Valence and Atomic Number

Daniel Harbour

January 2006

The semantic basis and morphosyntactic reflexes of Kiowa-Tanoan noun classification are perspicuously captured in a system with three bivalent number features: [±singular], [±augmented], [±group]. Privative analyses of the same facts require, *inter alia*, features without semantic motivation, syntactic mechanisms that violate of Inclusivity, and feature annotation reminiscent of bivalence. The semantic atoms of number are, therefore, bivalent.

Keywords bivalent, dual, features, inverse, noun classes, number, plural, privative, singular; Jemez, Kiowa, Kiowa-Tanoan

1. Introduction

Since its introduction by Jakobson, Karcevsky, and Trubetzkoy (1928), the feature has become the atomic mainstay not just of phonology, but of morphology, syntax, and much of semantics. One of the chief distinctions to have arisen since its inception is that between privativity and bivalence. For instance, to express plurality, one could posit privative [F] or bivalent [±F]. In the privative variant, elements are interpreted as plural if they bear [F]; elements without the feature are never interpreted as plural. In the bivalent variant, elements are interpreted as plural if they bear [+F], and as non-plural if they bear [−F]; and, again, elements without the feature are never interpreted as plural.

Parsimony prefers privativity. First, if non-assertion of plurality is interpreted as assertion of non-plurality, then [−F] is redundant. Second, the phrase structure grammar for bivalent features is an extension of that for privative features, and so bivalence requires richer resources (Adger 2006). Third, privativity is notationally more constrained: bivalence permits the three-way distinction $\emptyset \sim [-F] \sim [+F]$, but privativity, only the two-way distinction $\emptyset \sim [F]$.

This paper argues, however, that privativity is too restrictive: linguistic theory requires the three way distinction $\emptyset \sim [-\mathrm{F}] \sim [+\mathrm{F}]$ that only bivalence permits. This claim is based on Kiowa-Tanoan noun classification. Kiowa, the primary focus below, has nine morphologically distinct noun classes, recognizable by their agreement patterns across singular, dual and plural. The classes are semantically coherent, picking out such core semantic properties as collective∼non-collective, count∼mass, and heterogeneous∼homogeneous plural. The language motivatives three features on purely semantic grounds: two, [±singular] and [±augmented], generate the number categories singular, dual, plural; and the third, [±group], characterizes the types of pluralities that nouns form. (Paraphrases are given later.)

(1) **Feature definitions**

a. $[+\text{singular}] = \lambda \mathrm{P} \lambda x [\mathrm{P}(x) \wedge \text{atom}(x)]$

b. $[+\text{augmented}] = \lambda \mathrm{P} \lambda x \exists y [\mathrm{P}(x) \wedge \mathrm{P}(y) \wedge y \sqsubset x]$

c. $[+\text{group}] = \lambda \mathrm{P}_{[+\text{augmented}]} \lambda x \exists \mathrm{Q}_{\mathrm{Q} \neq \mathrm{P}} [\mathrm{P}(x) \wedge \text{Q-atom}(x)]$

(2) **Feature negation**

$[-\mathrm{F}] = \neg [+\mathrm{F}]$

Given the feature's semantics, it is possible to assign to each of the nine noun classes a feature-value combination corresponding to that class's semantic characteristic. Straightforward assumptions about the syntax of agreement are then sufficient to explain the agreement pattern that identifies the class. This result is significant because it provides a single explanation for each class's semantic and morphological structure.

The argument against privativity arises when we consider why Kiowa has only nine morphologically distinct classes, when, as explained below, semantic considerations lead one to expect some 27 classes, and morphological, some 64. Nine appears an arbitrary assemblage. However, when one applies the account just sketched to all potentially class-defining feature-value combinations, only 14 distinct classes emerge. Between them, Kiowa and its Tanoan relation Jemez exhaust all possibilities, and no related language attests others. The system, thus, predicts exactly the classes that exist.

If one attempts to change the bivalent features into privative ones, however, the class typology is lost. The system immediately undergenerates. To recapture generative adequacy, one must complicate the feature inventory and the syntactic component. However, the semantics of the noun class system motivates no additions to the feature inventory. Any such additions

are, therefore, for purely morphological purposes, and, so, sacrifice the tight connection between semantics and morphology. And altering the syntactic mechanisms admits classes that are unattested and so syntactic generality is compromised and accuracy lost. A coherent picture of the system is possible only if we accept that the number features are binary.

The argument is presented in three stages. Section 2 uses Kiowa's number system and a subpart of noun system to motivate the three semantically contentful features. Section 3 presents the complete typology of noun classes permitted by these features. It shows that, between them, Kiowa and Jemez attest all of the classes (3.1) and that there is a natural connection between the classifying features of each class and the semantics of the nouns subsumed (3.2). Section 4 defines three different notions of privativity and shows that none is capable of delivering as insightful an analysis of Kiowa-Tanoan noun classification as the bivalent system.

2. Features: Cardinality, Inverse, Groups

This section motivates three number features in the analysis of Kiowa nouns: [±singular], [±augmented], and [±group]. Section 2.1 introduces the canonical Kiowa noun and the mnemonic system used for noun classifcation. Subsequent sections examine the two types of deviation from the canonical agreement pattern. Section 2.2 introduces the inverse, the plural∼antiplural number marking typical of the Kiowa-Tanoan family. This reveals the existence of three further noun classes. Section 2.3 accounts for these by proposing an inventory of number features. The features occupy two DP-internal projections, Class and Number, which jointly value D, generating the inverse and agreement patterns. Finally, Section 2.4 examines grouphood, the second way in which nouns deviate from the canonical agreement pattern. The result is an account of the content and distribution of number features throughout the DP, the predictions of which are tested in Section 3.

2.1. Basic nouns

Kiowa distinguishes three numbers: singular, dual, plural.

(3) X!óú Ø /ę /gya-dɔ́ɔ́
stone 3S/3D/3P- be
'It's a stone / two stones / some stones.'

In (3), the noun is unmarked for number and the cardinality of its referent is straightforwardly revealed by the agreement prefix.[1] Nouns that display such transparent number agreement are termed **SDP nouns**. The first letter in the mnemonic stands for the agreement type triggered when the referent is singular, the second for the agreement type when the referent is dual, and the third for the agreement type when the referent is plural. So, SDP nouns, like 'stone', trigger S-agreement in the singular, D-agreement in the dual, and P-agreement in the plural.

Few Kiowa nouns are as transparent as 'stone'. They differ from the canonical, cardinality-transparent pattern of number agreement in one of two ways. The first, addressed immediately below, concerns cases in which the noun is suffixed according to its number. The second, addressed in Section 2.4, concerns grouphood. (It may be thought that, if few nouns are canonical, then the nomenclature is inapposite. However, the systematicity of the deviations will make it apparent that this is not so.)

2.2. Inverse marked nouns

Some nouns differ from SDP 'stone' in displaying number-sensitive suffixation:

(4) **Number-dependent noun marking**

Noun	**singular**	**dual**	**plural**
fish	ɔ́ɔ́pɻ́ɻ́	ɔ́ɔ́pɻ́ɻ́	ɔ́ɔ́pɻ́ɻ́-**dɔ́**
tomato	k!ɔ̨ɔ̨-**dɔ**	k!ɔ̃n	k!ɔ̨ɔ̨-**dɔ**
stick	áá-**dɔ**	áá	áá

The unsuffixed forms agree as one would expect on the basis of SDP nouns:

(5) a. Ɔ́ɔ́pɻ́ɻ́ **Ø**- dɔ́ɔ́
fish 3**S**-be
'It's a fish.' singular ⇔ S-agreement

b. Ɔ́ɔ́pɻ́ɻ́/k!ɔ̃n /áá **ę**- dɔ́ɔ́
fish /tomato/stick 3**D**-be
'It's two fish/tomatoes/sticks.' dual ⇔ D-agreement

[1] On the morphophonology of the agreement prefix, which is very complex, see Watkins 1984 or Harbour 2006a. Kiowa nouns never inflect for case.

c. Áá **gya**-dɔ́ɔ́
stick 3P- be
'It's some sticks.' plural ⇔ P-agreement

However, none of the suffixed forms trigger the numerically expected agreement. Rather, they all have a special agreement form.

(6) Ɔ́ɔ́pɻ́ɻ́**dɔ́**/k!ʠ**dɔ** /áá**dɔ** **e**- dɔ́ɔ́
fish.I /tomato.I/stick.I 3I-be
'It's some fish / a tomato / some tomatoes / some sticks.'

Such agreement is opaque to number, occurring with the singular and plural, as in (6), and with the dual, as in (7).

(7) **E**-x!óígyá
1I-fall.S/D.PF
'We two fell.'

This suffix is traditionally called the **inverse**;[2] its proprietal agreement form will be called **I-agreement**.

We can describe the agreement behavior of these nouns by substituting I into the SDP mnemonic. For instance, **ɔ́ɔ́pɻ́ɻ́** 'fish' is an **SDI noun**, as it triggers S-agreement in the singular, D-agreement in the dual, but I-agreement, together with inverse marking on the noun, in the plural. Similarly, given (4), **k!ɔ̂n** 'tomato' is an **IDI noun**, and **áá** 'stick', **IDP** .

2.3. Mechanism of inverse marking

2.3.1. Number features

To account for inverse marking, we must first adopt a particular view of number. The number categories, singular, dual, plural, are taken to be the compositions of the atomic features below, rather than the correspondents of category-specific number features, [singular], [dual], [plural]:

[2]The inverse suffix has a variety of allomorphs. They are phonologically conditioned, not proprietal to any semantic noun class. See Watkins (1984) and Harbour (2006a).

(8) **Feature composition of cardinalities**

Category	**[±singular]**	**[±augmented]**
singular	+	−
dual	−	−
plural	−	+

(9) **Definitions: [±singular], [±augmented]**

a. $[+\text{singular}] = \lambda \text{P} \lambda x [\text{P}(x) \wedge \text{atom}(x)]$

b. $[+\text{augmented}] = \lambda \text{P} \lambda x \exists y [\text{P}(x) \wedge \text{P}(y) \wedge y \sqsubset x]$

The minus values are defined as the negation of the plus values. Intuitively, [+singular] takes a predicate, such as 'fish', with standard lattice theoretic denotation (Link 1983), restricts its satisfaction to the atomic part of the lattice. Similarly, [+augmented] restricts the lattice associated with P, to those elements that are the join of elements that satisfy P. As a feature bundle, they are interpreted iteratively:

(10) **Feature bundles: interpretation**

$[\pm\text{singular} \pm\text{augmented}](\text{P}) = \big[\pm\text{augmented}\big]\big([\pm\text{singular}](\text{P})\big)$

So, for instance, [−singular −augmented](P) restricts the lattice associated with P to its non-atomic subpart, [−singular](P), and then, further, to the subpart with no further non-atomic subparts, [−augmented]. (This equates to the dual because dyads are the only non-atomic elements of the lattice that themselves lack non-atomic subparts. See Harbour 2006a, 2006b for full proofs of the correspondence in (8) and for the contradictority of [+singular +augmented].)[3]

[3]Typical evidence cited in favor of this compositional view of number comes from the dual (e.g., Hale 1997, Noyer 1992, Cowper 2005; see Harbour 2006b on other numbers). Observe, that, in (8), the dual is composed of elements of the singular and the plural. Similarly, in the following, the dual is a transparent composition of singular and plural.

(i) X!óú-**êl** gya-**ót**
stone-big.**S** 1S:3S-drop.**S**/**D**.PF
'I dropped a big stone.'

(ii) X!óú-**bîn** nen-**ót**
stone-big.**D**/**P** 1S:3D-drop.**S**/**D**.PF
'I dropped two big stones.'

With these features in hand, we can proceed to analysis of inverse marking and I-agreement.

2.3.2. Inverse forms

We account for inverse marking and I-agreement by associating with each noun, or noun class, a feature-value combination, as follows. As these combinations propagate through the syntax, they lead to conflicting feature specifications. Inverse forms, whether on the noun or on the verb, are the vocabularic reflex of such conflicts.

Assume, uncontroversially, that the unsuffixed form of the noun is basic. So, for SDI nouns, the S/D form is basic; for IDP, the D/P form; and for IDI, only the D form. We associate with each noun, the number features that correspond to its basic form. So, for SDI nouns, the feature common to the basic forms, S/D, is the feature common to singular, [+singular −augmented], and dual, [−singular −augmented]; that is, [−augmented]. So, the class feature for SDI nouns is [−augmented]. By similar reasoning, we have:

(11) **Class features I**

Class	**Class Feature**
SDI	[−augmented]
IDP	[−singular]
IDI	[−singular −augmented]

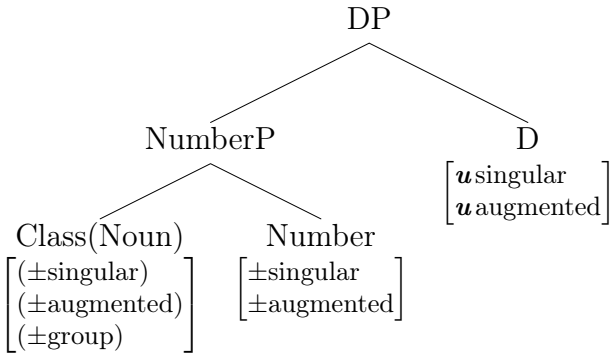
Syntactically, I assume DPs to have the following structure:

(iii) X!óú- **bîn** gyat- **p!ét**
stone-big.**D**/**P** 1S:3P-drop.**P**.PF
'I dropped some big stones.'

'Big' and 'drop' supplete for number and the dual shares the latter with singular and the former with plural. We have a ready account of this in terms of (8): [±singular] conditions **êl**∼**bîn**, [±augmented] **ót**∼**p!ét**.

Such evidence does not render the inventory {[singular], [dual], [plural]} impossible: [singular] might condition **êl**, [plural] **p!ét**, the others being elsewhere forms. However, see Harbour 2006a, chapter 4, for evidence from incorporation and adverb formation that none is an elsewhere from. Also, it will quickly become evident that this inventory is incapable of easily handling the inverse, discussed below.

(12)

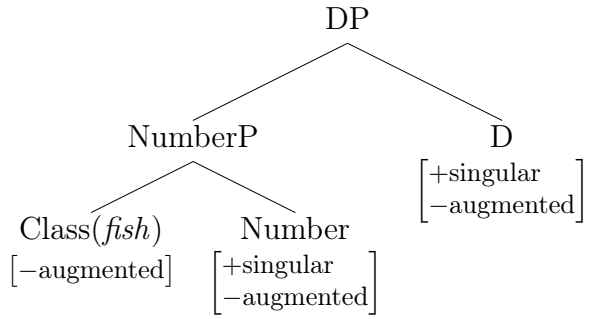


Class is the category forming projection that attaches to the root to create a noun (Marantz 1997, Kihm 2002), or in Ouhalla's (2005) terminology, makes the root syntactically visible. This is the locus of the features in (11). Number is the locus of the features that comprise singular, dual, and plural (Carstens 1991, Ritter 1991, 1993, and others). Finally, D has number features (otherwise there could be no number agreement, on the assumption it is D that agrees with categories of the extended verb projection; e.g., Chomsky 2001), and these features are uninterpretable (as they are 'misplaced': D is the locus of definiteness, and the loci of number features are Number and Class).

Inverse marking and I-agreement arise via the valuation of D's uninterpretable number features, as I shall now argue. Observe, first, that Class and Number must jointly value D: if only Number did, all nouns would be SDP, and if only Class did, nouns would agree invariantly for all numbers.[4] Now, in cases where the feature content of Class is a subset of Number, it is trivial to value D: D replicates the feature content of the two. This is illustrated below for the singular SDI noun, **ɔ́ɔ́pɟ́ɟ́** 'fish': Class is [−augmented], which is a subset of singular Number, [+singular −augmented]. All are straightforwardly replicable on D, which then triggers S-agreement.

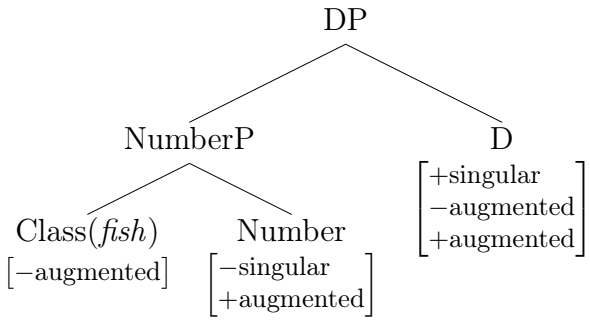
[4]Hence, Kiowa is similar to Kiswahili on Carsten's (1991) analysis.

(13)



However, Class is not always a subset of Number. For a plural SDI noun, for instance, Class is [−augmented], but Number [−singular +augmented]. In such circumstances, the valuation of D proceeds identically, I claim:

(14)



The crucial difference between this and the previous case is the marked situation of having conflicting feature specifications on a single head, D. Two comments are in order, concerning how conflict is syntactically possible and how it is morphologically realized.

Syntactically, uninterpretable features, notated [***u***F], are generally assumed to be features without values; they must be valued, that is, assigned a '+' or '−', for the syntactic computation to converge (Chomsky 2001). On this view, '***u***' marks a lacuna: uninterpretable [±F] is [_F], which the syntactic algorithms map to [+F] or [−F]. Consequently, there is no way to value [***u***F] as (14) [−F +F]. An extra [***u***F] must be produced, violating Inclusivity. As this violation involves only copying, it may not disturb all readers. However, an alternative view is possible, according to which uninterpretability involves overspecification, with both values present on a single X^0.

(15) **Uninterpretability and Valuation**

a. [***u***F] abbreviates [−F +F]: an uninterpretable instance of a fea-

ture consists of all value specifications of that feature.

b. Uninterpretable [αF] is valued if, and only if, it is matched with an interpretable [αF] in the appropriate domain.

c. Unvalued uninterpretable features are invisible at both interfaces. Valued uninterpretable features are visible at the PF interface.

On this view, D bears [−singular +singular −augmented +augmented] when Merged. In (13), D matches only [+singular −augmented], the other features delete, and D thus triggers P-agreement. In (14), D matches [−augmented] with Class and [−singular +augmented] with Number; so, D bears [−singular −augmented +augmented], a bundle with conflicting specification of a single feature, without violating Inclusivity.[5]

Morphologically, conflict is realized as an inverse form:

(16) **Kiowa Inverse**
[−F +F] ⇔ I

As a vocabulary item, (16) is abstract in several important ways. First, no phonological content is given (see Watkins 1984, Harbour 2006a on the complex details). Rather, I is used as a phonological cover term. Second, (16) is silent about syntactic category. If [−F +F] is located on D, the result is inverse marking, as in **ɔ́ɔ́pɟ́ɟ́-dɔ́** 'fish-I'.[6] If it is located on a head with which D agrees, the result is I-agreement, as in **e-dɔ́ɔ́** 'is/are' (3I-be). Third, (16) does not mention [±augmented] specifically, even though (15) concerns the conflict [−augmented +augmented]. The generality in (16) permits us immediately to apply the account to IDP and IDI nouns. For IDP, inverse marking will arise when Number bears a specification that conflicts with the classifying feature [−singular], that is, when Number is [+singular −augmented], or singular. And IDI, where Class is [−singular −augmented],

[5]Discussion of the overspecification approach to uninterpretability lies beyond the scope of this paper. However, two notes are in order. First, there is semantic evidence that contradictory feature specifications are, in fact, possible. The most complex number categories, such as unit augmented and trial, result from iterated interpretation of such specifications (Harbour 2006b). Second, overspecification trivially captures default agreement: it arises when neither value is matched, both are deleted, and only the host head is pronounced. On Chomsky's underspecification view, failure to match entails failure to value, so the computation should fail to converge, rather than yield default agreement.

[6]For non-conflicting features, D is generally null. See Harbour 2006a, chapter 2.

conflicts will arise when Number is [+singular −augmented] or [−singular +augmented], that is, either singular or plural. For SDP nouns, we simply suppose that Class is empty, in which case D replicates Number, resulting in agreement that transparently reveals the number of the referent.

We have, therefore, proposed a two-feature inventory that generates the number categories of Kiowa, and which can be used to classify Kiowa nouns so as to explain, in conjunction with a simple statement about exponence of feature conflicts, the distribution of inverse marking on nouns and I-agreement on verbs.

2.4. Grouphood

We now turn to the second set of nouns that deviate from the canonical SDP agreement pattern. At the morphological level, these display P-agreement where it is not expected, and S-agreement where P-agreement is expected. At the semantic level, they express types of grouphood: pluralia tantum nouns in the first instance (17), or collective nouns in the second (18).

(17) **Non-plural P-agreement**

a. Khɔ́ɔ́dé **gya**-dɔ́ɔ́
pants 3**P**- be
'It's one/two trousers.'

b. Kút **gya**-dɔ́ɔ́
book 3**P**- be
'It's one/two books.'

(18) **Plural S-agreement**

a. Áá **∅**- dɔ́ɔ́
tree 3**S**-be
'It's trees.'

b. Phán **∅**- dɔ́ɔ́
cloud 3**S**-be
'It's clouds.'

The groupings are conceptually complementary. Pluralia tantum nouns are composite even when not plural (trousers are composed of legs and so on; books are composed of sheets). They are pluralities with salient subparts.

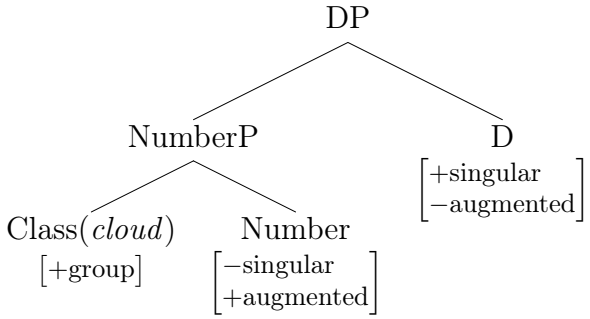
Collective nouns, such as spinneys of trees or banks of clouds, are singular-like when plural. They are pluralities without salient subparts. We capture this with the definition:

(19) **Definition: [±group]**
$\lambda \mathrm{P}_{[+\text{augmented}]} \lambda x \exists \mathrm{Q}_{\mathrm{Q} \neq \mathrm{P}} [\mathrm{P}(x) \wedge \text{Q-atom}(x)]$

[±group] is restricted to augmented parts of lattices, that is, to elements that composed of parts, and it asserts whether those parts are salient or non-salient. For spinneys or cloud banks, the plurality is perceived as an individual, without salient parts. For pants and books, the individual is perceived as a plurality, with salient parts.

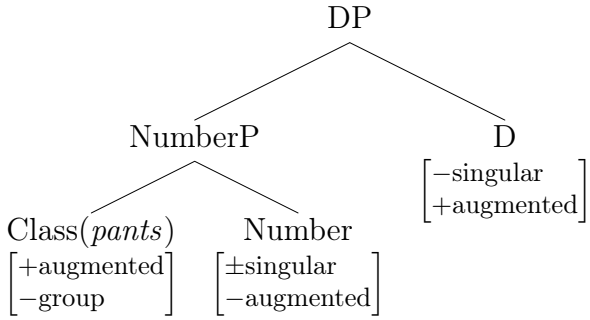
Formally, [±group] recalibrates the notion of atomhood, and concomitantly of singularity, etc., in line with the predicate Q-atom(x), that it introduces. So, when [+group] predicates of something [+augmented], D is valued as [+singular −augmented], as though agreeing with a singular object, a Q-atom.

(20)



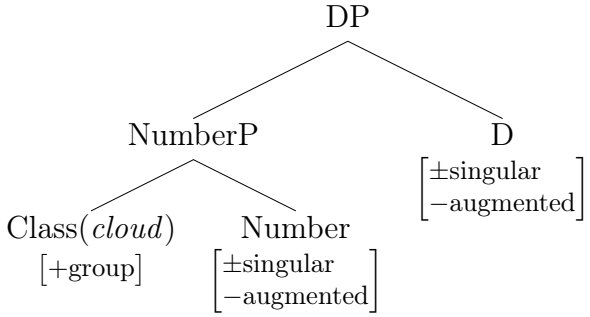
When [−group] predicates of something [+augmented], D is valued as [−singular +augmented], as though agreeing with a plural object, a collection of heterogeneous non-Q-atoms.

(21)



Observe that [+augmented] must be specified on Class in this case. It is absent from Number for reasons of cardinality (8). Yet, [−group] requires its presence in order to affect the valuation of D; hence its inclusion in Class. When there is no [+augmented] element for [±group] to predicate of, it is uninterpreted and computationally inert:

(22)



We can, therefore, expand the typology of noun classes and their classifying features:

(23) **Class features II**

Class	**Class Feature**
SDP	∅
SDI	[−augmented]
IDP	[−singular]
IDI	[−singular −augmented]
SDS	[+group]
PPP	[+augmented −group]

3. Complete Typology of Noun Classes

We are now in a position to prove an extremely interesting result, namely, that Kiowa almost optimally exploits the space of noun classes available to it. This result emerges from the need to cure the analysis of the previous section of the apparent arbitrariness it acquires when we ask what constitutes a possible noun class in Kiowa.

The problem is this: in (23), some classes have one classifying feature, some two, some none. Some use positive values, some negative. No feature is common to all. If we consider that noun classes are recognized on the basis of the agreement types used, S/D/P/I, for singular, dual and plural, we would

expect $4^3 = 64$ different classes. The six in (23) comprise an apparently arbitrary subset.

However, when we begin to examine the typology that the account developed above permits, we discover three important facts:

(24) **Important Facts**

a. Only a small number of morphologically distinct classes, 14, is generable.
b. All and only the generable classes are attested (most, though not all, in Kiowa).
c. There is a semantically natural connection between each classifying feature set and the nouns the class subsumes.

This section proves these three results. By the end of the section, we will, therefore, have an inventory of bivalent number features that perfectly generates the attested number-based noun classes. This will place us in a situation to examine, in the final section, whether the same results are replicable privatively.

3.1. Possible classes

Even before we calculate the effect of the various classificatory possibilities, it is obvious that the feature inventory proposed above substantially constrains the inventory of classes. There are three features that can be used to classify nouns, and they may be specified as absent, as plus, or as minus (as is [±group] for IDI, SDS, and PPP in (23), respectively). This yields $3^3 = 27$ possible values of Class. So, $64 - 27 = 37$ mnemonic possibilities are excluded at once.

The remaining classes are tabulated in (25). Of the 27 possibilities, [−augmented ±group] and [+singular +augmented] are excluded below: as [±group] is predicates of [+augmented], the specification [−augmented ±group] is semantically questionable; and [+singular +augmented] is simply contradictory (Harbour 2006a). (Their inclusion results in no mnemonics not discussed below.) '0' represents absence of a feature; boldfacing marks classes not attested above.

(25) **Typology of classes: bivalent features**

[±singular]	[±augmented]	[±group]	Class
+	−	0	**SII**
+	0	+	**SIS**
+	0	−	**SIP**
+	0	0	**SII**
−	+	+	**SSS**
−	+	−	PPP
−	+	0	**IIP**
−	−	0	IDI
−	0	+	**IDS**
−	0	−	IDP
−	0	0	IDP
0	+	+	**SSS**
0	+	−	PPP
0	+	0	**IIP**
0	−	0	SDI
0	0	+	SDS
0	0	−	SDP
0	0	0	SDP

It will be observed that many distinct feature specifications yield nouns with identical agreement profiles. Consequently, five classes emerge that were not attested above: **SII**, **SIP**, **SSS**, **IDS**, **IIP**. Interestingly, all exist.

Áá 'tree', mentioned above, is, in fact, an IDS noun.

(26) a. Áá- **dɔ** **e**- dɔ́ɔ́
tree-I 3**I**-be
'It's a tree.'

b. Áá **ę**- dɔ́ɔ́
tree 3**D**-be
'It's two trees.'

c. Áá **∅**- dɔ́ɔ́
tree 3**S**-be
'It's some trees.'

Thǫ́ǫ́ɔ́lkhɔ́í 'whisky' is SSS.

(27) a. Thǫ́ǫ́ólkhóí **Ø**- dóó
whisky 3**S**-be
'It's whisky.'

b. Yíí thǫ́ǫ́ólkhóí g**ya**- thóm
two whisky 1S:3**S**-drink.PF
'I drank two whiskies.'

c. Phą́ą́o thǫ́ǫ́ólkhóí g**ya**- thóm
three whisky 1S:3**S**-drink.PF
'I drank three whiskies.'

The SII class, in Kiowa, consists of a single item, the first person. Demonstration of its existence requires close attention to exponence and syncretisms that would take us too far afield (see Harbour 2006a, chapters 3, 5). It is simpler to observe that the class is common in Jemez (Noyer 1992, Sprott 1992, Yumitani 1998):

(28) Jemez SII class (Yumitani 1998, p. 120)

a. Nąę̂- **Ø** k^{hy}ą́ę̂nį̂-**Ø** ʔílæ Ø- hólǽ
that-**Ø** dog- **Ø** much 3S-heavy
'That dog is heavy.'

b. Nį́·- **tʔæ** k^{hy}ą́ę̂nį̂-**š** ʔílæ į̨l- fiólǽ
that-**I** dog- **I** much 3D-heavy
'Those [two] dogs are heavy.'

c. Nį́·- **tʔæ** k^{hy}ą́ę̂nį̂-**š** ʔílæ e- hólǽ
that-**I** dog- **I** much 3I-heavy
'Those [several] dogs are heavy.'

Inverse marking on the noun and demonstrative illustrate the SII pattern.

Observe, that, in contrast to Kiowa, verbal agreement is not invariant under inverse marking—compare 3D **į̨l-** with 3I **e-** in (28). However, D- and I-agreement do frequently syncretize, as in (30a). To capture this, I suggest that the Jemez inverse is different from that of Kiowa (16).

(29) **Jemez Inverse**
[αF αG] $\Leftrightarrow$ I

This causes inverse marking whenever two number features have the same sign. So, the dual will always be inverse marked, as will the singular of any

noun classed [+augmented]/[−singular], and the plural of any noun classed [+singular]/[−augmented]. The dual, [−singular −augmented], is a special case of (29); so, D-agreement, if it exists, will emerge over I-agreement. Where no D-specific vocabulary items exist, however, dual and inverse will syncretize, as desired.

Two further classes are made possible by (29): **IIS** corresponding to [−singular +group] and **III** corresponding to [−singular −augmented] (IDS and IDI in Kiowa, given (16)). They, and the remaining classes, IIP, SIP, SIS, are entirely unattested in Kiowa, but are, again, present in Jemez:

(30) Jemez IIP class (Yumitani 1998, p. 126)

a. Nį́·- **t^{ʔ}æ** t^{y}ê·tɨbæ-**š** nį́· **į**l- k^{ʔ}á
that-**I** box- **I** I :1S:3**I**-lie.S/D
'That box is mine.'
'Those [two] boxes are mine.'

b. Nî·- **Ø** t^{y}ê·tɨbɑ-**Ø** nį́· **į**- g^{y}ó·
that-**Ø** box- **Ø** I :1S:3**P**-lie.P
'Those [several] boxes are mine.'

(31) Jemez SIS class (Yumitani 1998, p. 100)

a. Bélá- **Ø Ø**- ší
bread-**Ø** 3**S**-fall.S/D
'A loaf of bread fell off.'

b. Bélǽ- **š į**l- ší
bread-**I** 3**D**-fall.S/D
'[Two] loaves of bread fell off.'

c. Bélá- **Ø Ø**- t^{y}í
bread-**Ø** 3**S**-fall.P
'[Several] loaves of bread fell off.'

Observe that the noun is inverse marked only in (31b) and that the agreement is identical for singular and plural (31a, c). SIS nouns appear in general to permit P-agreement, as an alternative to S-agreement, in the plural. The difference between S-agreement and P-agreement in the plural is reminiscent of collective versus non-collective plurals in Kiowa: Sprott (1992, p. 90ff) characterizes P-agreement as correlating with "being less concentrated, more diffuse, more spread out, and less identifiable as a collectivity or set". In

discussing in (31), he notes that one informant is inclined to think of loaves of bread for (32a) versus tortillas for (32b), "Because when you're done with oven bread you have those breads sitting on the counter, but with tortillas it's just a stack".

(32) Jemez SIS∼SIP variation[7] (Sprott 1992, p. 91)

a. Béla **ta-** há
bread 1s:3**S**-bake
'I baked bread.'

b. Béla **tul-** há
bread 1s:3**P**-bake
'I baked bread.'

Strictly speaking, therefore, there are not distinct SIS and SIP classes, but rather an amalgamated class with optional [+group] specification. The situation constitutes only a minor divergence from the typology in (25).

Finally, Sprott (p. 281) gives **sų́ʔų́**(**sh**) 'rain' and **tyų́ų́wesh** 'salt' as nouns that invariantly trigger I-agreement, hence III nouns.

We have, therefore, demonstrated the validity of (24a): despite there seeming to be 64 mnemonically possible classes, and 27 featurally possible ones, the number of classes that in fact exist is small, 14 to be precise. Moreover, to my knowledge, all descriptions of Kiowa-Tanoan languages report only classes in (25), or dualless or (29)-related variants thereof.[8] Consequently, the account permits all and only the attested classes. We now turn to the final claim that is important before we compare the bivalent analysis above with privative variants.

3.2. Semantic naturalness

The final claim to be justified is that classes pick out semantically natural groupings of nouns and that there is a conceptually natural connection between the classifying feature of each class and the semantic characteristic of the nouns it subsumes. This will (further) justify the use of semantically contentful features, rather than abstract gender features, in the characterization of the classes.

[7]Sprott's and Yumitani's differing orthographies have been retained.

[8]See especially Noyer 1992 for references and comparative discussion, and Sprott 1989 for thorough references.

The classes attested in Kiowa are listed below. The discussion of their semantic naturalness follows Harbour 2006a (to which the reader is referred for greater detail and further references).

(33) **Kiowa noun classes**

Class and Features		**Semantic Characteristics**
SDP	$\emptyset$	default
SII	[+singular]	first person only
SDI	[−augmented]	independently mobile objects
IDP	[−singular]	vegetation; most non-SDI implements; most non-SDI body parts
IDS	[−singular +group]	vegetation occurring in natural collections; implements that may act collectively
IDI	[−singular −augmented]	hair types; midsize fruit growing in clusters
SDS	[+group]	non-shape-inductive objects
PPP	[+augmented −group]	pluralia tantum nouns; granular mass nouns (for some speakers)
SSS	[+augmented +group]	non-granular mass nouns

SII is clearly a natural class, as it has only one element, and the connection between its member, the first person, and singularity is obvious (see Cysouw 2003 for recent conceptual and typological discussion).

The SDI class comprises all independently mobile objects. This includes all animates, such as people and animals (but not herds), mobile heavenly bodies such as the sun and moon, contraptions such as cars and wagons, cutting implements such as knives and scissors, and body parts capable of independent motion such as limbs, eyes, and articulated tails. Now, [+augmented] ensures that properties of the group are properties of the subgroup; that is, it ensures homogeneity. By contrast, [−augmented] is a measure of non-homogeneity. As independence of motion is a guarantor of non-homogeneity, there is a natural nexus between SDI's class feature, [−augmented], and its defining characteristic, independent mobility.

Vegetation falls into one of three classes: IDP, IDS, IDI. All are [−singular (...)]. Given the inherent connection between atomicity and individuality, this amounts, reasonably enough, to viewing vegetation as inherently non-individual. The same line of thought is carried over to non-SDI implements

and body parts. Thus, most solid objects, such as animals, vegetables, implements, are treated in one of two complementary ways: the independently mobile, individual-like ones are [−augmented] and the immobile, non-individual-like ones are [−singular].

For some immobile objects, the classification ends there. They are IDP. For those that form collective, or collectively acting, pluralities, such as spinneys and groves, or guns and canons, or embers and lamps, the classifying feature [+group] is further added, giving IDS. For fruits that grow in non-homogeneous clusters, with salient individuals, such as apples, plums, persimmons, tomatoes, the feature [−augmented] is further added, giving IDI. The class also includes hair that grows in natural collections, such as head hair and eyebrows. These are simultaneously salient as individuals [−augmented] and as collections [−singular]. (Considering the features separately avoids the uncomfortable necessity of having to conceiving of hairs, tomatoes, and so on as inherently dual [−singular −augmented].)

Non-shape-inductive objects are things such as clouds, puddles, rivers, Westerners' houses. This class, like IDI, is small: it comprises objects that are clearly delineated but that can have very varied shapes. Owing to such variation in shape, when several such objects are side by side, the boundaries of each are difficult to detect. Consequently, in pluralities, the individuals are not salient, but rather, the plurality itself is. Hence, non-shape-inductive objects are [+group].

The connection between pluralia tantum nouns and [+augmented −group] was discussed above. The lack of class features for SDP and its status as a default is straightforward.

The final nouns to be discussed for Kiowa are mass nouns. All are [+augmented], capturing their well noted plurisimilitude (Link 1983). They are subdivided into granular and non-granular, with this difference being expressed by the feature [±group], which measures salience of subparts.[9]

The same coherence apparently holds for Jemez (reading into Sprott 1992, Yumitani 1998 and following also Noyer 1992).[10]

(34) **Jemez noun classes**

[9]There is a slight, though superficial, notational complication in using three-place cardinality-tracking mnemonics to talk of mass nouns. See Harbour 2006a, chapter 2, for discussion.

[10]An alternative analysis, following Noyer, is available in terms of positive class features:

(i) **Jemez noun classes: alternative analysis**

Class and Features		Semantic Characteristics
SIP	$\emptyset$	default
SIS	[+group]	collective counterpart of SIP
IIP	[−singular]	vegetation; complex artifacts; body parts
IIS	[−singular +group]	collective counterpart of IIP
SII	[−augmented]	animates
SSS	[+augmented +group]	non-granular mass nouns
III	[−singular −augmented]	weakly granular mass nouns
PPP	[+augmented −group]	granular mass nouns

The difference between the class mnemonics in (33) and (34) results from the differing inverse conditions (16) and (29). However, the reasoning behind assignation of features to noun class characteristics applies much as before. This is not claim that the noun classes are identical. For instance, III contains just two members: **sų́ʔų́**(**sh**) 'rain' and **tyų́ų́wesh** 'salt' ('weakly granular', as they occur in natural, but non robust units, drops and crystals). The featurally corresponding class in Kiowa is IDI, which contains hair and certain fruit, argued above also to be mass-like. Given that these nouns all share

Class and Features		Semantic Characteristics
SIP	[+singular −group]	default
SIS	[+singular +group]	collective counterpart to SIP
IIP	[+augmented]	vegetation; complex artifacts; body parts
IIS	[−augmented +group]	collective counterpart to IIP
SII	[+singular]	animates
SSS	[+augmented +group]	non-granular mass nouns
III	[+singular +augmented]	weakly granular mass nouns
PPP	[+augmented −group]	granular mass nouns

It is difficult to decide between the accounts. Note, however, that (i) is curious in lacking a default class, and questionable in the treatment it forces of III, IIS and SIS. The class pairs IIS∼IIP and SIS∼SIP do not differ with regard to the same feature, as in (34); rather SIS∼SIP oppose for [±group], and IIS∼IIP for [±augmented]. Furthermore, the combination [−augmented +group] for IIS is a semantically odd, given that [±group] predicates of [+augmented]. The problem of semantic oddity also afflicts the treatment of III: if specified with plus values, it must be [+singular +augmented], which is contradictory (Harbour 2006a). Either this contradictority must be accepted (perhaps by considering the two feature's classificatory roles separately, as was done to avoid inherently duality of [−singular −augmented] in Kiowa), or a lone minus classification, [−singular −augmented], must be retained from (34).

characteristics with other classes, it is not surprising that they are apt to be reclassified. By contrast, as animacy does not overlap with other characteristics, membership of the SDI /SII class is robust across the languages.

On the analysis above, Kiowa and Jemez differ primarily with respect to the nature of inverse marking and agreement. The inventories of their noun classes are all but identical. A striking fact is that the cardinality features are used almost exclusively negatively (except for [+augmented], which cooccurs with [±group], and for [+singular], for the first person, in Kiowa). However, relative to this restriction, the space of possible classes is almost optimally exploited by both languages individually, and is optimally exploited the two languages jointly.[11]

4. Against Privativity

We are now in a position to state the case against privativity. It is that no privative recasting of the account offered above can preserve its virtues:

(35) **Virtues of bivalence-based account**

a. All features are semantically motivated. None are mere morphological conveniences.
b. The syntactic mechanisms that generate inverse marking on nouns and I-agreement on verbs are nothing more than the mechanisms of agreement familiar from other languages.
c. The features generate all and only the attested classes.
d. The features provide a clear explanation of why Kiowa and Jemez have the particular subsets of possible classes that they do.

To begin the argument, we distinguish two notions (and one pseudonotion) of privativity. Both are then applied to the data discussed above.

4.1. Types of privativity

In a binary feature system, there is a difference between [+F], [−F] and absence of [±F]. Consider, for instance, the SII class has a positive specification for [±singular], the IDP class, a negative specification, and the SDP class, a

[11] Adopting the analysis of the previous footnote, this optimal exploitation result is retained, but an interesting difference emerges between the languages, as Noyer observes: Kiowa classifies using mostly minus, Jemez, primarily plus.

zero specification. I take the hallmark of a privative feature system to be that only a two-way distinction is possible. This amounts to neutralizing the unmarked∼zero opposition, which can be achieved in two ways. One possibility is to define a new feature [F′] corresponding to [αF], with [ᾱF] corresponding to zero:

(36)

Binary	→	**Privative**
[αF]		[F′]
[ᾱF]		∅
∅		∅

Let us call this **presence∼absence privativity**.

The alternative is to define a new two-valued feature [±F″], with one value, plus, say, being the marked one, and the other being redundantly supplied (cf., Chomsky and Halle 1968/1991).

(37)

Binary	→	**Privative**
[αF]		[+F″]
[ᾱF]		[−F″]
∅		[−F″]

Let us call this **plus∼minus privativity**.

A third possibility is to define two different features, corresponding to the each of the values of [±F]:

(38)

Binary	→	**Privative**
[αF]		[F′]
[ᾱF]		[F″]
∅		∅

Although the resulting notation—features without values—is identical to the first option, it merely masks a three-way distinction, rather than disposing of it. I regard this as pseudoprivativity. It is not considered further.

Neither presence∼absence nor plus∼minus privativity permits a three-way distinction between plus, minus, and zero. The fundamental difference between the two is that the plus∼minus privativity permits reference to more natural classes than the presence∼absence privativity does. {[−F], ∅}, which is not a natural class in the binary system, is mapped onto a natural class, {[−F″]}, in the second system, and so may be referred to by morphological rules and vocabulary items. This is not possible in presence∼absence

privativity. Let us proceed with the first, more restrictive option.

4.2. Presence∼absence privativity

4.2.1. Account

We begin by positing two features, which I shall simply call [F] and [G], that generate cardinalities as shown below:

(39)

Features	Cardinality	Agreement Type
[F]	singular	S-agreement
[F G]	dual	D-agreement
[G]	plural	P-agreement

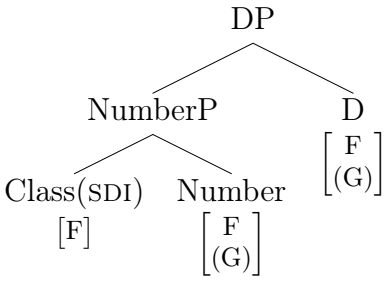
(Clearly, [F] and [G] correspond to [−augmented] and [−singular] respectively.) This feature composition captures the composite nature of the dual (footnote p. 6) as well as the underlying classification of the Kiowa noun classes of Sections 2.1 and 2.2: SDP is ∅, SDI is [F], IDP is [G], and IDI is [F G]. The challenge is to use these features to generate the other classes observed in Kiowa and Jemez. This involves specifying the featural content of Class and Number and the conditions under which they give rise to inverse marking and agreement.

However, generating inverse is not trivial. Above, it arose simply by copying cardinality features from Class and Number onto D and then spelling out feature/value conflict, [−F +F] for Kiowa, [αF αG] for Jemez, in a uniform fashion. With valueless privative features, such conflicts cannot arise. The only solution appears to be to suppose that the inverse is itself a value that D attains when Class and Number are in a specific relation. That is, we posit a feature [inverse] with the following property:

(40) **Inverse by exclusion**
D is valued as [inverse] when Class $\not\subseteq$ Number

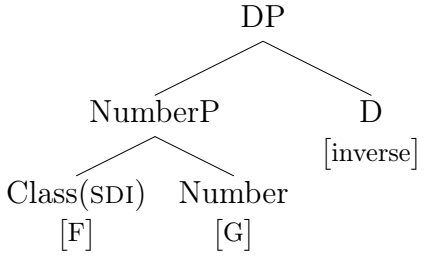
To illustrate, consider a singular or dual SDI noun. Class is [F] and Number is [F (G)]. So, Class $\subseteq$ Number and the content of Number (and Class) is copied onto D.

(41)



For the plural, however, Number is [G]. Copying alone, without (40), would value D as [F G], triggering D-agreement. However, [F] $\not\subseteq$ [G]. So, Class $\not\subseteq$ Number and, by (40), we have:

(42)



It is easily verified that, given (40), the correct inverse marking and agreement types result for SDP, IDP and IDI nouns, given the respective classifications $\emptyset$, [G], and [F G].

The idea that [inverse] is a feature has been proposed before (Noyer 1992, Harbour 2003). However, the idea is clearly inferior to the bivalent approach pursued above. First, the previous account required only features that were semantically motivated. By contrast, [inverse] has no meaning: it arises purely in the course of syntactic computation, as a value of uninterpretable number on D and heads of the extended verbal projection. It is a mere morphological convenience. Second, [inverse] violates syntactic Inclusivity (Chomsky 2001): it is introduced to the syntax, not by Merge, but by computation, which therefore must do more than just match and copy.

The lack of motivation for (40) becomes more problematic when we consider the SII class. The SDP, SDI, IDP and IDI classes between them exhaust the possible classes generated by {[F], [G]}. The simplest way to capture the SII class is by admitting a second inverse condition:

(43) **Inverse by inequality**
D is valued as [inverse] when Class $\neq$ Number

For SII, we specify that Class is [F] and that D valuation is subject to (43). For the singular, Number is [F], therefore Class = Number, and D is valued straightforwardly as [F]. However, for the dual and plural, [F] = Class $\neq$ Number = [(F) G]. Consequently, (43) applies and D is valued as [inverse].

To capture the behavior of a class, then, we must specify both the content of the Class head and whether its inverse forms arise by exclusion (40) or by inequality (43).

Nothing posited so far is sufficient to generate the SDS and PPP (pluralia tantum) classes. These motivated the feature [±group], both values of which were crucial and both distinct from absence of the feature. Unfortunately, we cannot posit a feature [Gr] meaning the same as [+group] and a second feature [Oup] meaning the same as [−group], as this is precisely the pseudoprivativity dismissed at the end of Section 4.1. It defeats the purpose of 'going privative' by merely dressing up a binary distinction in the notation of privativity. Moreover, having different features disguises the fact that we are dealing with the same basic semantic property: grouphood and its assertion or denial. However, if we introduce just one feature, one class is lost: without [Gr] = [+group], there is no SDS, without [Oup] = [−group], no PPP.

An alternative solution is to introduce a diacritic on class features, which I shall call **^{x}-notation**. That is:

(44) **Definition: ^{x}-notation**
Let [C] be a feature on Class and [N], a feature combination on Number. Then:
a. $[C^x] \overset{\subseteq}{=} [N]$ if, and only if, $[C] \overset{\subseteq}{=} [N]$.
b. If $[C^x] \overset{\subseteq}{=} [N]$, value(D) = [N]. If $[C^x] \overset{\nsubseteq}{\neq} [N]$, value(D) = [C],

Simply put, the notation permits D to be valued as Class in exactly those cases where it would normally be valued as [inverse]. Before commenting on this, let me illustrate how it works.

The SDS class is $[F^x]$, subject to inverse by exclusion. So, for singular or dual, D simply replicates Number: $[F^x] \subseteq$ [F (G)], since [F] $\subseteq$ [F (G)], so (40) does not apply. However, for the plural, Class $\nsubseteq$ Number, as Number = [G], [F] $\nsubseteq$ [G], and so $[F^x] \nsubseteq$ [G]. So, (40) applies. Ordinarily, this would value D as [inverse]. But, because of the ^{x}-notation on Class, $[F^x]$, D is valued instead as the class feature [F]. Thus, we have S-agreement when plural. The result is SDS.

The PPP class behaves similarly. Class is [G^x], subject to inverse by inequality. So, the straightforward case is the plural: Number is [G] and, given that [G] = [G], it follows that [G^x] = [G]. So, Class = Number, (43) does not apply and D is valued as [G]. However, for singular and dual, Class $\neq$ Number: [G] $\neq$ [F (G)], so [G^x] $\neq$ [F (G)]. So, (43) applies. But, because of the ^{x}-notation on Class, [G^x], D is valued instead as the class feature [G]. Thus, we have P-agreement for all numbers.

Let us finally consider IDS. A reasonable initial guess is [F^x G] subject to inverse by exclusion, combining IDP and SDS. However, (40) applies whenever Class $\not\subseteq$ Number, that is, whenever [F^x G], or equivalently, [F G] $\not\subseteq$ Number. Thus, (40) applies both for singular and plural. By the definition of ^{x}-notation, D is valued in these cases as [F], resulting in SDS again.

To avoid this problem, we must relativize (40) so that 'only problematic features count'. That is, for singular, Number = [F] and the problematic feature is [G], not [F^x]; so the latter is ignored and D is valued as [inverse]. Similarly, for plural, Number = [G] and the problematic feature is [F^x]; so [G] on Class is ignored, and D is valued as [F]. (IDI, [F G], functions as before.)

Assuming the revision of the previous paragraph, the valuation of D proceeds, in anthropomorphized summary, as follows.

(45)
a. Momentarily ignore ^{x}-notation.
b. If Class $\underset{=}{\subseteq}$ Number, replicate Number on D.
c. If Class $\underset{\neq}{\not\subseteq}$ Number, consider the problematic Class feature, i.e., the feature of Class the removal of which would ensure that Class $\underset{=}{\subseteq}$ Number. Value D in accord with that feature, i.e., as the feature if it is ^{x}-notated, as [inverse] otherwise.[12]

Consider the inventory of classes now generable. There are in total 18 possibilities, given the nine class features [(F$^{(x)}$) (G$^{(x)}$)] and the two inverse conditions, (40) and (43).

(46) **Typology of classes: privative features I**

[12]Talk of 'the problematic feature' assumes that there is only one. This is true except on one occasion: when Class is empty, inverse by inequality applies, and Number = [F G]. In this case, D is valued as [inverse].

Class	Inverse by Inequality	Inverse by Exclusion
∅	III	SDP
[F]	SII	SDI
[G]	IIP	IDP
[F G]	IDI	IDI
[F^x]	SSS	SDS
[G^x]	PPP	PDP
[F^x G]	IDS	IDS
[F G^x]	PDI	PDI
[F^x G^x]	PDS	PDS

All Kiowa classes are generated. The Jemez classes SIP, SIS, IIS, however, are not.

Undergenerativity can be repaired if inverse marking on Jemez nouns realizes not only [inverse], but also dual, [F G].

(47) **Jemez inverse: privative version**
[inverse]/[F G] ⇔ I

Essentially, this maps D in (46) onto I, creating the missing mnemonics, SIP, SIS, IIS, from SDP, SDS, IDS. By recreating the effect of (29) in this way, we have a system that generates all the necessary noun classes.

With two systems, one bivalent and one privative, that generate the same set of noun classes, which is to be preferred?

4.2.2. Evaluation of account

The privative account possesses, I believe, a certain elegance, as one and the same mechanism specifies both when D is not valued as [inverse], despite applicability of (40)/(43), and how it is valued instead. It is, however, inferior in several regards.

First, the implications of ^{x}-notation are potentially problematic. It is not clear why language should permit it or even what such a device is: what other uses might language make of the formal underpinnings of ^{x}-notation? One must wonder whether the introduction of ^{x}-notation is in the spirit of 'going privative', the point of which was to show that the ∅∼[−F]∼[+F] distinction permitted by bivalent features is superfluous. If we need compensatory devices, creating a new three way distinction, ∅∼[F]∼[F^x], then this suggests

that privative features alone are too restrictive. Moreover, ^{x}-notation makes pure privativity seem too restrictive in a particularly suspicious fashion. The feature must be enriched by a form of diacritic notation. Given that '+' and '−' are themselves feature diacritics of a sort, ^{x}-notation points the way back to bivalence.

The second device required to make the account descriptively adequate is (30a), which forces syncretism between dual and inverse. Empirically, the idea is reasonable, as the two syncretize elsewhere in the language; contrast (28b)/(28c) with (30a). However, implementation of this syncretism is opaque: [inverse] and [F G] are featurally disjoint, which ought to predict the impossibility of syncretism, unless their realization is an elsewhere form. However, this requires claiming that zero realization of D, for singular, plural and mass nouns, is more marked than inverse/dual marking. A similar problem holds for verbal agreement: Noyer 1992 argues that either S- or P-agreement is unmarked, and it is highly odd to regard the crosslinguistically marked dual and even more marked inverse as being, in fact, mere elsewhere forms. (The syncretism is straightforward in the bivalent system; see the discussion following (29).)

Third, the privative feature system overgenerates by 50%. The following classes are predicted to be possible in Kiowa/Jemez: PDP/PIP, PDI/PII, PDS/PIS. All these arise from [G^{x}], but ^{x}-notation cannot be restricted to [F] without loss of PPP. Non-attestation of these classes, and exploiting only two thirds of possible classes across the whole family, makes the system, or the family, seem arbitrary.

Fourth, the privative system loosens the connection between feature semantics and noun class semantics. The contentful feature [±group] has been replaced by ^{x}-notation. As the notation is a purely formal device, to which no meaning is assigned, there can be no correlation between it and the semantic characteristics of the nouns with which it is associated. Again, this makes the system as a whole appear somewhat arbitrary.

Finally, the two different inverse conditions themselves lack motivation. If there is a tendency for vocabulary items to realize marked feature combinations (and, conversely, for zero to correlate with default specifications), then, for the bivalent system, the motivation for the existence of inverse forms is straightforward: in Kiowa, inverse is the vocabularic reflex of the marked situation in which feature values conflict; in Jemez, the marked situation in which the opposing features [±singular] and [±augmented] have non-opposing values. In the privative system, however, no such motivation

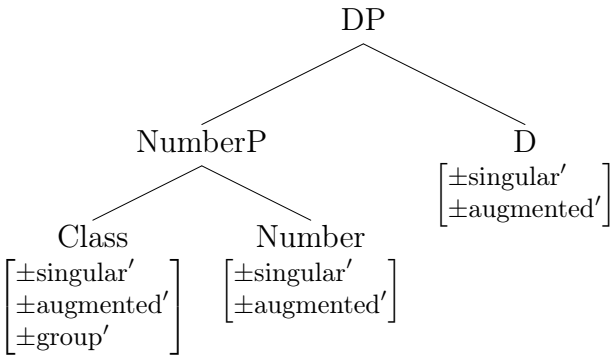
is forthcoming. In fact, the whole concept of an inverse is unexpected, as feature conflicts cannot arise. They must be induced by principles such as (40) and (43). Consequently, there is no natural motivation on this account for one inverse, let alone two. Now, there is the interesting observation, concerning (46), that count nouns (modulo the first person) can be exclusively derived using (40) and mass nouns, using (43). However, it is impossible to capture this semantic partitioning of the two conditions so long as the conditions themselves lack semantic motivation.

It is, therefore, fair to conclude that the bivalent account is syntactically more natural, semantically more insightful, and morphologically more constrained.

4.3. Plus∼minus privativity

Given the problems with presence∼absence privativity, it is reasonable to turn to the plus∼minus system. However, it is quickly shown that this system is simply descriptively inadequate. Let the bivalent features have privative correspondents [±singular′], [±augmented′] and [±group′]. The DP is:

(48)



Zero specification, corresponding to the parentheses in (12), is not permitted. Allowing both the Kiowa and Jemez inverse conditions yields 16 possibilities.

(49) **Typology of classes: privative features II**

Features			Inverse	
[±singular′]	[±augmented′]	[±group′]	(16)	(29)
+	+	+	SSS	SSS
+	+	−	PPP	PPP
+	−	+	SIP	SIP
+	−	−	SIS	SIS
−	+	+	SSS	SSS
−	+	−	PPP	PPP
−	−	+	IDP	IIP
−	−	−	IDS	IIS

Total absence of Class only generates one further class, SDP, and so, even permitting the semantically questionable [−augmented ±group] and [+singular +augmented] in (49), there are insufficiently many distinct classes: 10 falls four short. The only possibility is to enrich the system with further features and conditions concerning their effect on valuation of D. However, the semantic motivation of the features will be moot (as will be the naturalness of the conditions on valuation), given how neatly the features [±singular], [±augmented] and [±group] correspond to the actual semantic properties of the numbers and noun classes that Kiowa-Tanoan presents.

5. Conclusion

On purely conceptual grounds, privativity is to be preferred over bivalence. However, faced with facts, bivalence is demonstrably superior. It permits an analysis of Kiowa-Tanoan noun classification that (a) uses only [±singular], [±augmented], and [±group], features that are directly semantically motivated, (b) uses only syntactic mechanisms that are independently required (Carstens 1991, Chomsky 2001), (c) generates all and only the attested noun classes, and (d) explains, in conjunction with the differing inverse conditions (16) and (29), why Kiowa and Jemez have precisely the classes they do. By contrast, the best of the privative analyses, presence∼absence privativity, (a′) requires a conceptually obscure feature [inverse], for purely morphological expedience, (b′) uses syntactic mechanisms that violate Inclusivity (to induce inverse marking) and that, qua feature annotation, are formally akin to bivalence (^{x}-notation), (c′) overgenerates, and (d′) does not explain the distribution of classes across Kiowa and Jemez. The conclusion to be

drawn is that the atoms of number provided by Universal Grammar are bivalent and that some languages crucially exploit the three-way distinction, $\emptyset \sim [-\mathrm{F}] \sim [+\mathrm{F}]$, that this permits.

References

Adger, David. 2006. Remarks on minimalist feature theory and move, ms Queen Mary, University of London (forthcoming *Journal of Linguistics*).

Carstens, Vicki May. 1991. The morphology and syntax of determiner phrases in Kiswahili. Ph.D. thesis, University of California, Los Angeles.

Chomsky, Noam. 2001. Derivation by phase. In Michael Kenstowicz, ed., *Ken Hale: a Life in Language*, 1–52, Cambridge, MA: MIT Press.

Chomsky, Noam and Halle, Morris. 1968/1991. *The Sound Pattern of English*. Cambridge: MIT Press, paperback edition.

Cowper, Elizabeth. 2005. A note on number. *Linguistic Inquiry* 36:441–455.

Cysouw, Michael. 2003. *The Paradigmatic Structure of Person Marking*. Oxford: Oxford University Press.

Hale, Kenneth. 1997. Some observations on the contribution of local languages to linguistic science. *Lingua* 100:71–89.

Harbour, Daniel. 2003. The Kiowa case for feature insertion. *Natural Language and Linguistic Theory* 21:543–578.

Harbour, Daniel. 2006a. *Morphosemantic Number*. Dordrecht: Kluwer.

Harbour, Daniel. 2006b. Numerus: Der morphologische Gebrauch semantischer Atome. Presentation, Universität Leipzig.

Jakobson, Roman. 1971. *Selected Writings I*. Berlin: Mouton de Gruyter, 2 edition.

Jakobson, Roman, Karcevsky, S., and Trubetzkoy, Nikolai S. 1928. "Quelles sont les méthodes les mieux appropriés à un exposé complet et pratique d'une langue quelconque?", Jakobson 1971, pp. 3–6.

Kihm, Alain. 2002. What's in a noun: Noun classes, gender, and nounness. www.llf.cnrs.fr/fr/kihm.

Link, Godehard. 1983. The logical analysis of plurals and mass terms: A lattice-theoretical approach. In R. Bäuerle, C. Schwarze, and A. von Stechow, eds., *Meaning, Use and Interpretation of Language*, 302–323, Berlin: Walter de Gruyter.

Marantz, Alec. 1997. No escape from syntax: don't try morphological analysis in the privacy of your own lexicon. In A. Dimitriadis, L. Siegel, C. Surek-Clark, and A. Williams, eds., *PWPL 4.2, Proceedings of the 21st Annual Penn Linguistics Colloquium*, 201–225, Pennsylvania: University of Pennsylvania Working Papers in Linguistics.

Noyer, Rolf. 1992. Features, positions and affixes in autonomous morphological structure. Ph.D. thesis, MIT.

Ouhalla, Jamal. 2005. Agreement features, agreement and antiagreement. *Natural Language and Linguistic Inquiry* 23:655–686.

Ritter, Elizabeth. 1991. Two functional categories in noun phrases: evidence from Modern Hebrew. In Susan Rothstein, ed., *Syntax and Semantics 26*, 37–62, New York: Academic Press.

Ritter, Elizabeth. 1993. Where's gender? *Linguistic Inquiry* 24:795–803.

Sprott, Robert W. 1989. An annotated bibliography of Kiowa-Tanoan. *Kansas Working Papers in Linguistics* 14, 2:98–113.

Sprott, Robert W. 1992. Jemez syntax. Ph.D. thesis, University of Chicago.

Watkins, Laurel (with the assistance of Parker McKenzie). 1984. *A Grammar of Kiowa*. Lincoln: University of Nebraska Press.

Yumitani, Yukihiro. 1998. A phonology and morphology of Jemez Towa. Ph.D. thesis, University of Kansas.