep the singular markers in (4) from competing with plural markers. However, given that the plural markers in (8) all bear the feature [+pl], and given that the singular markers in (4) do not bear any number feature, singular markers can never become the most specific markers for any given plural environment: Plural features outrank class and case features on the hierarchy of features in (7).²⁰

¹⁹ There is a well-known generalization concerning an alternation between nominative singular and genitive plural with respect to the occurrence of /Ø/: An inflection class has /Ø/ in the genitive plural iff it does not have /Ø/ in the nominative singular; classes I, III have /Ø/ in the nominative singular, and classes II, IV in the genitive plural. It is not quite clear whether there could be a simple, conservative way to make this follow under the present set of assumptions (but see footnote 27). In any event, it seems that an account of *all* such “trans-number” syncretisms (including /a/ and /i/) in terms of underspecification of morpho-syntactic features assumption must remain out of reach for systematic reasons. Hence, in line with our guiding assumption that there is no systematic syncretism across numbers, we will consider the singular/plural alternation effect with /Ø/ accidental from a purely synchronic perspective. (Incidentally, all systematic accounts of this phenomenon that we know of require a significantly more complex approach, e.g., by permitting reference to existing output forms in the determination of markers; see Bailyn & Nevins (2003) for a recent analysis.)

²⁰ Conversely, plural markers can never compete in singular environments because their morpho-syntactic features include [+pl], which implies that they can never qualify as a subset of the features of a singular noun stem, which includes the feature [-pl].

For this reason, competing singular markers are not listed in T_8 .

T_8 : *The interaction of inflection markers in the plural in Russian*

	I: [+ α , - β]	II: [- α , + β]	III: [- α , - β]	IV: [+ α , + β]
nom/pl: [+subj, -gov, -obl]	/i/ ₇	/i/ ₇	/i/ ₇	/a/ ₆ (/i/ ₇)
acc/pl: [-subj, +gov, -obl]	/i/ ₇	/i/ ₇	/i/ ₇	/a/ ₆ (/i/ ₇)
dat/pl: [-subj, +gov, +obl]	/am/ ₃	/am/ ₃	/am/ ₃	/am/ ₃
gen/pl: [+subj, +gov, +obl]	/ov/ ₄	/Ø/ ₅	/ov/ ₄	/Ø/ ₅
inst/pl: [+subj, -gov, +obl]	/ami/ ₂	/ami/ ₂	/ami/ ₂	/ami/ ₂
loc/pl: [-subj, -gov, +obl]	/ax/ ₁	/ax/ ₁	/ax/ ₁	/ax/ ₁

Taking the singular and plural paradigms together, we end up with an interesting result: For each natural class of inflection classes that is predicted to be possible under class feature decomposition, there is indeed at least one marker that refers to it. A list of inflection markers that thus refer to underspecified class information is given in (9):

- (9) [+ α] (I, IV): /om/ (Sg.), /e/ (Sg.)
 [- α] (II, III): /i/ (Sg.)
 [+ β] (II, IV): /Ø/ (Pl.)
 [- β] (I, III): /Ø/ (Sg.), /ov/ (Pl.)

Thus far, we have not yet said anything about the animacy effect that shows up with class I in the singular, and with all inflection classes in the plural, and that consists of inserting the respective genitive marker in accusative environments with animate stems. The resulting instances of syncretism look very different from the ones addressed so far, and we believe that they should therefore not be captured in the same way, by underspecified feature matrices on inflection markers. Thus, we would like to suggest that the animacy-induced instances of accusative/genitive syncretism go back to two rules of referral (see Zwicky (1985)), i.e., rules that explicitly state (rather than derive) the fact that the marker for a given morpho-syntactic context is identical to the marker of some other morpho-syntactic context; such a rule may thus override the results of the core system based on underspecification. The following rules of referral are based on similar rules in Corbett & Fraser (1993, 135) and Stump (2001, 229); the suspension of the decomposition- and specificity-based outcome by this rule is reflected in the formulation of the rule (where “ $I_{\{...\}}$ ” stands for “the inflection marker determined by the Subset Principle for context {...}”, and “ \rightarrow ” stands for “is replaced by”).²¹

²¹ One might speculate whether these rules ultimately have a functional motivation, essentially that of ensuring differential object marking (as discussed in Aissen (2003) and literature cited there); see Comrie (1978) and Baerman et al. (2002). Also see Wunderlich (2004), whose optimality-theoretic account of the phenomenon incorporates this insight.

- (10) a. $I_{\{[+\alpha, -\beta], [-subj, +gov, -obl]\}} \rightarrow I_{\{[+\alpha, -\beta], [+subj, +gov, +obl]\}} / [+animate] ___.$
 b. $I_{\{[+pl], [-subj, +gov, -obl]\}} \rightarrow I_{\{[+pl], [+subj, +gov, +obl]\}} / [+animate] ___.$

This concludes our discussion of Russian noun inflection. The main result is that class features are indispensable in an account of this system, and that there is also good reason to assume that they are quite abstract, binary features: Full specification with respect to these features encodes the standard inflection classes, and underspecification with respect to these features yields natural classes of inflection classes, which permits a systematic account of trans-paradigmatic syncretism. In the next section, we will see that the situation is completely analogous in Greek.

2.2. Noun Inflection in Greek

2.2.1. Data

Modern Greek has three major cases: nominative, accusative, and genitive. In addition, there is a fourth vocative case.²² As for the number of inflection classes, a traditional view that is documented in, e.g., Ruge (1986) recognizes three inflection classes. In contrast, Ralli (1994) argues that there are eight inflection classes. We adopt the system argued for by Ralli here (and also her numbering of the inflection classes); but it should be clear that class feature decomposition permits the formation of natural classes of inflection classes, which can then accommodate the more traditional view (to the extent that it proves correct).

Let us begin with inflection class I; see table T₉. This class contains masculine and some feminine noun stems. It shows the greatest variety of inflection markers, with only one instance of intra-paradigmatic syncretism arising (/i/ in the nominative/vocative plural). This inflection class has also appropriately been called the “declension of the seven forms” (see Ruge (1986, 30)).

T₉: *Inflection class I: masc, fem*

	I	
	<i>anθrop_m</i> (‘man’)	<i>psif_f</i> (‘vote’)
nom/sg	anθrop-os	psif-os
acc/sg	anθrop-o(n)	psif-o(n)
gen/sg	anθrop-u	psif-u
voc/sg	anθrop-e	(psif-e)
nom/pl	anθrop-i	psif-i
acc/pl	anθrop-us	psif-us
gen/pl	anθrop-on	psif-on
voc/pl	anθrop-i	psif-i

Next, inflection classes II, III, and IV are illustrated in table T₁₀. Class II contains only masculine stems; class III and class IV are confined to feminine stems. These

²² The discussion in this section is mainly based on the following sources: Mackridge (1985), Babiniotis (1986), Ruge (1986), Ralli (1994), Ralli (2002), and Alexiadou (2004); see also the contributions in Anastasiadi-Simeonidi et al. (2003).

inflection classes show much more intra-paradigmatic syncretism than class I. In addition, there is substantial stem alternation, which, as before, we will remain silent about (note in particular that the examples given here all involve formation of the plural stem by subtraction of the final stem vowel). These three inflection classes are grouped together under the label of “s-principle” in Ruge (1986). Inflection classes that obey the s-principle are characterized by the occurrence of /s/ in the singular, either in the nominative or in the genitive (but never in both cases), with the masculine class II opting for the former, and the feminine classes III and IV opting for the latter.

*T*₁₀: *Inflection classes II-IV: masc, fem*

	II <i>maxit(i)</i> _m ('fighter')	III <i>avl(i)</i> _f ('yard')	IV <i>pol(i)(e)</i> _f ('city')
nom/sg	maxit-i-s	avl-i-∅	pol-i-∅
acc/sg	maxit-i-∅	avl-i-∅	pol-i-∅
gen/sg	maxit-i-∅	avl-i-s	pol-i-s
voc/sg	maxit-i-∅	avl-i-∅	pol-i-∅
nom/pl	maxit-es	avl-es	pol-is
acc/pl	maxit-es	avl-es	pol-is
gen/pl	maxit-on	avl-on	pol-e-on
voc/pl	maxit-es	avl-es	pol-is

Finally, table *T*₁₁ lists the four neuter classes; these classes share some markers (most notably in the plural), but are otherwise sufficiently different to preclude grouping them under a single inflection class.

*T*₁₁: *Inflection classes V-VIII: neut*

	V <i>vun</i> _n ('mountain')	VI <i>krat</i> _n ('state')	VII <i>spiti</i> _n ('house')	VIII <i>soma(t)</i> _n ('body')
nom/sg	vun-o	krat-os	spiti-∅	soma-∅
acc/sg	vun-o	krat-os	spiti-∅	soma-∅
gen/sg	vun-u	krat-us	spitj-u	soma-t-os
voc/sg	vun-o	krat-os	spiti-∅	soma-∅
nom/pl	vun-a	krat-i	spitj-a	soma-t-a
acc/pl	vun-a	krat-i	spitj-a	soma-t-a
gen/pl	vun-on	krat-on	spitj-on	soma-t-on
voc/pl	vun-a	krat-i	spitj-a	soma-t-a

As in Russian, class membership cannot be determined on the basis of inherent features of noun stems in Greek. Thus, gender features do not suffice for this purpose: Masculine noun stems can belong to either class I or class II; feminine noun stems can belong to class I, class III, or class IV; and neuter noun stems can belong to any of the classes in V–VIII. Similarly, phonological features on the noun stem do not suffice to predict inflection class: What one might initially take to be a theme vowel is either a part of the ending, in which case it cannot encode inflection class by definition; or it is a part of the stem, where it fails to unambiguously encode inflection class. Compare, e.g., *maxit(i)* ('fighter'), *papa(δ)* ('priest'), and *papu(δ)* ('grandfather'), all of which

belong to class II. Finally, semantic features on the stem (like [\pm animate]) also fail to predict inflection class. The conclusion to be drawn from this is again that pure class features are indispensable. And, as in Russian, the widespread occurrence of trans-paradigmatic syncretism provides strong arguments for decomposing these features into more abstract items.

2.2.2. Analysis

The core of the Greek noun inflection system is given in table T₁₂. There is both intra-paradigmatic syncretism (see, e.g., /o/ in the nominative and accusative singular of class V) and trans-paradigmatic syncretism (as in the case of /u/, which shows up in genitive singular environments of classes I, V, and VII).

T₁₂: *Syncretism within and across inflection classes in Greek*

	‘7 forms’	‘s-principle’			‘neuter’			
	I _{m,f}	II _m	III _f	IV _f	V _n	VI _n	VII _n	VIII _n
nom/sg	os	s	∅	∅	o	os	∅	∅
acc/sg	o(n)	∅	∅	∅	o	os	∅	∅
gen/sg	u	∅	s	s	u	us	u	os
voc/sg	e	∅	∅	∅	o	os	∅	∅
nom/pl	i	es	es	is	a	i	a	a
acc/pl	us	es	es	is	a	i	a	a
gen/pl	on	on	on	on	on	on	on	on
voc/pl	i	es	es	is	a	i	a	a

As before, intra-paradigmatic syncretism can be traced back to natural classes of cases resulting from case feature decomposition, and lexical entries of inflection markers referring to these natural classes via underspecification. The Greek case system is simpler than the one found in Russian to begin with. Furthermore, we will abstract away from the vocative in what follows (which has a form different from the nominative form only in class I). Decomposition of the three remaining cases in Greek can then be taken to be identical to what we have seen for the respective cases in Russian, except for the absence of the feature [\pm subject]; see (11).²³

(11) *Decomposition of cases in Greek*: [\pm governed], [\pm oblique]

nominative: [\neg gov, \neg obl]
 accusative: [+gov, \neg obl]
 genitive: [+gov,+obl]

Next, again as before, trans-paradigmatic syncretism strongly suggests the presence of natural classes of inflection classes, and thus motivates the decomposition of class

²³ The Greek genitive characterization is thus a proper subset of both the Russian genitive and the Russian dative characterizations. This is in accordance with the syntactic evidence: The genitive in Greek, in addition to its prototypical DP-internal role, shows up in many syntactic contexts where other languages employ the dative, such as the indirect object of double object verbs.

features. Interestingly, although Greek has fewer cases than Russian, it has more noun inflection classes. We propose that the eight classes envisaged by Ralli (1994) result from the cross-classification of the three primitive class features $[\pm\alpha]$, $[\pm\beta]$, and $[\pm\gamma]$, as in (12).²⁴

(12) *Decomposition of inflection classes in Greek: $[\pm\alpha]$, $[\pm\beta]$, $[\pm\gamma]$*

I:	$[+\alpha, +\beta, +\gamma]$	<i>anθrop_m</i> ('man'), <i>psif_f</i> ('vote')
V:	$[+\alpha, +\beta, -\gamma]$	<i>vun_n</i> ('mountain')
VII:	$[+\alpha, -\beta, +\gamma]$	<i>spiti_n</i> ('house')
VIII:	$[+\alpha, -\beta, -\gamma]$	<i>soma(t)_n</i> ('body')
VI:	$[-\alpha, +\beta, +\gamma]$	<i>krat_n</i> ('state')
II:	$[-\alpha, +\beta, -\gamma]$	<i>maxit(i)_m</i> ('fighter')
IV:	$[-\alpha, -\beta, +\gamma]$	<i>pol(i)(e)_f</i> ('city')
III:	$[-\alpha, -\beta, -\gamma]$	<i>avl(i)_f</i> ('yard')

As shown in (13), inflection markers for the singular of Greek noun inflections may make crucial use of underspecified case and class information (the latter is again underlined in marker entries). Again, specificity of the markers decreases from top to bottom.

(13) *Greek inflection markers (singular):*

1. /o(n)/:	$\{[+N], [+ \alpha, + \beta, + \gamma], [+ \text{gov}, - \text{obl}]\}$
2. /os/:	$\{[+N], [+ \alpha, - \beta, - \gamma], [+ \text{gov}, + \text{obl}]\}$
3. /us/:	$\{[+N], [- \alpha, + \beta, + \gamma], [+ \text{gov}, + \text{obl}]\}$
4. /o/:	$\{[+N], [+ \alpha, + \beta, - \gamma], [- \text{obl}]\}$
5. /os/:	$\{[+N], [+ \beta, + \gamma], [- \text{obl}]\}$
6. /s/:	$\{[+N], [- \alpha, \text{N}\beta], [- \text{N}\text{gov}, - \text{N}\text{obl}]\}$
7. /u/:	$\{[+N], [+ \alpha], [+ \text{gov}, + \text{obl}]\}$
8. /Ø/:	$\{[+N]\}$

The marker /o(n)/₁ is fully specified as the accusative marker of class I; the markers /os/₂ and /us/₃ are fully specified as the genitive markers of classes VIII and VI, respectively. /o/₄ is a non-obliqueness marker for class V. /os/₅ is the first inflection marker that exhibits underspecified class information: It is the non-obliqueness marker for classes I and VI, which form a natural class characterized by the features $[+\beta, +\gamma]$ (however, /os/₅ is blocked in accusative singular contexts of class I by the more specific marker /o(n)/₁).

²⁴ The classes are not listed here according to the number they receive in Ralli's analysis, but according to shared class features, beginning (somewhat arbitrarily) with the $[\pm\alpha]$ distinction. Note that, as in Russian (see footnote 12), there is no strict correlation between gender information and the primitive class features adopted here: In particular, the four neuter declensions do not form a natural class; e.g., $[+\alpha]$ subsumes classes V, VII, and VIII but fails to cover class VI, integrating the masculine/feminine class I instead. Similar conclusions apply in the case of feminine stems; e.g., $[-\alpha]$ does not correlate with feminine gender because of the neuter and masculine classes VI and II, respectively; $[-\beta]$ does not correlate with feminine gender because of the neuter classes VII and VIII; and class I, which contains feminine stems, is not characterized by either $[-\alpha]$ or $[-\beta]$. Finally, the same goes for masculine stems: The only feature that class I and class II have in common is $[+\beta]$, which also characterizes the neuter classes V and VI.

Next, /s/₆ emerges a special type of marker: Instead of bearing the features $[-\alpha, +\beta]$ or $[-\alpha, -\beta]$, it is characterized by the feature specification $[-\alpha, \aleph\beta]$; and similarly for its case specification. Here, \aleph is a variable ranging over the feature values \pm . Assuming that variables ranging over feature values can show up in morpho-syntactic specifications of inflection markers, the two /s/ markers in class II and classes III and IV can emerge as one.²⁵ Without this option, there would have to be two /s/ markers, one specified as $\{[+N], [-\alpha, +\beta], [-gov, -obl]\}$, and one specified as $\{[+N], [-\alpha, -\beta], [+gov, +obl]\}$, and the covariance of feature values for class and case would be left unaccounted for. In contrast, the use of variables over feature values captures the gist of the s-principle, which incorporates a combined economy/alternation effect (i.e., class II, III, and IV must use /s/ exactly once, in either the nominative or the genitive).^{26,27}

The last two markers in (13) are /u/₇, the genitive marker for $[+\alpha]$ -marked classes (which is blocked by more specific /os/₂ in class VIII); and finally /Ø/, the default marker that emerges whenever there is no more specific marker present. To conclude, all instances of syncretism in the singular of Greek noun inflection are accounted for, except for that involving /os/, which has two possible sources in the paradigm. As before, the imperfection may lie in the analysis or in the system as such, with the extremely specific distribution of /os/₂ (as opposed to that of /os/₅) arguably suggesting the latter. The interaction of inflection markers in the singular is illustrated in table T₁₃.²⁸

The noun inflection markers for plural environments in Greek are listed in (14). /on/₁ is an obliqueness marker on a par with its Russian counterparts /am/, /ami/, and /ax/ that is invariant across inflection classes. /is/₂ and /us/₃ are class-specific markers, indicating non-obliqueness in class IV and accusative in class I, respec-

²⁵ The \aleph -notation is originally known as the α -notation, a label that cannot be used here for obvious reasons. The concept was introduced in Chomsky (1965, 175 & 233) and Chomsky & Halle (1968, 83), and has been used in morphology in Noyer (1992) (but see Harley (1994)); also compare the rule for /i/-insertion in Halle (1992, 39), and, more generally, Johnston (1996).

²⁶ It seems plausible to assume that, other things being equal, markers with variables over feature values count as less specific than markers without such variables. Consequently, /s/₆ is blocked by a more specific /os/₅ in the fourth context in which we would otherwise expect it, viz., in the nominative singular of class VI.

²⁷ As noted by Jonathan Bobaljik (p.c.) and Alexis Dimitriadis (p.c.), the use of variables over feature values increases the number of possible natural classes. This is a welcome result for cases in Greek (because /s/₆ may then fit in nominative and genitive contexts), but it potentially undermines the above claim about classes I and II, and III and IV, not forming natural classes in Russian; for instance, a specification $[\aleph\alpha, -\aleph\beta]$ would encode a natural class comprising class I ($[+\alpha, -\beta]$) and class II ($[-\alpha, +\beta]$). More generally, the \aleph -notation is a powerful tool that needs to be severely restricted. For the problem at hand, we may assume that only one class feature of inflection markers may be specified by a variable over feature values (which ensures that there is no increase in natural classes of inflection classes). In addition, any use of this technique must be linguistically well motivated (as we take it to be in the case of the s-principle in Greek). – Note incidentally that the singular/plural alternation effect with /Ø/ in Russian (see footnote 19) might in principle be amenable to an analysis along these lines, given some modifications (with /Ø/ receiving a specification containing $[\aleph pl], [\aleph\beta]$); but we will not pursue the issue here.

²⁸ Note in passing that the system again seems to show indications of iconicity, with less sonorous markers in general emerging as more specific.

T_{13} : The interaction of inflection markers in the singular in Greek

	I: [+ α + β + γ]	II: [- α + β - γ]	III: [- α - β - γ]	IV: [- α - β + γ]	V: [+ α + β - γ]	VI: [- α + β + γ]	VII: [+ α - β + γ]	VIII: [+ α - β - γ]
nom/sg: [-gov,-obl], [-pl]	/os/5 (/Ø/8)	/s/6 (/Ø/8)	/Ø/8	/Ø/8	/o/4 (/Ø/8)	/os/5 (/s/6, /Ø/8)	/Ø/8	/Ø/8
acc/sg: [+gov,-obl], [-pl]	/o(n)/1 (/os/5, /Ø/8)	/Ø/8	/Ø/8	/Ø/8	/o/4 (/Ø/8)	/os/5 (/Ø/8)	/Ø/8	/Ø/8
gen/sg: [+gov,+obl], [-pl]	/u/7 (/Ø/8)	/Ø/8	/s/6 (/Ø/8)	/s/6 (/Ø/8)	/u/7 (/Ø/8)	/us/3 (/Ø/8)	/u/7 (/Ø/8)	/os/2 (/u/7, /Ø/8)

tively. More interesting in the present context is the observation that some of these markers crucially refer to underspecified class information, i.e., natural classes of inflection classes: /es/4 is a non-obliqueness marker for classes II and III, and /i/5 is a non-obliqueness marker for classes I and VI (where /i/5 is blocked by more specific /us/3 in the accusative plural of class I in exactly the same way that the singular marker /os/5 turned out to be blocked by the more specific singular marker /o(n)/1 in the accusative singular of class I; see T_{13}). The plural marker /a/6 does not carry any class or case information and thus qualifies as least specific.

(14) Greek inflection markers (plural):

1. /on/: { [+N],[+pl],[+gov,+obl] }
2. /is/: { [+N],[+pl],[- α ,- β ,+ γ],[-obl] }
3. /us/: { [+N],[+pl],[+ α ,+ β ,+ γ],[+gov,-obl] }
4. /es/: { [+N],[+pl],[- α ,- γ],[-obl] }
5. /i/: { [+N],[+pl],[+ β ,+ γ],[-obl] }
6. /a/: { [+N],[+pl],[-obl] }

Thus, the Syncretism Principle is adhered to without exception in the plural in Greek; the interaction of plural markers is shown in table T_{14} .

T_{14} : The interaction of inflection markers in the plural in Greek

	I: [+ α + β + γ]	II: [- α + β - γ]	III: [- α - β - γ]	IV: [- α - β + γ]	V: [+ α + β - γ]	VI: [- α + β + γ]	VII: [+ α - β + γ]	VIII: [+ α - β - γ]
nom/pl: [-gov,-obl], [+pl]	/i/5 (/a/6)	/es/4 (/a/6)	/es/4 (/a/6)	/is/2 (/a/6)	/a/6	/i/5 (/a/6)	/a/6	/a/6
acc/pl: [+gov,-obl], [+pl]	/us/3 (/i/5, /a/6)	/es/4 (/a/6)	/es/4 (/a/6)	/is/2 (/a/6)	/a/6	/i/5 (/a/6)	/a/6	/a/6
gen/pl: [+gov,+obl], [+pl]	/on/1	/on/1	/on/1	/on/1	/on/1	/on/1	/on/1	/on/1

2.3. Noun Inflection in German

2.3.1. Data

As a third and final illustration of the role of decomposed class features in inflectional morphology, we consider German noun inflection.²⁹ German has four cases: nominative, dative, accusative, and genitive. Inflection marking on nouns is minimal in the singular (quite in contrast to inflection marking on pronouns, determiners, and ‘strongly’ inflected adjectives). However, there are several differences in the plural, which, in interaction with the minimal marking options available in the singular, give rise to a substantial number of inflection classes. We assume that the core system of German noun inflection involves eight major inflection classes.³⁰

The first four classes are illustrated by the examples in table T₁₅. Class I contains masculine stems (for which it is the unmarked class) and neuter stems. It exhibits an inflection marker /*(e)s*/ in the genitive singular (where presence or absence of *e* depends on whether the stem ends in a consonant or in a vowel); otherwise, there is no overt marker in the singular, i.e., the marker is / \emptyset /. In the plural, the marker for non-dative cases is /*(e)*/ (realization as \emptyset or *e* is conditioned by whether or not the stem ends in a trochee whose second syllable consists of schwa plus /*n*/, /*l*/, or /*r*/; compare, e.g., the nominative plural *Segel* (‘sail’)); the marker for the dative is /*(e)n*/ (where *e*-realization obeys the same generalization).³¹ Class II is confined to masculine noun stems. It looks exactly like class I, except for the fact that there is umlaut in the plural; following standard practice, we note umlaut as a floating feature ” on the inflection marker; thus, class II employs the plural markers /”*(e)*/ and /”*(e)n*/. Class III is again identical in the singular; the plural markers are /”*er*/ (with an invariant *e*) for the non-dative cases, and /”*ern*/ for the dative. This class is arguably an unmarked class for neuter stems; but it also contains some masculine stems. Class IV contains masculine stems and neuter stems; it is marked for both of them. Inflection marking in the singular is as before; in the plural there is a uniform marker /*(e)n*/, with *e* realization depending on whether the stem ends in a vowel or in a consonant.

The remaining four major classes are illustrated in table T₁₆. Class V contains the so-called weak masculine noun stems; these stems take the inflection marker /*(e)n*/ in all environments except for nominative singular contexts, where they are not overtly

²⁹ The following discussion draws on Wurzel (1998), Cahill & Gazdar (1999), Blevins (2000), Eisenberg (2000), Wiese (2000), Sternefeld (2004), and literature cited in these works.

³⁰ In what follows, we disregard plural formation by means of the inflection marker /*s*/. We believe that a case can be made that /*s*-plurals lie outside the system of German noun inflection proper, with /*s*/ attaching essentially only to those items that resist integration into the regular inflectional system and require to be left unaffected by resyllabification, as it standardly occurs with other inflection markers in the plural (thus, /*s*-plural formation primarily affects loan-words and proper names, plus stems ending in a non-schwa vowel).

³¹ Given that we have assumed throughout that the inflection markers determined in the morphological component may undergo further modification towards PF, these systematic morpho-phonological alternations would not have to be indicated in the markers; we do so mainly for reasons of compatibility with the existing literature.

*T*₁₅: Inflection classes I–IV

	I		II	III		IV	
	<i>Hund</i> _m (‘dog’)	<i>Schaf</i> _n (‘sheep’)	<i>Baum</i> _m (‘tree’)	<i>Buch</i> _n (‘book’)	<i>Mann</i> _m (‘man’)	<i>Strahl</i> _m (‘ray’)	<i>Auge</i> _n (‘eye’)
nom/sg	Hund-Ø	Schaf-Ø	Baum-Ø	Buch-Ø	Mann-Ø	Strahl-Ø	Auge-Ø
acc/sg	Hund-Ø	Schaf-Ø	Baum-Ø	Buch-Ø	Mann-Ø	Strahl-Ø	Auge-Ø
dat/sg	Hund-Ø	Schaf-Ø	Baum-Ø	Buch-Ø	Mann-Ø	Strahl-Ø	Auge-Ø
gen/sg	Hund-es	Schaf-es	Baum-es	Buch-es	Mann-es	Strahl-s	Auge-s
nom/pl	Hund-e	Schaf-e	Bäum-e	Büch-er	Männ-er	Strahl-en	Auge-n
acc/pl	Hund-e	Schaf-e	Bäum-e	Büch-er	Männ-er	Strahl-en	Auge-n
dat/pl	Hund-en	Schaf-en	Bäum-en	Büch-ern	Männ-ern	Strahl-en	Auge-n
gen/pl	Hund-e	Schaf-e	Bäum-e	Büch-er	Männ-er	Strahl-en	Auge-n

marked. Classes VI, VII, and VIII are relevant only for feminine stems. Of these, class VI is the canonical, unmarked one: The markers are uniformly /Ø/ in the singular, and /(e)n/ in the plural. Class VII combines the singular of class VI with the plural of the masculine class II. Finally, class VIII is an extremely marked feminine class that differs from class VII only in having no umlaut in the plural, like the unmarked masculine class I (note that the final vowel in *Drangsal* (‘distress’) could in principle be subject to umlaut).

*T*₁₆: Inflection classes V–VIII

	V	VI	VII	VIII
	<i>Planet</i> _m (‘planet’)	<i>Ziege</i> _f (‘goat’)	<i>Maus</i> _f (‘mouse’)	<i>Drangsal</i> _f (‘distress’)
nom/sg	Planet-Ø	Ziege-Ø	Maus-Ø	Drangsal-Ø
acc/sg	Planet-en	Ziege-Ø	Maus-Ø	Drangsal-Ø
dat/sg	Planet-en	Ziege-Ø	Maus-Ø	Drangsal-Ø
gen/sg	Planet-en	Ziege-Ø	Maus-Ø	Drangsal-Ø
nom/pl	Planet-en	Ziege-n	Mäus-e	Drangsal-e
acc/pl	Planet-en	Ziege-n	Mäus-e	Drangsal-e
dat/pl	Planet-en	Ziege-n	Mäus-en	Drangsal-en
gen/pl	Planet-en	Ziege-n	Mäus-e	Drangsal-e

As before, the first thing to note is that genuine, arbitrary class features are necessary to correctly assign noun stem to their inflection classes. First, gender features on the stem do not suffice to predict inflection class: Masculine stems can belong to classes I, II, III, IV, or V; feminine stems can belong to classes VI, VII, or VIII; and neuter stems can belong to classes I, III, or IV. Second, phonological features on the stem do not suffice to predict inflection class (this is particularly evident when we take into account that many inflection markers have versions with and without *e*, depending on the nature of the stem-final segment). Third, semantic features on the stem do not suffice to predict inflection class. To take a critical case: Even though animacy is often regarded as a typical feature of noun stems in class V (the class of weak masculines), not all members of class V are in fact [+animate] (e.g., the example chosen in *T*₁₆ is not), and not all masculine noun stems marked [+animate] are in class V.

2.3.2. Analysis

The system of inflection markers as it can be extracted from T₁₅ and T₁₆ is given in table T₁₇. The German marker inventory is much smaller than its Russian or Greek counterparts. This implies that there is an enormous amount of syncretism, both of the intra-paradigmatic and the trans-paradigmatic type.

T₁₇: Syncretism within and across inflection classes in German

	I _{m,n}	II _m	III _{n,m}	IV _{m,n}	V _m	VI _f	VII _f	VIII _f
nom/sg	∅	∅	∅	∅	∅	∅	∅	∅
acc/sg	∅	∅	∅	∅	(e)n	∅	∅	∅
dat/sg	∅	∅	∅	∅	(e)n	∅	∅	∅
gen/sg	(e)s	(e)s	(e)s	(e)s	(e)n	∅	∅	∅
nom/pl	(e)	”(e)	”er	(e)n	(e)n	(e)n	”(e)	(e)
acc/pl	(e)	”(e)	”er	(e)n	(e)n	(e)n	”(e)	(e)
dat/pl	(e)n	”(e)n	”ern	(e)n	(e)n	(e)n	”(e)n	(e)n
gen/pl	(e)	”(e)	”er	(e)n	(e)n	(e)n	”(e)	(e)

As before, intra-paradigmatic syncretism can be traced back to a decomposition of case features. Given that German has four cases, one might think that these result from a cross-classification of two binary features. However, there is one instance where it seems that three cases form a natural class that must be characterized by a common feature not shared by the fourth case, because the fourth case exhibits the default marker (which is completely unspecified with respect to case information). The case in point involves the singular of the weak masculine inflection class V: Accusative, dative, and genitive have /*(e)n*/, but a brief glance at T₁₇ reveals that the remaining marker /*∅*/ must be the default marker of the system. The only way to permit a systematic reference to three out of four cases in a system based on cross-classification of two binary features would again be to resort to the assumption going back to Zwicky (1970), that complements of natural classes can also be referred to – the cases which are not nominative, in the case at hand (see above, page 14). Although this might well be a viable possibility, we will here make the more straightforward assumption that the cases in German result from a cross-classification of three binary features [*±subject*], [*±governed*], and [*±oblique*], where accusative, dative, and genitive qualify as [*+gov*]. Thus, nominative, accusative, dative, and genitive have a fine-structure that is exactly as in Russian (and the syntactic justification is essentially analogous).

(15) *Decomposition of cases in German: [*±subject*], [*±governed*], [*±oblique*]*

- nominative: [*+subj, -gov, -obl*]
- accusative: [*-subj, +gov, -obl*]
- dative: [*-subj, +gov, +obl*]
- genitive: [*+subj, +gov, +obl*]

Turning next to the classes in German noun inflection, there are three primitive features, as in Greek, whose cross-classification yields the classes in T₁₇; see (16).

(16) *Decomposition of inflection classes in German: $[\pm\alpha]$, $[\pm\beta]$, $[\pm\gamma]$*

I:	$[+\alpha, -\beta, +\gamma]$	<i>Hund_m</i> ('dog'), <i>Schaf_n</i> ('sheep')
II:	$[+\alpha, -\beta, -\gamma]$	<i>Baum_m</i> ('tree'), <i>Nagel_m</i> ('nail')
III:	$[+\alpha, +\beta, +\gamma]$	<i>Buch_n</i> ('book'), <i>Kalb_n</i> ('calf'), <i>Mann_m</i> ('man')
IV:	$[+\alpha, +\beta, -\gamma]$	<i>Strahl_m</i> ('ray'), <i>Auge_n</i> ('eye')
V:	$[-\alpha, +\beta, +\gamma]$	<i>Planet_m</i> ('planet'), <i>Bote_m</i> ('messenger')
VI:	$[-\alpha, +\beta, -\gamma]$	<i>Ziege_f</i> ('goat')
VII:	$[-\alpha, -\beta, -\gamma]$	<i>Maus_f</i> ('mouse')
VIII:	$[-\alpha, -\beta, +\gamma]$	<i>Drangsal_f</i> ('distress'), <i>Finsternis_f</i> ('darkness')

There are only three inflection markers for singular environments; these are listed in (17): $/(e)n/1$ is a marker for accusative, dative, and genitive in the weak masculine inflection class V. $/(e)s/2$ is a marker that shows up in the genitive of $[+\alpha]$ classes, i.e., the masculine or neuter classes I–IV.³² Finally, $/\emptyset/3$ shows up everywhere else.

(17) *German inflection markers (singular):*

- $/(e)n/$: $\{[+N], [-\alpha, +\beta, +\gamma], [+gov]\}$
- $/(e)s/$: $\{[+N], [+ \alpha], [+subj, +gov, +obl]\}$
- $/\emptyset/$: $\{[+N]\}$

The minimal interaction of inflection markers in the singular is shown in table T₁₈.

T₁₈: *The interaction of inflection markers in the singular in German*

	I: $[+\alpha, -\beta, +\gamma]$	II: $[+\alpha, -\beta, -\gamma]$	III: $[+\alpha, +\beta, +\gamma]$	IV: $[+\alpha, +\beta, -\gamma]$	V: $[-\alpha, +\beta, +\gamma]$	VI: $[-\alpha, +\beta, -\gamma]$	VII: $[-\alpha, -\beta, -\gamma]$	VIII: $[-\alpha, -\beta, +\gamma]$
nom/sg	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$
acc/sg	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/(e)n/1$ $(/\emptyset/3)$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$
dat/sg	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$	$/(e)n/1$ $(/\emptyset/3)$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$
gen/sg	$/(e)s/2$ $(/\emptyset/3)$	$/(e)s/2$ $(/\emptyset/3)$	$/(e)s/2$ $(/\emptyset/3)$	$/(e)s/2$ $(/\emptyset/3)$	$/(e)n/1$ $(/\emptyset/3)$	$/\emptyset/3$	$/\emptyset/3$	$/\emptyset/3$

A list of plural markers is given in (18). These markers provide massive evidence for a decomposition of class features because the eight inflection classes in T₁₇ exhibit only four distinct patterns: Class III ($[+\alpha, +\beta, +\gamma]$) uses $/'ern/1$ and $/'er/2$. Classes I and VIII ($[-\beta, +\gamma]$) employ $/(e)n/3$ and $/(e)/4$. Classes II and VII ($[-\beta, -\gamma]$) have $/'(e)n/5$ and $/'(e)/6$. And the remaining classes IV, V, and VI (which can be characterized by $[+\beta]$ because the markers for the $[+\beta]$ -class III are more specific) resort to a $/(e)n/7$ throughout.³³

³² As before, note that none of the primitive class features co-varies fully with a gender feature (see footnotes 12, 24); in particular, even though $[-\alpha]$ typically characterizes a feminine inflection class, and $[+\alpha]$ a non-feminine inflection class, the correlation breaks down in the case of class V, which is marked $[-\alpha]$ but contains only masculine stems. Therefore, the $[+\alpha]$ -specification in $/(e)s/2$'s lexical entry provides an argument for arbitrary class features, and for their decomposition.

³³ On this approach, the similarity of the dative marker and the general marker in the first three groups is, from a synchronic point of view, accidental. This is incompatible with the most of the

(18) *German inflection markers (plural):*

1. /"ern/: $\{[+N],[+pl],[+\alpha,+\beta,+\gamma],[\text{-subj},+\text{gov},+\text{obl}]\}$
2. /"er/: $\{[+N],[+pl],[+\alpha,+\beta,+\gamma]\}$
3. /(e)n/: $\{[+N],[+pl],[\text{-}\beta,+\gamma],[\text{-subj},+\text{gov},+\text{obl}]\}$
4. /(e)/: $\{[+N],[+pl],[\text{-}\beta,+\gamma]\}$
5. /"(e)n/: $\{[+N],[+pl],[\text{-}\beta,-\gamma],[\text{-subj},+\text{gov},+\text{obl}]\}$
6. /"(e)/: $\{[+N],[+pl],[\text{-}\beta,-\gamma]\}$
7. /(e)n/: $\{[+N],[+pl],[+\beta]\}$

The interaction of plural markers in the system of German noun inflection is shown in T_{19} .

T_{19} : *The interaction of inflection markers in the plural in German*

	I: [+ α - β + γ]	II: [+ α - β - γ]	III: [+ α + β + γ]	IV: [+ α + β - γ]	V: [- α + β + γ]	VI: [- α + β - γ]	VII: [- α - β - γ]	VIII: [- α - β + γ]
nom/pl	/(e)/ ₄			/(e)n/ ₇	/(e)n/ ₇	/(e)n/ ₇		/(e)/ ₄
acc/pl	/(e)/ ₄			/(e)n/ ₇	/(e)n/ ₇	/(e)n/ ₇		/(e)/ ₄
dat/pl	/(e)n/ ₃ (/e/ ₄)			/(e)n/ ₇	/(e)n/ ₇	/(e)n/ ₇		/(e)n/ ₃ (/e/ ₄)
gen/pl	/(e)/ ₄			/(e)n/ ₇	/(e)n/ ₇	/(e)n/ ₇		/(e)/ ₄

To sum up, we have argued on the basis of the noun inflection systems of Russian, Greek, and German that inflection class features are indispensable in morphology, and that they must be understood not as privative features directly encoding the class, but as more abstract, binary features. Cross-classification of these features yields the

literature on this issue, where it is assumed that there is a separate dative marker /n/ which attaches to the plural markers /"er/₂, /(e)/₄, and /"(e)/₆. Such a view presupposes that inflection marking in dative plural contexts is truly agglutinative rather than fusional in German. This may or may not be correct; but whatever assumptions one decides to make to reconcile this assumption with the otherwise strictly fusional system of nominal inflection in German will leave our main claim – viz., that plural inflection markers in German refer to natural classes of inflection classes – unaffected. Still, in our view, there is reason to doubt an agglutinative marking of plural and dative in German. First, agglutination does not show up anywhere else in the system of German declensions. Second, it is unclear why it should be just dative plural contexts that are affected by agglutination. (Note also that the dative specification in the pronominal, determiner, and strong adjectival inflections is strictly fusional, with a partition into two separate markers impossible.) Third, it has not yet been shown convincingly that there is a good reason why an alleged agglutinative /n/ dative marker does not attach to other plural markers, like /s/ (as in *Auto-s* vs. **Auto-s-(e)n*, excluded from discussion here) and, in particular, /n/ (as in classes IV, V, and VI) and /Ø/ (in classes I, II, VII, and VIII, in cases where *e* is not realized because the stem ends in *n*); compare *Frau-en*, *Wagen-Ø* with **Frau-en-(e)n*, **Wagen-Ø-(e)n*. Fourth and finally, it seems that the *n* in dative plural contexts is about to disappear in colloquial varieties of German, especially in PP-internal contexts, thereby unifying marking in the four plural contexts; see Gallmann (1998). This would seem to imply a radical shift from agglutination to fusion in dative plural contexts in the standard approach, but can be analyzed in terms of simplification and assimilation of a single marker in the present analysis.

standard inflection classes; underspecification with respect to these features yields natural classes of inflection classes, which inflection markers make use of in their lexical entries, thereby accounting for trans-paradigmatic syncretism. With instances of intra-paradigmatic syncretism derived by underspecification with respect to primitive case features ([±subj],[±gov],[±obl]), most instances of syncretism in the three noun inflection systems are explained, and the demands imposed by the meta-grammatical Syncretism Principle (1) can be met.³⁴

Let us now turn to the question which role class features play in syntax.

3. Class Features in Syntax

There are two ways in which class features might figure in syntax: as features on lexical items, or as separate functional heads. We will argue in this section that neither option is available. Let us begin with the second, more radical possibility, according to which class features project class marker phrases in syntax.

3.1. Class Marker Phrases

Bernstein (1993) suggests that the presence of class features in morphology has a syntactic reflex (also see Haegeman (1998) for a generalisation of this proposal). The assumption is that those languages which provide the morphological evidence for class features, e.g., Spanish (see Harris (1991)), have a functional projection in the DP that intervenes between NP and Num(ber)P, viz., a “class marker phrase” (CMP) that hosts the respective marker. In contrast to what we have seen to be the case with inflection

³⁴ Baerman (2005a;b) argues that there are systematic instances of syncretism which cannot be accounted for by underspecification because the paradigm cells that participate in the syncretism do not seem to form a natural class. That is certainly true (and explicitly acknowledged as a possibility in the formulation of the Syncretism Principle). However, we would like to suggest that each pattern of syncretism in a language should be thoroughly investigated from the perspective of feature decomposition and underspecification before the conclusion can be reached that the inflectional system is somehow suboptimal vis-à-vis (1); and we contend that closer scrutiny will often reveal that the situation is far from hopeless for an underspecification approach. To name just one example: Baerman (2005a, 824) argues that the syncretism involving comitative singular and locative plural in the nominal declension system of (the Eastern Finnmark variety of) North Sami involves an “unnatural class”; see the following partial paradigm:

- (i) *North Sami pronoun declension* (simplified):

	sg	pl
nom	gii	gea-t
acc/gen	gea-n	gea-id
loc	gea-s	gea-inna
com	gea-inna	gea-iguin

However (notwithstanding our above conclusion that instances of trans-number syncretism may be exempted from an analysis in terms of underspecification), this syncretism can straightforwardly be accounted for by decomposition and underspecification. Locative and comitative are both oblique cases; furthermore, they share semantic features. This may plausibly be taken as independent evidence for a shared primitive case feature, which we may refer to as [+loc] for present purposes. On this view,

classes in Russian, Greek, and German, inflection classes in Spanish (which has lost morphological case on nouns) are not needed to provide markers for different cases; their sole task is to provide an invariant theme vowel as an inflection marker, which can be /o/, /a/, or /Ø/ (the last marker may trigger phonologically conditioned *e*-insertion). As shown by Harris, gender features on noun stems in Spanish do not suffice to systematically predict the choice of inflection marker for any given stem; hence, inflection class features are needed, as in Russian, Greek, and German. This is shown in table T₂₀.³⁵

T₂₀: *Inflection classes I–III in Spanish* (based on Harris (1991), Aronoff (1994)):

	I		II		III			
	<i>muchach_m</i> (‘boy’)	<i>man_f</i> (‘hand’)	<i>di_m</i> (‘day’)	<i>muchach_f</i> (‘girl’)	<i>Cid_m</i> (‘Cid’)	<i>sed_f</i> (‘thirst’)	<i>padr</i> (‘father’)	<i>madr</i> (‘mother’)
inflected	muchach-o	man-o	di-a	muchach-a	Cid-Ø	sed-Ø	padr-Ø[e] (<i>e</i> inserted)	madr-Ø[e] (<i>e</i> inserted)

Given that Spanish has class features, Bernstein postulates a separate CMP for this language, as in (19).

(19) [DP D [NumP Num [CMP CM [NP N]]]]

The presence of this CMP in a language is then held responsible for two further properties: (i) the presence of head movement within the DP, resulting in N A order; and (ii) the occurrence of indefinite noun ellipsis. As shown in (20), Spanish exhibits both these properties, whereas a language like English, which does not have inflection class features for nouns, does not exhibit either of them.

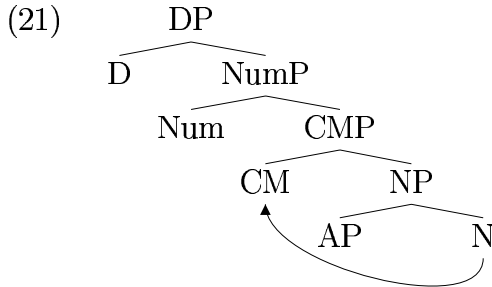
- (20) a. [DP la muchacha₁ americana t₁]
 the girl american
 b. [DP uno pequeño [N -]]
 a small (one)
 c. [DP a red ball]/*[DP a ball₁ red t₁]

/inna/ would be the general [+loc] marker for singular and plural, with /s/ and /iguin/ emerging as more specific markers for locative singular and comitative plural contexts, respectively. What is more, assuming that inflection markers can have variables over feature values as part of their lexical entries (the *N*-notation; see the Greek marker /s/ in (13)), /inna/ could in fact be specified as a highly specific marker that alternates between singular and plural (see footnote 27): Suppose that [±x] is a feature that distinguishes locative and comitative (where locative = [+loc, -x], and comitative = [+loc, +x]). Then, /inna/ might be specified as [Npl], [+loc, -Nx], which would account for the syncretism in (i) without even invoking a competition of markers (and the concept of default). Similar conclusions apply to other cases brought up by Baerman – e.g., the surprising patterns of syncretism in Dhaasanac paradigms, which may plausibly be taken to instantiate a single homogeneous phonological process of lenition (Jochen Trommer, p.c.).

³⁵ The class features here are rendered as [class I], [class II], and [class III]. We can ask ourselves whether a decomposition of these features is possible, or even necessary. Given the radically impoverished system of noun inflection in Spanish, empirical evidence for decomposition is hard to imagine. However, a decomposition of features like [class I] into combinations of more primitive features is of course possible, and can plausibly be assumed for reasons of uniformity alone.

d. * $[_{DP} \text{ a small } [_N -]]$

Assuming that both in English and Spanish adjectives are located in the specifier of NP (see Cinque (1993)), in the Spanish example (20-a) the head noun moves from its base position to a higher head in the functional domain, while it remains in its base position in English. As shown in (21), a CMP provides a language with just the right kind of position for this head movement.



With respect to indefinite noun ellipsis, Bernstein proposes that this operation depends on movement of a noun inflection marker to D, with the indefinite article (which, by assumption, starts out as the specifier of NumP) adjoining to it.

3.2. Problems for Bernstein's Correlations

There is evidence against the two correlations postulated by Bernstein which can be taken to undermine the motivation for class marker phrases.³⁶ The first problem is that there are languages that exhibit N movement and indefinite noun ellipsis in the absence of distinct class-feature driven inflectional morphology. Thus, French is similar to Spanish with respect to N A order and ellipsis, although its system of noun inflection differs from that of Spanish considerably, i.e., it has no obvious noun inflection markers:

- (22) a. $[_{DP} \text{ Un cube}_1 \text{ rouge } [_{NP} \text{ } t_1]]$ est sur le coin gauche de cette table
 a cube red is on the left corner of this table
 b. $[_{DP} \text{ Un bleu } [_N \text{ e }]]$ est sur le coin droit
 a blue (one) is on the right corner

Italian is also similar to Spanish with respect to N A order and noun ellipsis, although it is not immediately transparent whether the language can be assumed to have class markers (see Bernstein (1993)); consider (23-ab).

- (23) a. $[_{DP} \text{ un libro}_1 \text{ grande } t_1]]$
 a book big
 b. $[_{DP} \text{ un grande } [_N -]]$
 a big (one)

A final, striking case is that of Modern Hebrew. Hebrew does not have any noun inflection classes (see Aronoff (1994, 75-79)). However, there is good evidence for N movement, resulting in N A order, and for indefinite noun ellipsis (see Ritter (1991)

³⁶ Also see Alexiadou et al. (2001) for some of the following observations.

and Danon (1996)). N A order is illustrated in (24).³⁷

(24) [DP ha smalot₁ ha yapot t₁]
 the dresses the nice

(25) illustrates indefinite noun ellipsis in Hebrew.

(25) raʔti šloša praxim ʔadumim ve [DP ʔarbaʔa sgulim [N –]]
 (I) saw three flowers red and four purple

The second problem for Bernstein’s correlation is that there is also evidence against its other direction: There are languages that lack N movement in the presence of class-driven inflection marking. Such counter-evidence comes from the three languages discussed in section 2, viz., Russian, Greek, and German. Let us begin with Greek.

As we have seen, Greek has quite an elaborate system of class-driven noun inflection. However, N movement across adjectives does not seem to take place – the head noun always follows adjectives. This is shown in (26).

(26) a. *[DP to spiti₁ meghalo/paljo/oreo t₁]
 the house big/old/nice
 b. [DP to meghalo/paljo/oreo spiti₁]
 the big/old/nice house
 c. *[DP i gineka₁ amerikanida t₁]
 the woman American
 d. [DP i amerikanida gineka]
 the American woman

N ellipsis is possible, though:

(27) I Maria tha agorasi ena prasino vivlio ki ego [DP ena kokino [N –]]
 Mary_{nom} fut buy-3sg a green book and I a red (one)
 ‘Mary will buy a green book and I a red one.’

As shown above, German also has class-driven noun inflection. It also has N ellipsis (see (29)), but no N movement (see (28)).

(28) Er hat [DP ein neues Buch₁] / *[DP ein Buch₁ neues t₁] gekauft
 he has a new book a book new bought

(29) Er hat [DP ein neues [N –]] gekauft
 he has a new (one) bought

As a third language with class-driven noun inflection, let us finally consider Russian. Russian permits indefinite N ellipsis (see (31)). N A order is also possible, as shown by the examples in (30). However, there is good reason to doubt that this phenomenon involves head movement. The reason is that N may end up in front of numerals (Franks (1995)), determiners, and even outside the DP. For this reason, the phenomena in (30) are probably better analyzed as instances of (potentially remnant) NP scrambling, as indicated here.

³⁷ See, however, Shlonsky (2000) and Sichel (2002) for an alternative analysis involving XP fronting.

- (30) a. Èto [NP₁ vopros] složnyj t₁
 this is question_{nom} complicated_{nom}
 b. My tam žili [NP₁ goda] dva t₁
 we there lived year_{gen} two
 c. [DP₂ [NP₁ Razgovor] ètot t₁] ja načal t₂ naročno
 conversation this I began intentionally
 d. [NP₁ t₂ Čelovek] on [DP neploxo_{j2} t₁]
 person he is not bad

- (31) U menja bol'shaja mašina a u nego [DP malen'kaja [N -]
 with me big car and with him small (one)

T₂₁ summarizes the distribution of N movement and indefinite N ellipsis in the languages considered here. As shown by this table, Bernstein's correlation can hardly be maintained in light of the evidence discussed here, and with it goes the argument for class marker phrases. (See Alexiadou (2004), Alexiadou et al. (2001) for a treatment of indefinite noun ellipsis that capitalizes on gender agreement.)

T₂₁: *Distribution of class features, ellipsis, and NA order.*

<i>Language</i>	<i>Indefinite ellipsis</i>	<i>N movement</i>	<i>Inflection classes</i>
Spanish	+	+	+
French	+	+	(-)
Italian	+	+	(-)
Hebrew	+	+	-
Greek	+	-	+
Russian	+	(-)	+
German	+	-	+

3.3. General Considerations

We conclude that class features do not project in syntax. Closer inspection supports a stronger claim: There is no evidence for assuming that class features are syntactically active (as features on other categories) at all. To see this, suppose that inflection class features were active in syntax. Then, we might possibly expect there to be verbs that select inflection class features such that, e.g., only inflection class III (i.e., [- α , - β]-marked) nouns were available as objects of these verbs in Russian. Even more to the point, we might expect subject-verb agreement with respect to inflection class (i.e., a designated morphological reflex of the subject's inflection class on the verb); or noun-adjective agreement with respect to inflection class. Things like these do not seem to occur; see, e.g., the lack of noun-adjective agreement with respect to inflection class in Spanish in (32).

- (32) a. [DP la chica inteligente]
 the girl intelligent
 b. [DP el chico inteligente]
 the boy intelligent

Syntactic inertness is exactly the property that distinguishes inflection class features from gender features, which do figure in syntactic agreement relations. However, whereas gender features are syntactically visible, they do not play a central role in the fusional noun inflection systems of Russian, Greek, and German (see section 2). More generally, we may speculate that there is a division of labour between class features and gender features: Both are inherent features marked on a noun stem in the lexicon, but whereas class features are relevant only in morphology, gender features are of crucial importance in syntax.³⁸ To sum up, inflection class features are of no use in syntax; they are not visible in this component. Thus, class features are interpretable in morphology but uninterpretable in syntax.³⁹

This conclusion has important consequences if we adopt the Legibility Condition (see Chomsky (2000; 2001b)), a version of which is given in (33).

(33) *Legibility Condition:*

Morpho-syntactic features can be present in some component of grammar only if they are interpretable in this component.

Given (33), the further conclusion has to be that class features are not merely syntactically uninterpretable; they must in fact be absent in syntax. This state of affairs is strongly reminiscent of a situation that Chomsky (2000; 2001b) argues to occur in the case of features that are present in syntax but uninterpretable, hence absent, at LF. Chomsky suggests that such features can act as probes and thereby trigger syntactic operations. To capture this convergence of morphology and syntax, we develop

³⁸ In line with this, at least in the type of language currently under consideration, the gender of a noun stem is read off agreement in syntax. Note that this view is not incompatible with the assumption that the language learner's burden can to some extent be reduced by assuming default implicational relations holding between inflection class, gender, semantic, and phonological features of a noun stem, which predict some typical associations of features but can be overridden; see, e.g. Fraser & Corbett (1994) for Russian, Aronoff (1994) for Spanish and Latin. The main point here is that, however these features ultimately come to co-occur on a given noun stem, they must be kept separate, playing different roles in different components of grammar. Note also that we do not wish to imply that gender features are completely irrelevant in systems of noun inflection. For instance, gender (rather than class) information is needed to predict the right order of derivational affixes in German (see Eisenberg & Sayatz (2004, 110-115)). Even more important in the present context is the observation that gender features *are* relevant (in addition to inflection class features) in systems of noun inflection that are historically closely related to the ones discussed here. Thus, as noted above, gender features seem to play an important role in Icelandic noun inflection (see footnote 12). Similarly, the distribution of accusative/genitive syncretisms in the plural in Polish differs from the similar phenomenon in Russian (see (10)) in that reference must be made not to the feature [\pm animate], but to the gender feature [\pm masculine] (and the feature [\pm person]); see, e.g., Gunkel (2003). For reasons like these, we do not want to contrive ways to exclude gender information systematically from inflectional morphology in the domain of nouns (however, see Bachrach & Wagner (2005) for a different view). Also cf. Ritter (1993) for pertinent discussion.

³⁹ A clarification may be in order: Many languages, among them, e.g., Swahili (see Krifka (1995)) and Archi (see Kibrik (1979)), exhibit 'noun classes,' and there is syntactic agreement with respect to this information. However, this does not call into question the claim just made because a different

a probe-based approach to fusional inflection in the next section.⁴⁰

4. Proposal

Given the Legibility Condition in (33), features that are uninterpretable at LF must be deleted in syntax. Under the minimalist approach developed in Chomsky (2000; 2001b), which we adopt here, such features can be deleted by participating in an Agree operation. Agree applies under matching of a probe and a goal: Simplifying a bit, the probe is an LF-uninterpretable feature that shows up on a category that (minimally) c-commands a category containing a feature bundle acting as the goal, and Agree takes place if there is both an LF-uninterpretable feature and a matching feature in the goal. Depending on other factors, Agree then may or may not be accompanied by an additional movement operation that displaces a category containing the goal and re-merges it with a category on whose head the probe feature is. We propose that an analogous procedure underlies class-driven fusional inflection: Class features of a noun stem act as probes in morphology in the same way that, say, ϕ features of T act as probes in syntax.⁴¹ This presupposes that morphology and syntax are separate components; and indeed, we propose that Agree operates in morphology to remove syntactically uninterpretable features before syntax is reached, in the same way that Agree operates in syntax to remove LF-uninterpretable features before LF is reached.

Let us flesh out this proposal. Suppose that there is a sequence of grammatical components as in (34).⁴²

(34) Lexicon \rightarrow Morphology \rightarrow Syntax \rightarrow PF, LF

We assume that the lexicon is a mere list of exceptions. Morphology follows the lexicon but precedes syntax. We can plausibly conceive of this component as a more elaborate version of a numeration, in the sense that it assembles the material that will be used in the syntactic derivation. The morphological component takes items from the lexicon

phenomenon is involved: The ‘class’ features in question are needed to determine an agglutinative ‘class’ marker for a given noun stem, and for syntactic agreement with the noun; their role is not to determine a fusional marker encoding case and number. Thus, ‘class’ in Bantu or Daghestanian languages in fact means gender, not inflection class. See Corbett (1991, 43-49) for further discussion.⁴⁰ Clearly, (33) treats the syntactic and semantic components of the grammar identically, and does not differentiate between “interface” components and others. In our view, there is no reason to presuppose that different components manipulate/interpret features in a fundamentally different way. (In particular, this holds if a derivational approach to semantic interpretation is adopted; see Stechow (2005) for preliminary remarks.)

⁴¹ In her analysis of Swedish noun inflection, Josefsson (2001) has independently suggested that class features act as probes. However, abstracting away from identical terminology, her analysis emerges as quite different, as does its underlying rationale: The class feature acting as a probe is assumed to be a separate nominal syntactic head that is merged with a category-neutral root (rather than a feature of a noun stem that triggers pre-syntactic Merge with an inflection marker, as in our proposal; see below).

⁴² For present purposes, it is immaterial whether this sequence is run through only once, or whether it is (or parts of it are) run through repeatedly, as in multiple spell-out approaches with a phase-based cycle.

and turns them into objects that can be interpreted by syntactic operations. Crucially, morphology and syntax employ the same structure-building operations: First, there is simple Merge, which typically applies under selection. Instantiations of simple Merge in morphology could be taken to include certain types of agglutinative inflection and derivational morphology that apply pre-syntactically (with other types applying in the syntax; see section 5 below). Second, there is Merge under Agree (pure Agree as such is not structure-building). In syntax, Merge under Agree typically involves movement. However, assuming that the absence of displacement is the remaining fundamental difference between morphology and syntax, this option is not available for Agree in morphology. We suggest that Merge under Agree can take place without any pre-existing structure in morphology, concatenating two items taken directly from the lexicon. Our claim is that fusional inflection driven by class features is an instantiation of this operation.⁴³

More specifically, we propose that class-driven, fusional noun inflection works as follows. First, a noun stem is selected from the lexicon with its inherent, non-predictable (or not fully predictable, given the qualification in footnote 38) features; these include class and gender features. Second, when the noun stem enters morphology, non-inherent features are added; among these are case and number features. (This conforms exactly to the assumptions made in Chomsky (1965, 171).) All features on a noun stem are fully specified, whether inherent or not. Third, the (syntactically uninterpretable) class feature of a noun stem acts as a probe, looking for a matching goal with which it can undergo Agree. An appropriate feature bundle on an inflection marker can act as such a goal. The class, case, and number features of an inflection marker differ from their counterparts on a noun stem in two respects: They are always inherent; and they can be (and often are) underspecified. Fourth, the only way to provide a matching inflection marker for an Agree operation with the probe on the noun stem is to select it from the lexicon and merge it with the noun stem. Thus, the inflection marker determined by the Subset Principle is selected from the lexicon and merged with the noun stem, resulting in Agree.⁴⁴ Fifth, the class features of the noun stem are deleted in morphology. Furthermore, all morpho-syntactic features of the inflection marker are deleted.⁴⁵ Finally, the inflected noun enters syntax, bearing

⁴³ Note that, on this view, agglutinative noun inflection in morphology and fusional noun inflection in morphology differ in that the former involves a selection relation between a noun stem and an inflection (e.g., case) marker without a syntactically uninterpretable feature, whereas the latter involves a matching relation involving a syntactically uninterpretable feature.

⁴⁴ It must be independently ensured that such Merge operations result in the inflection marker ending up to the right of the noun stem (i.e., that inflection is suffixal in the case at hand).

⁴⁵ The reason for this additional deletion is obvious for class features of an inflection marker (which are no more interpretable in syntax than their counterparts on noun stems). But what about other morpho-syntactic features of an inflection marker like, in particular, case features? Case features of inflection markers must be deleted because their potential underspecification makes them syntactically defective: Syntax needs fully specified case information, not the underspecified case information provided by inflection markers. Thus, underspecified case features are uninterpretable in syntax, and must therefore be absent, given the Legibility Condition. There is further evidence that underspecified case features of inflection markers must be absent in syntax: Given that the rightmost item of

only fully specified and syntactically interpretable features.⁴⁶

This conception of fusional noun inflection as class feature-driven Merge under Agree is illustrated by two examples each from Russian, Greek, and German in (35). The Russian examples in (35-ab) involve a class III noun in the dative singular and a class II noun in the accusative singular, respectively; the Greek examples in (35-cd), a class I noun in the genitive singular and a class VI noun in the nominative plural; and the German examples in (35-ef), a class I noun in the genitive singular and a class V noun in the dative plural. Throughout, features that are deleted under Agree are struck out.

- (35) a. [_N /tetrad'/ ('notebook') - /i/]
 {[+N],[~~-anim~~],[~~-pl~~],[~~-α,+γ~~],[~~-subj,+gov,+obl~~]} ~~{[+N],[~~-α~~],[~~+obl~~]}~~
- b. [_N /komnat/ ('room?') - /u/]
 {[+N],[~~-anim~~],[~~-pl~~],[~~-α,+γ~~],[~~-subj,+gov,-obl~~]} ~~{[+N],[~~-subj,+gov~~]}~~
- c. [_N /anθrop/ ('man') - /u/]
 {[+N],[~~-pl~~],[~~+α,+β,+γ~~],[+gov,+obl]} ~~{[+N],[~~+α~~],[~~+gov,+obl~~]}~~
- d. [_N /krat/ ('state') - /i/]
 {[+N],[~~+pl~~],[~~-α,+β,+γ~~],[~~-gov,-obl~~]} ~~{[+N],[~~+pl~~],[~~+β,+γ~~],[~~-obl~~]}~~
- e. [_N /Hund/ ('dog') - /(e)s/]
 {[+N],[~~-pl~~],[~~+α,+β,+γ~~],[+subj,+gov,+obl]} ~~{[+N],[~~+α~~],[~~+subj,+gov,+obl~~]}~~
- f. [_N /Planet/ ('planet') - /en/]
 {[+N],[~~+pl~~],[~~-α,+β,+γ~~],[~~-subj,+gov,+obl~~]} ~~{[+N],[~~+pl~~],[~~+β~~]}~~

The probe-based approach developed so far goes a long way towards accounting for fusional noun inflection in terms of well-established elementary operations in minimalist grammar. However, there is still one step in the analysis where a special assumption appears to be necessary at first sight: Selection of the correct inflection marker from the lexicon for a given noun stem is determined by the Subset Principle. Recall that the Subset Principle has two parts: one that ensures that an inflection marker must fit (in a given context provided by the noun stem's morpho-syntactic features), and one that ensures that among the markers that satisfy this requirement, the most specific one is chosen. The first requirement does not need to be stipulated anymore in a probe-based

a word that is specified for property \mathbb{P} qualifies as the head with respect to \mathbb{P} in morphology (see DiSciullo & Williams (1987)), a simultaneous presence of underspecified case information on an inflection marker and fully specified case information on a noun stem wrongly implies that *only* the former kind of information is accessible in syntax. Problems of this type do not arise if we assume that all morpho-syntactic features of an inflection marker are syntactically uninterpretable, and are deleted by a morphological inflection operation.

⁴⁶ Stump (2001) distinguishes between two basic types of approaches to inflectional morphology, viz., realizational vs. incremental approaches. In incremental approaches, inflection markers contribute information that is not otherwise present; in realizational approaches, all information is there to begin with, and the inflection marker contributes no new information. It is worth pointing out that the present approach qualifies as realizational in this sense, and not as incremental: Despite being a lexical item with morpho-syntactic features, an inflection marker does not actually carry any morpho-syntactic information that the noun stem would not already have itself; furthermore, all relevant morpho-syntactic information on the inflection marker is in fact deleted after pre-syntactic inflection.

approach since Agree presupposes feature matching: If a morpho-syntactic feature shows up on an inflection marker without also showing up on the noun stem, there will invariably be a feature mismatch; the reason is that, by assumption, there is no underspecification with respect to morpho-syntactic features on noun stems. As for the second requirement, that of specificity, Chomsky (2001b, 15) suggests a principle Maximize Matching Effects for Agree operations in syntax, in order to guarantee that “if local [probe, goal] match [...], their uninterpretable features must be eliminated at once, as fully as possible”. As such, Maximize Matching Effects is sensitive only to the quantity of features, not to their quality. However, given that there are hierarchies of feature classes, as in (7), it is arguably a natural extension of this principle (that leaves its syntactic consequences unaffected) to assume that maximization of feature matching is sensitive to the nature of the features as well, along the lines of (6). Under this assumption, a specific Subset Principle can be dispensed with: Selection of the most specific inflection marker follows from a maximization of matching effects. This is shown for the example in (35-a) in (36): Agree of /tetrad’/ and /i/ maximizes feature matching, as opposed to Agree of /tetrad’/ and /u/ or of /tetrad’/ and /a/, in which fewer, or less highly ranked, uninterpretable features undergo deletion.

- (36) a. $[_N /tetrad’/ \text{ (‘notebook’) } - /i/]$
 $\{[+N],[-anim],[-pl],[-\alpha, -\bar{\alpha}],[-subj,+gov,+obl]\} \quad \{[+N],[-\alpha],[+obl]\}$
- b. $*[_N /tetrad’/ \text{ (‘notebook’) } - /u/]$
 $\{[+N],[-anim],[-pl],[-\alpha, -\bar{\alpha}],[-subj,+gov,+obl]\} \quad \{[+N],[-subj,+gov]\}$
- c. $*[_N /tetrad’/ \text{ (‘notebook’) } - /a/]$
 $\{[+N],[-anim],[-pl],[-\alpha, -\bar{\alpha}],[-subj,+gov,+obl]\} \quad \{[+N]\}$

Thus, fusional noun inflection can fully be accounted for in terms of independently motivated properties of Agree operations in syntax.

A further interesting consequence of the present approach concerns indeclinables. Russian, Greek, and many other languages that employ fusional noun inflection exhibit the phenomenon of indeclinable noun stems that resist inflection for case and number. These items are usually loan-words; see, e.g., *buržua_m* (‘bourgeois’), *kofe_m* (‘coffee’) in Russian, or *reporter_m* (‘reporter’), *plaz_f* (‘beach’) in Greek.⁴⁷ The standard approach to indeclinables is to assign them to a separate inflection class, which effectively treats them on a par with other noun stems and thus denies their special status. In contrast, the present approach permits a maximally simple account of indeclinables: These noun stems have fully specified gender, case, and number features (the latter two types of features are added in morphology), but they simply lack a class feature. Hence, there is no probe on them in morphology that might trigger inflection; consequently, inflection does not take place.

⁴⁷ Indeclinable noun stems are practically non-existent in German, though, except perhaps for some marginal cases involving abbreviations that are pronounced letterwise, like *PKW* (‘Personenkraftwagen’, ‘car’); however, even in these cases, there is a tendency to assign the stem to a regular inflection class. Loan-word nouns that are not (yet) fully integrated into the core inflectional system in German typically take an /s/-plural, which implies an exceptional, marked class (see footnote 30), but a class nevertheless.

5. Further Issues

5.1. The Timing of Inflection

Let us take a step back. We have argued that (highly abstract, decomposed) class features are needed in fusional noun inflection systems of languages like Russian, Greek, and German. A priori, there are three possibilities concerning the timing of inflection, all of which are compatible with this hypothesis:

- (37) a. Fusional noun inflection applies pre-syntactically.
- b. Fusional noun inflection applies inner-syntactically.
- c. Fusional noun inflection applies post-syntactically.

Class features play no role in syntax, and the version of the Legibility Condition adopted here actually prohibits their presence in this component. This reasoning makes option (37-b) unavailable, but it does not necessarily decide between options (37-a) and (37-c). We have adopted a pre-syntactic approach to noun inflection where class features are deleted before the noun enters syntax. But what about a post-syntactic approach?

Post-syntactic approaches are most prominently pursued within distributed morphology (see Halle & Marantz (1993) and Harley & Noyer (2003) for overviews). In such an approach, fusional noun inflection has the status of a spell-out operation: An inflection marker is a vocabulary item that is inserted post-syntactically into a designated head position (a functional morpheme) in the vicinity of the noun stem. As noted above, the analyses developed in section 2 can in principle be reformulated in a distributed morphology analysis without much ado: The (often underspecified) morpho-syntactic features borne by the inflection markers can be re-interpreted as the insertion contexts associated with vocabulary items; the (fully specified) morpho-syntactic features borne by noun stems can be re-interpreted as the features provided by the syntactic context (on the functional morpheme into which vocabulary insertion takes place, and/or on the associated noun stem); and the Subset Principle can act as a condition on vocabulary insertion rather than on merging of inflection markers (which, of course, corresponds to its original formulation; cf. Halle (1997)).

However, such a post-syntactic approach turns out to be problematic in view of the argument developed in section 3. Basically, there are two possibilities for a class feature to be present post-syntactically and participate in an inflection operation: The first possibility is that the class feature is present in syntax already, even though it becomes relevant only after syntax. This possibility faces the same problems as genuinely inner-syntactic approaches: At the point where a post-syntactic approach to fusional noun inflection needs a class feature, the Legibility Condition has long forced its deletion. This leaves the second possibility: The class feature is not yet present in syntax; rather, it enters the derivation after syntax, but before vocabulary insertion (see, e.g., Embick (2000), Harbour (2003)), perhaps by an operation like dissociation (see Embick (1998)).⁴⁸ This second possibility invariably violates the Inclusiveness Condition (see

⁴⁸ Predecessors of such an operation are Halle & Marantz's (1994) redundancy rules that post-syntactically introduce class features for theme vowels of clitic pronouns in Spanish, and Halle &

Chomsky (1995; 2000; 2001b)) according to which new elements (like features) cannot be introduced in the course of the derivation. Thus, a post-syntactic approach will have to violate either the Legibility Condition or the Inclusiveness Condition.⁴⁹ We conclude that the present, pre-syntactic approach is the only option that respects both the Legibility Condition and the Inclusiveness Condition, and should therefore, *ceteris paribus*, be preferred to a post-syntactic approach.⁵⁰

In addition to these considerations, the present, pre-syntactic approach to fusional noun inflection has one central property that distinguishes it from a post-syntactic approach in terms of distributed morphology, and that strikes us as interesting: It relies exclusively on elementary (Merge and Agree) operations that are independently motivated, rather than on additional morphology-specific operations like vocabulary insertion which have no syntactic counterpart, and whose properties are very different. We take it that an analysis that employs identical elementary operations in morphology and syntax is preferable to an analysis that employs different sets of elementary operations in the two domains. However, closer inspection reveals that this conceptual difference is not necessarily one between pre- vs. post-syntactic approaches; rather, it separates approaches in which an (actual, non-abstract) inflection marker is merged with a stem from those in which it is not (either because it is inserted, as in distributed morphology, or because it is introduced by rules or schemas, as in word-and-paradigm approaches). Thus, we might in fact conceive of a variant of our proposal in which class features act as probes in a post-syntactic morphological component, triggering an operation of Merge under Agree with the most specific matching inflection marker, and thus undergo deletion before PF is reached. This would avoid the conceptual

Marantz's (1993) post-syntactic insertion of an AGR-morpheme into a T-adjoined position in English (the latter is an even more radical example since it involves a whole category rather than a single feature).

⁴⁹ Two remarks. First, one might think that a late insertion approach violates the Inclusiveness Condition by definition, given that phonological material is inserted post-syntactically into the derivation (by vocabulary insertion). However, Chomsky (2000, 118) explicitly exempts PF operations from the Inclusiveness Condition. Hence, a late insertion approach could in principle respect this principle – but not if it adopts post-syntactic insertion of a class feature (which is not phonological in nature). Second, as noted by Asaf Bachrach (p.c.), it might technically be possible to respect a version of the Inclusiveness Condition in a post-syntactic approach after all if one assumes (i) that late vocabulary insertion is not confined to functional categories, but affects lexical categories as well (see Marantz (1995) for the idea, and Embick (2000) for an argument against it), and (ii) that these vocabulary items can bear features that trigger further operations. Under such a view, a noun stem could be inserted late that in turn carries a class feature, and this class feature would then determine subsequent insertion of an inflection marker. (As a matter of fact, the mechanism of class feature insertion for theme vowels in Spanish pronouns proposed by Halle & Marantz (1994, 282) works more or less like this.) However, even assuming that the Inclusiveness Condition would not prohibit such an instance of “piggy-back” insertion of morpho-syntactic features (which is far from clear and depends on subtleties of formulation), we take it that this kind of approach requires an unrestricted concept of vocabulary insertion (and a highly complex notion of vocabulary item), and should therefore be avoided if possible.

⁵⁰ Needless to say, it is by no means clear that all other things are indeed equal in all empirical domains, and there may well be cases where a post-syntactic approach to inflectional morphology

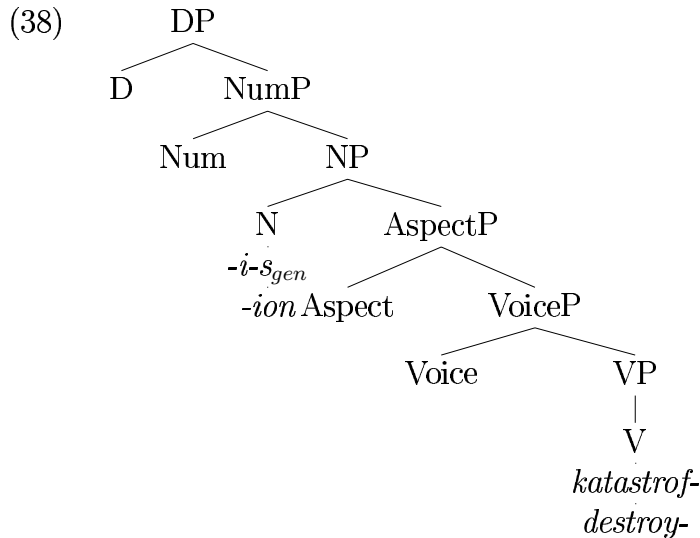
problem of introducing additional machinery that is otherwise absent from derivations; but it would not fare any better than a standard distributed morphology approach with respect to the task of reconciling the Legibility Condition and the Inclusiveness Condition.

5.2. The Status of Derivational Morphology

We have argued that fusional noun inflection involves a probe-based Agree operation that takes place pre-syntactically, in a morphological component. However, we have been careful not to make any specific claims about particular cases of agglutinative inflection and derivational morphology, except for noting that the present approach is compatible with these operations applying in morphology, in syntax, or in both components. As a case in point, Siloni (1997) (based on Chomsky (1970), Wasow (1977)) argues that there is both pre-syntactic (“lexical”, in our approach: morphological) and syntactic nominalization in Hebrew: Event nominalization is pre-syntactic, gerund formation takes place in syntax. It is worth noting that such an analysis does not contradict the present approach; in particular, there is no reason why nominalization should be precluded from applying in the syntax (see Borer (2004), Alexiadou (2001) and references cited there), e.g., via head movement of *V* to a nominalizing head *N* (as in van Hout & Roeper (1998)). However, if syntactic nominalization occurs in a language with fusional noun inflection, it is clear that head movement of *V* must go to an *N* head that is already inflected, as a result of a pre-syntactic Agree operation triggered by *N*’s class feature. This is shown for a Greek example in (38).

looks initially advantageous, or initially disadvantageous. Consider the first possibility first. Putative morphology/syntax mismatches in feature specifications are a case in point. These have been addressed in distributed morphology by post-syntactic (but pre-morphology) operations like impoverishment, which deletes features before morphological spell-out (see Bonet (1991), Noyer (1992), Halle & Marantz (1993), Bobaljik (2002), Frampton (2002); also cf. Ackema & Neeleman (2003)) or even changes features (see Noyer (1998)), and fission, which makes features of a feature bundle individually accessible to spell-out (see Noyer (1992), Frampton (2002)). There is no need for operations of this type in the present analysis; but there may be in other cases. As it turns out, the present approach can be extended to capture such effects (e.g., a pre-syntactic version of impoverishment is adopted in Müller (2005a) to account for the interaction of verb inflection and pro-drop).

However, as noted, there may also be empirical domains where a post-syntactic approach faces problems that a pre-syntactic approach manages to avoid. For instance, free relative clauses, across-the-board dependencies, and parasitic gap constructions in languages like Russian (or Polish; see McCreight (1988), Franks (1995)) and German (see Groos & van Riemsdijk (1981), Bayer (1988)) obey morphological rather than syntactic case matching requirements, in the sense that identity of the morphological output form (i.e., intra-paradigmatic syncretism), rather than of the syntactic case feature specification, is decisive in allowing the constructions. In a post-syntactic approach to noun inflection, the relevant information is not yet there at the point where syntax would seem to need it; so capturing these effects is far from straightforward; see Sauerland (1996); but also see Trommer (2005a), where such phenomena are accounted for within distributed morphology by invoking (i) impoverishment, and (ii) an operation of chain reduction.



Here, the genitive singular nominalization *katastrof-i-s* (‘destruction’) results from first merging a nominalization suffix *i* bearing an *s*-principle class feature probe with the matching genitive singular inflection marker *s* in morphology, and then applying head movement of the verb stem *katastrof* to the inflected noun *i-s* in the syntax. Thus, in this analysis, inflection precedes derivation, which at first sight seems to go against the received wisdom that derivation always precedes inflection (see, e.g., Anderson (1992)). However, this apparent contradiction is resolved when we take into account that this problem is mainly terminological: Derivation continues to precede inflection when we look at the eventual order of morphemes rather than the order of rule applications.

6. Concluding Remarks

In the present study, we have been concerned with the status of inflection class features in a minimalist grammar. Based on evidence from the fusional noun inflection systems of Indo-European languages (in particular, Russian, Greek, and German), we have tried to shed new light on the form and function of these features. In a nutshell, we have argued that inflection class features are highly abstract, binary features that act as morphological probes. The main payoffs of this hypothesis are that trans-paradigmatic syncretism can be accounted for (because underspecification with respect to class features yields natural classes of inflection classes), and that fusional inflection emerges as the result of the basic operations envisaged in minimalist grammar (viz., Merge and Agree). The theory has been developed on the basis of noun inflection systems, but the null hypothesis is that it applies more generally, to all fusional systems of inflection (e.g., to fusional pronominal, determiner, or adjectival inflection, but also to fusional verb inflection).

Thus, we may speculate that all fusional inflection is in fact driven by class features. There are two kinds of problems that may arise for this hypothesis: First, there could be fusional inflectional systems in which there is no partition of the entire domain of the items that need to be inflected into subdomains; and second, there could be fusional inflectional systems in which the partition of the entire domain is fully pre-

dictable by non-arbitrary features. The first kind of problem does not seem to arise since fusional inflection typically goes hand in hand with the presence of inflection classes.⁵¹ The second kind of problem looks initially more pressing: Fusional systems like that of adjectival inflection in Russian, or that of pronominal inflection in German, exhibit inflection classes, but these classes seem to be completely determined by gender and number features, with resort to specific inflection class features apparently unnecessary. Since gender and number features are interpretable in syntax, it is clear that they cannot act as pre-syntactic probes. A full-fledged analysis of these types of system is beyond the scope of this article; but we would like to tentatively propose that inflection class features acting as probes underlie these cases as well, with the relevant (syntactically) uninterpretable class features being parasitic on (syntactically) interpretable gender or number features.

These considerations reinforce the conclusion that syntactically uninterpretable inflection class features are apparent imperfections in grammatical systems, in the same way in which LF-uninterpretable features qualify as apparent imperfections in the theory laid out in Chomsky (2000; 2001b) (but not in Chomsky (2001a)). In both cases, the imperfection may only be apparent because the features emerge as an optimal means to bring about another property that also initially looks like an imperfection: fusional inflection in one case (which blurs different pieces of grammatical information by encoding them as a single unit), displacement in the other. As for displacement, Chomsky argues that closer inspection may reveal the displacement property not to be an imperfection after all. Fusional inflection, too, might plausibly be argued to be an imperfection that is only apparent, and might emerge as an optimal solution to the conflicting demands of economy of expression and explicitness of encoding grammatical information. However, we will not pursue these matters here any further.

⁵¹ That said, given a maximally simple notion of inflection classes, it actually follows that a (trivial) inflection class is present even if there is only one inflectional pattern. Compare, e.g., the definition of inflection class in Aronoff (1994, 64) (“a set of lexemes whose members each select the same set of inflectional realizations”), from which it follows that “a language whose major lexical categories each have only one inflectional class will still have inflectional classes” (see Aronoff (1994, 182, fn. 6)).

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