Valence and Atomic Number*

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Abstract 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 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 (*e.g.*, Noyer 1992 versus Harley and Ritter 2002; see Adger and Harbour 2007b and below for further references). For instance, to express plurality, one could posit privative [F] or bivalent [±F]. In the bivalent variant, elements are interpreted as plural if they bear [+F], and as non-plural if they bear [−F]. In the privative variant, elements are interpreted as plural if they bear [F];

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elements without the feature are taken non-plural (Harley and Ritter 2002) or to be compatible with either interpretation (Reinhart 2002).

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 ∅∼[−F]∼[+F], but privativity, only the two-way distinction ∅∼[F]. Moreover, privativity has been adopted in some recent influential work (Harley and Ritter 2002, Béjar 2003, Béjar and Řezáč 2004).

This paper argues, however, that privativity is too restrictive (as found in an early attempt to adopt thoroughgoing privativity; Silverstein 1986: 188, 227–228.). Linguistic theory requires features with the three-way distinction ∅∼[−F]∼[+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 motivates three features on 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*[1]

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

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

c. $[+\text{group}] = \lambda \text{P}\colon [+\text{augmented}] \,.\, \lambda x\colon \text{P}(x)\, [\text{Q-atom}(x)]$
(Q, a contextually supplied free variable over predicates)

(2) *Ancillary definitions*

a. *Presupposition*: '$\lambda z\colon \phi$' means that ϕ is a presupposition on z

b. *Q-atom*: x is a Q-atom if, and only if, $\text{Q}(x) \wedge \neg\exists y[\text{Q}(y) \wedge y \sqsubset x]$

c. *Feature negation*: $[-\text{F}] = \neg[+\text{F}]$

[1]These definitions differ in some details from those of Harbour (2007), for reasons discussed below. The feature [±singular] is a different type from the other two, ⟨e,t⟩ rather than ⟨⟨e,t⟩,⟨e,t⟩⟩. They could be made type-identical by rewriting [+singular] as $\lambda \text{P} \,.\, \lambda x\colon \text{P}(x)[\text{atom}(x)]$. The shorter formula is used here for readability.

Given the features' 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 one could well expect up to 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.

In sum, then, the virtues of a bivalence-based account are (a) semantic, as well as morphological, well-foundedness, (b) use of standard syntactic mechanisms, (c) descriptive adequacy with respect to the inventory of noun classes, and (d) explanatory adequacy with respect to the inventory of noun classes.

If one attempts to change the features that Kiowa-Tanoan motivates from bivalent into privative ones, however, the class typology is lost. The system immediately undergenerates, contra (c). 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, contra (a). Any such additions are, therefore, for purely morphological purposes, and, so, sacrifice the tight connection between semantics and morphology. And altering the syntactic mechanisms, contra (b), admits classes that are unattested, contra (d), 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 class 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, a simultaneously plural and antiplural number marking, characteristic 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. (The theory described below is developed more fully in Harbour 2007 but departs from it in the treatment of [±group.)

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.[2] 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

[2]On the morphophonology of the agreement prefix, which is very complex, see Watkins (1984) or Harbour (2007). Kiowa nouns never inflect for case.

Table 1: *Number-dependent noun marking*

Noun	**singular**	**dual**	**plural**
fish	ɔ́ɔ́pɻ́ɻ́	ɔ́ɔ́pɻ́ɻ́	ɔ́ɔ́pɻ́ɻ́-**dɔ́**
tomato	k!ɔ̂ɔ̨-**dɔ**	k!ɔ̂n	k!ɔ̂ɔ̨-**dɔ**
stick	áá-**dɔ**	áá	áá

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, as Corbett 2005: 26 observes, "canonical instances ... may well not be the most frequent", and, besides, deviations from the canonical case are all highly systematic.)

2.2. Inverse marked nouns

Some nouns, such as those in table 1, differ from SDP 'stone' in displaying number-sensitive suffixation. The unsuffixed forms agree as one would expect on the basis of SDP nouns:

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

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

c. Áá **gya**-dɔ́ɔ́
stick 3**P**- 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.

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

Table 2: *Feature composition of cardinalities*

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

Such agreement is opaque to number, occurring with the singular and plural, as in (5), and with the dual, as in (6).

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

This suffix is traditionally called the **inverse**; its proprietal agreement form will be called **I-agreement**. (Both have a variety of allomorphs; see Watkins 1984 and Harbour 2007.)

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 table 1, **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 in table 2, rather than the correspondents of category-specific number features, [singular], [dual], [plural]. To achieve this, the following definitions are assumed:

(7) *Definitions:* [±singular], [±augmented]
a. $[+\text{singular}] = \lambda x[\text{atom}(x)]$
b. $[+\text{augmented}] = \lambda \text{P} \,.\, \lambda x\colon \text{P}(x) \,.\, \exists y[\text{P}(y) \wedge y \sqsubset x]$

The minus values are defined as the negation of the plus values. Intuitively, [+singular] combines with 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 at least one of which satisfies P. As a feature bundle, they are interpreted iteratively:

(8) *Feature bundle 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 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 (2006, 2007) for full proofs of the correspondence in table 2 and for the contradictority of [+singular +augmented].)[3,4] See section 2.3.3 for a more detailed sample derivation.

[3]If the order of composition in (8) is reversed, the set of distinctions that the features make collapses with that made by [±augmented] alone. Informally, [±augmented] divides the lattice corresponding to 'fish', say, into its atoms (elements without subelements that satisfy 'fish') and non-atoms. Further specification of [±singular] either picks out the whole of the same region or nothing at all: for instance, [+singular]([−augmented](λx *fish*(x))) redundantly picks out all and only the atoms from the atomic stratum defined by [−augmented](λx *fish*(x)), and [−singular]([−augmented](λx *fish*(x))) picks out all the non-atoms, of which there are none. So, if the order is the opposite of (8), then [±singular] makes no contribution and fails to yield a system of relevance to the analysis of Kiowa and Jemez.

[4]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 2006 on other numbers). Observe, that, in table 2, 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.'

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

Table 3: *Class features I*

Class	**Class Feature**	**Examples**
SDI	[−augmented]	*(wo)man*, *ant*, *knife*, *axe*, *sun*, *star*
IDP	[−singular]	*seed*, *grass*, *onion*, *bucket*, *dish*
IDI	[−singular −augmented]	*apple*, *plum*, *tomato*, *hair*, *eyebrow*

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.

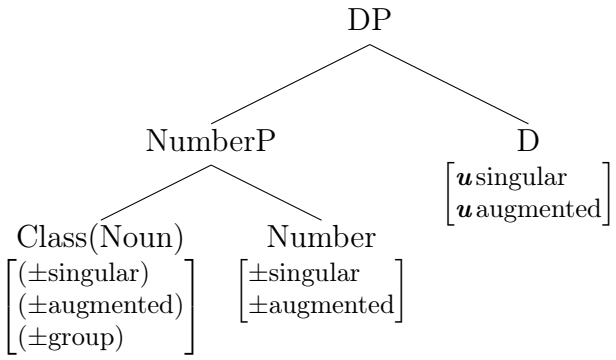
Assume, uncontroversially, that the unsuffixed form of the noun is basic. So, for SDI nouns, the S/D form is basic; for IDP, the D/P form; and for IDI, only the D form. We associate with each noun, the number features that correspond to its basic form. So, for SDI nouns, the feature common to the basic 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 the initial typology in table 3 (shown with example nouns).

Syntactically, I assume DPs to have the following structure:

'I dropped some big stones.'

'Big' and 'drop' supplete for number and the dual shares the latter with singular and the former with plural. ('Big' in (i)–(iii) is a compounded form of the predicate 'be big', which agrees like any other, as in **X!óú Ø-êt** / **ę-bîn** / **gya-bîn** 'The stone / two stones / several stones is/are big', cf (3).) Table 2 readily accounts for (i)–(iii): if [±singular] conditions **êl∼bîn**, [±augmented] **ót∼p!ét**, then we directly capture their distribution. Such evidence does not render the inventory {[singular], [dual], [plural]} impossible: [singular] might condition **êl**, and [plural] **p!ét**, the others being elsewhere forms. However, see Harbour 2007, ch. 4, for evidence from incorporation and adverb formation that none is an elsewhere form. Also, this inventory would have difficulty with the inverse; see note 16.

(9)



Number is the locus of the features that comprise singular, dual, and plural (Carstens 1991, Ritter 1991, 1993, and others). These features are interpreted in accord with (7)–(8). 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 table 3. For the moment, we will treat these features as purely formal, that is, without semantic content, though we will see in section 3 that the features, even if model-theoretically inert, nonetheless are determined by the conceptual content of the head noun. 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). Not only are these features wholly without semantic import, they also have no value (notated [***u***F]) and must be valued in the syntax. It is the process of valuation, I argue, that gives rise to inverse marking and I-agreement.

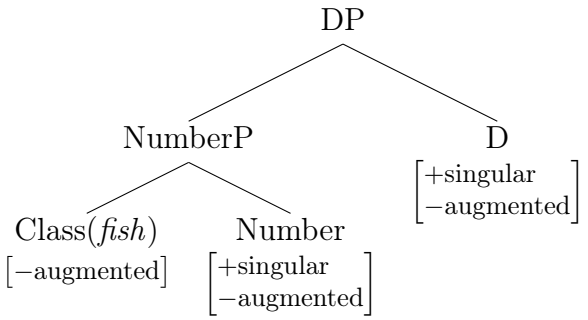
Observe, first, that Class and Number must jointly value D: if only Number did, all nouns would be SDP, and if only Class did, nouns would agree invariantly for all numbers. In practical terms, I assume that this is possible because Class and Number are equidistant from D, as the lowest projections of the noun phrase (an approach developed at length in Harbour 2007, ch. 3–4); however, the precise mechanism is not crucial to what follows.[5]

In cases where the feature content of Class is a subset of Number, it is

[5]Consequently, NumberP here must be identified with Borer's 2005 DivP, rather than her #P. Given that Borer regards Div as the locus of plural inflection, it is, on current terms, the locus of number features; so, this identification seems straightforward. See Tsoulas (2009) for further comparison of these two approaches to number. (The symbol '#' is used by other authors, *e.g.*, Harley and Ritter (2002), Béjar (2003), to signify the locus of number features.)

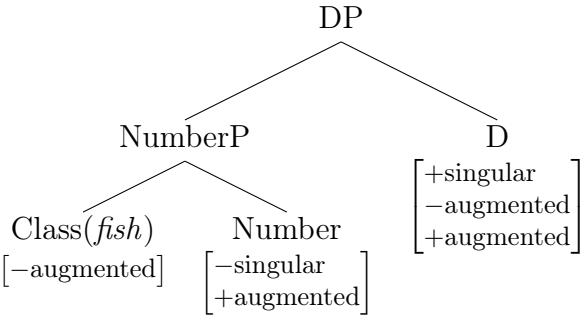
trivial to value D: D replicates the feature content of the two. This is illustrated below for the singular SDI noun, **ɔ́ɔ́pɻ́ɻ́** 'fish': Class is [−augmented], which is a subset of singular Number, [+singular −augmented]. All are straightforwardly replicable on D, which then triggers S-agreement.

(10)



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:

(11)



The crucial difference between this and the previous case is the marked situation of having conflicting feature specifications on a single head, D. Semantically, this raises no issue because the only model-theoretically interpreted features are those under Number. Nonetheless, two comments are in order, concerning how conflict is syntactically possible and how it is morphologically realized. (See section 2.3.3 for more detail of the derivation of (10)–(11).)

Syntactically, unvalued features are generally assumed straightforwardly to lack values (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 (11) [−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 pos-

sible, according to which [***u***F] abbreviates overspecification, with both values present on a single X^0.

(12) *Valuation*

a. [***u***F] abbreviates [−F +F]: an uninterpretable instance of a feature 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. A feature that has been matched is visible at PF. (Unmatched [***u***F] features are invisible.)

On this view, D bears [−singular +singular −augmented +augmented] when Merged. In (10), D matches only [+singular −augmented], the other features delete, and D thus triggers P-agreement. In (11), 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. (Recall that number features on D are semantically inert, so the meaning of these feature conflicts is not an issue.)[6]

The morphological properties of this system are explored at length in Harbour (2007, ch. 3–5). In brief, they are as follows. Conflict is realized as an inverse form:

(13) *Kiowa Inverse*
[−F +F] ⇔ I

As a vocabulary item, (13) is abstract in several important ways. First, no phonological content is given (see Watkins 1984, Harbour 2007 on the complex details). Rather, I is used as a phonological cover term. Second, (13) is silent about syntactic category. If [−F +F] is located on D, the result is inverse marking, as in **ɔ́ɔ́pɟ́ɟ́-dɔ́** 'fish-I'.[7] 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, (13) does not mention [±augmented] specifically, even though (12) concerns the conflict [−augmented +augmented]. The generality in (13) 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

[6]Discussion of the overspecification approach to uninterpretability lies beyond the scope of this paper. See Harbour (2007: 76–78) for brief examination and Harbour (2009b and in press) for further evidence of cooccurrence of [+F −F].

[7]For non-conflicting features, D is generally null. See Harbour 2007, ch. 2.

with the classifying feature [−singular], that is, when Number is [+singular −augmented], or singular. And IDI, where Class is [−singular −augmented], 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.

2.3.3. Derivations I

To round off, I will run through (10) and (11), explaining which features are pronounced and which are interpreted, that is, how the system thus far developed works as a whole. The mechanisms of syntactic valuation have already been discussed, so we will focus only on how these structures are treated in terms of pronunciation and interpretation.

The parts of the tree that are pronounced are only the head noun and, if (13) applies, D. Number is always unpronounced. Consequently, (10), with vocabulary items inserted, is $[_{\text{Class}}$ **ɔ́ɔ́pɨ́ɨ́** $[_{\text{Number}}$ $[_{\text{D}}$ $]]]$, pronounced simply as **ɔ́ɔ́pɨ́ɨ́**. The plural, (11), differs only in the application of (13) to D, which, in this case, calls for insertion of **dɔ́**, resulting in $[_{\text{Class}}$ **ɔ́ɔ́pɨ́ɨ́** $[_{\text{Number}}$ $[_{\text{D}}$ **dɔ́** $]]]$, pronounced as **ɔ́ɔ́pɨ́ɨ́dɔ́**.

The parts of the tree that are interpreted are the head noun and Number. The number features on Class and D are model-theoretically inert. In the interests of space, we derive only the plural:

(14)
$$
\begin{aligned}
&[\![\,\text{NumberP}\,]\!] \\
&= [\![\,[-\text{singular}\ +\text{augmented}](\text{fish})\,]\!] \\
&= [\![\,+\text{augmented}\,]\!]([\![\,-\text{singular}\,]\!](\lambda x\ [\text{fish}(x)])) && \text{by (8)} \\
&= [\![\,+\text{augmented}\,]\!](\lambda x\ [\neg\text{atom}(x)](\lambda x\ [\text{fish}(x)])) && \text{by (1a), (2c) and assuming } \neg\lambda x\ \text{P}(x) = \lambda x\ \neg\text{P}(x) \\
&= [\![\,+\text{augmented}\,]\!](\lambda x\ \neg\text{atom}(x) \wedge \text{fish}(x))^{8} && \text{by predicate modification} \\
&= \lambda\text{P}\,.\,\lambda x\colon \text{P}(x)\,.\,\exists y[\text{P}(y) \wedge y \sqsubset x]\ (\lambda x\ \neg\text{atom}(x) \wedge \text{fish}(x)) && \text{by (1b)}
\end{aligned}
$$

[8] If the alternative definition of [±singular] is adopted (note 1), for type-identity with [±augmented], then function application applies at this step, not predicate modification.

$$= \lambda x\colon \neg\text{atom}(x) \wedge \text{fish}(x)\,.\,\exists y\,[\neg\text{atom}(y) \wedge \text{fish}(y) \wedge y \sqsubset x]\ {}^{\text{by function application}}$$

This last formula is satisfied by non-atomic fish (according to the presuppositional clause) that have subelements that are non-atomic fish (according to the nuclear clause). In other words, given that dyads are the only non-atomic elements that have only atomic subelements, the presupposition clause restricts x to pluralities and the nuclear clause for restricts x to non-dyads. Consequently, we have the plural. The interpretation of NumberP can then be further restricted by numerals, quantifiers, or by the model-theoretically potent features within D, such as, possibly, [+definite] (see Adger, Harbour, and Watkins 2009, ch. 6, for discussion in the context of Kiowa; the topic lies beyond current scope).

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 S-agreement where P-agreement is expected and P-agreement where it is not expected. At the semantic level, they express types of grouphood: collective nouns in the second (15), or pluralia tantum nouns in the first instance (16).

(15) Plural S-agreement

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

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

(16) Non-plural P-agreement

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

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

The groupings are conceptually complementary. Collective nouns, such as spinneys of trees or banks of clouds, are singular-like when plural. They are pluralities without salient subparts. Pluralia tantum nouns are composite even when not plural (trousers are composed of legs and seats; books, of covers and leaves). They are pluralities with salient subparts.

We can formalize the complementary notion of grouphood as follows:

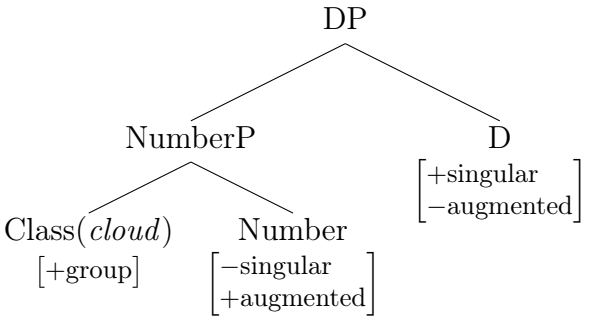
(17) *Definition:* [±group]
$[+\text{group}] = \lambda \text{P}\colon [+\text{augmented}]\,.\,\lambda x\colon \text{P}(x)\,[\text{Q-atom}(x)]$

[±group] is restricted to augmented parts of lattices, that is, to elements composed of parts, and it is used to signify 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. Following a reviewer's suggestion (and in improvement over Harbour 2007; *cf*, the relationship between possessor and possessee in Partee and Borschev 2003), Q is treated as a contextually supplied, open variable: as the relevant collective noun in (16) and as the heterogeneous parts in (17). (For a measure of the degree of how dependent Q can be on extralinguistic, cultural/encyclopedic knowledge, see Ojeda 1998 of noun classification in Tohono O'odham, *f.k.a.* Papago). The formal compositional details of this feature's semantics can however be left aside: if we locate [±group] under Class, then, like the previous Class features, it expresses part of the conceptual content of the root noun and so, though syntactically visible, its interpretation is subsumed by that of the noun and it is model-theoretically inert.[9]

[9]For a compositional account, [±group] induces a new lattice-like structure from the old one; *cf*, the PL feature of Chierchia 1998. For [+group], the induced structure is that generated by collective (e.g., if the P-atoms are {*a*, *b*, *c*, *d*, *e*, *f*, ...}, then the Q-atoms are {*abc*, *abd*, ..., *abcd*, ...}). For [−group], the structure is that generated by taking the heterogeneous parts (e.g., legs and seat, or covers and leaves) as atoms. In both cases, joins of Q-atoms are probably subject to well-formedness conditions, for which reason the structures are not lattices (e.g., for the collectives, the join is defined only if the corresponding P-pluralities are disjoint, making $abc \sqcup def$ well-defined, but $abc \sqcup abd$ not). The number features that determine the value of D also indicate which level (atomic versus non-atomic) of this new structure is accessed: the atomic-level in the case of collectives, the non-atomic in the case of pluralia tantum. (Where the Q-atoms are collectives, it is, I assume, a matter of parametric/lexical variation as to whether the joins are accessible. Kiowa appears to allow this only for some IDI nouns, e.g., 'different sorts of apples/hair'; see Watkins 1984: 88–89, Harbour 2007: 44. The Arabic plural-of-plurals, as in *rijaal-aat*

A separate issue concerns the syntax of [±group]. Descriptively, we need to say that the feature, when [+augmented] is present, overrides the usual valuation process (simple copying of [±singular] and [±augmented] from Class and Number) and instead causes D to be valued as though agreeing with a single spinney or bank or with a plurality of legs and seats or covers and leaves. Naively drawing trees for (15a) and (16a), with the previously established feature specifications for Number and D, we have:[10]

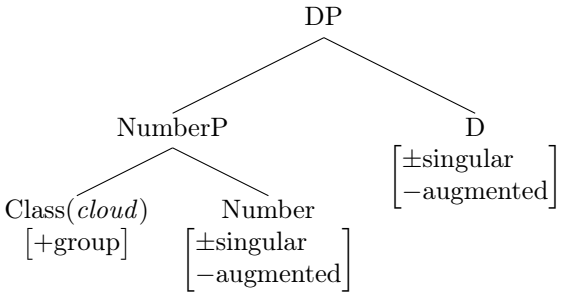
(18)



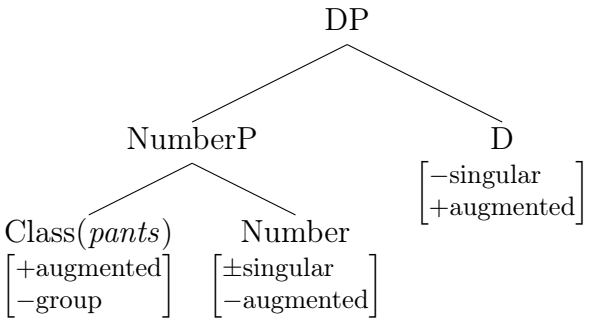
'collections of men' (man.PL-PL), e.g., Ojeda 1992, may represent the same phenomenon.)

[10]Observe that [+augmented] is specified on Class in (19): it is absent from Number for reasons of cardinality (table 2) and, if absent from Class too, would not affect agreement in (16a). Hence its position. When there is no [+augmented] element for [±group] to 'predicate' of, it is uninterpreted and computationally inert and D is valued by copying, as though [±group] were absent, as in:

(i)



(19)



The question is what kind of mechanism allows D to be valued in this exceptional way. A useful analogy for the treatment of these nouns is the phenomenon of reference transfer:

(20) The hash browns at table six is/*are getting angry
'The person at table six, who ordered hash browns, is getting angry'

The point of such examples is that an internally plural phrase agrees and refers as though singular. Dowty and Jacobson (1988) and Pollard and Sag (1994) amongst others use such examples to argue that agreement is essentially semantic, concerned with referents rather than syntactically specified features. It is hard to reconcile this position with the treatment of inverse marking and agreement above, according to which the inverse does not have a semantics and so cannot be semantically tracked. And it is unattractive to attenuate the claim to make agreement sometimes semantic, sometimes syntactic. Alternatively, though, one might suppose that sentences like (20) involve a covert dummy noun, meaning 'person', and that this what *is* agrees with. This could be adapted to deal with the Kiowa cases, with the dummy noun being 'Q-atom'. Whichever mechanism one ultimately believes to be responsible for this phenomenon, the claim would be that [±group] marks the set of nouns for which the mechanism is used obligatorily in Kiowa.

That said, it is important to reiterate that the syntactic mechanism is not the primary concern here. It is rather that there are complementary semantic properties, suggestive of a bivalent feature, that characterize nouns like those in (15)–(16). With this conceptual distinction in place, we can expand the typology of noun classes and their classifying features to table 4 (again, example nouns are given).

Derivation II

Table 4: *Class features II*

Class	Class Feature	Examples
SDP	$\emptyset$	*shoe*, *boot*, *rock*, *key*
SDI	[−augmented]	(*wo*)*man*, *ant*, *knife*, *axe*, *sun*, *star*
IDP	[−singular]	*seed*, *grass*, *onion*, *bucket*, *dish*
IDI	[−singular −augmented]	*apple*, *plum*, *tomato*, *hair*, *eyebrow*
SDS	[+group]	*cloud*, *lake*, *river*, *road*
PPP	[+augmented −group]	*pants*, *shirt*, *book*

Little need be said about the derivation of the nouns just discussed. The syntax has been sketched and the morphological and semantic details are much as in section 2.3.3. In slightly more detail, in terms of pronunciation, all [±group] does is induce singular or plural features on D where valuation by copying alone would not. However, as these features on D have no pronunciation, they do not affect how the noun is pronounced (their affect is pronounced only in the agreement system). So, all that is pronounced in these cases is the root noun, making these cases parallel to (10). And in terms of interpretation, all features are ignored except those under Number, given the treatment of Class as model-theoretically inert. Thus, the plural (19) is interpreted like (11), that is, as per (14), with the fact that these plurals form singular-like collectives constituting merely part of the speakers encyclopedic knowledge of the object in question. (The singular in (20) is interpreted like (10).)

3. Complete Typology of Noun Classes

We are now in a position to prove an extremely interesting result, one crucial to the comparison of bivalence and privativity: that Kiowa almost optimally exploits the space of noun classes available to it. This result emerges from the need to cure the inventory of classes in table 4 of the apparent arbitrariness it acquires when we ask what constitutes a possible noun class in Kiowa. The issue is that 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 the table comprise an apparently arbitrary subset.

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

(21) *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. The section also discusses the difference between Kiowa-Tanoan and Indo-European noun classification and justifies the claim that class features express part of the conceptual content of the head noun. (An extremely preliminary sketch of these results was presented in Harbour 2007: 112–113, with mention, rather than actual analysis, of Jemez.)

3.1. Possible classes

Kiowa uses three features for noun classification, and these may be specified as absent, as plus, or as minus (as is [±group] for IDI, SDS, and PPP, respectively; table 4). The possible classes are laid out in table 5.[11] Many distinct feature specifications yield nouns with identical agreement profiles, so that, in fact, only five classes emerge that were not attested above: **SII**, **SIP**, **SSS**, **IDS**, **IIP**. Interestingly, all exist.

[11]The table systematically excludes [−augmented ±group], [+singular +augmented], and [+F −F]. The reason for this is that, as discussed in section 3.2, Class encodes properties of the head noun. To have a noun class defined by [+F −F], say, would be to claim that there are nouns characterized by both having and lacking the property denoted by [±F]. By parity of reasoning, the contradictory specification [+singular +augmented] is not a possible value of class and [−augmented ±group] is also suspect, given that [±group] 'predicates' of [+augmented]. That said, it is easily checked that their inclusion results in no mnemonics beyond those in table 4; so the exclusion is an innocent simplification. (See also note 13.)

Table 5: *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

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

(22) 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 **Ø**- dɔ́ɔ́
tree 3**S**-be
‘It’s some trees.’

Thǫ́ǫ́ɔ́lkhɔ́í ‘whisky’ is SSS.

(23) a. Thǫ́ǫ́ɔ́lkhɔ́í **Ø**- dɔ́ɔ́
whisky 3**S**-be
‘It’s whisky.’

b. Yíí thǫ́ǫ́ɔ́lkhɔ́í g**ya**- thóm
two whisky 1S:3**S**-drink.PF
‘I drank two whiskies.’

c. Phą́ą́o thǫ́ǫ́ɔ́lkhɔ́í 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 2007, ch. 3, 5). It is simpler to observe that the class is common in Jemez (Noyer 1992, Sprott 1992, Yumitani 1998):

(24) Jemez SII class (Yumitani 1998: 120)

a. Nąę̂- **Ø** k^{hy}ą́nį̂-**Ø** ʔílæ Ø- hólą́
that-**Ø** dog- **Ø** much 3S-heavy
‘That dog is heavy.’

b. Nį́- **tʔæ** k^{hy}ą́nį̂-**š** ʔílæ į̨l- ɦólą́
that-**I** dog- **I** much 3D-heavy
‘Those [two] dogs are heavy.’

c. Nį́·- **t^{ʔ}æ** k^{hy}ǽnį̂-**š** ^{ʔ}ílæ 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.

In contrast to Kiowa, Jemez verb agreement is not invariant under inverse marking: inverse-marked nouns occur with 3D **į̨l-** and 3I **e-** in (24). However, D- and I-agreement do frequently syncretize, as in (26a). To capture this, I suggest that the Jemez inverse is different from that of Kiowa (13).

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

This causes inverse marking whenever two number features have the same sign. So, dual nouns 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 (25); so, D-agreement, if it exists, will emerge over I-agreement, by Pāṇini's Principle ([−singular −augmented] is more specific than [αF αG]). Where no D-specific agreement exists, however, dual and inverse will syncretize, as desired.

Two further classes are made possible by (25): **IIS** corresponding to [−singular +group] and **III** corresponding to [−singular −augmented] (IDS and IDI in Kiowa). They, and the remaining classes, IIP, SIP, SIS, are entirely unattested in Kiowa, but are, again, present in Jemez. In (26), inverse marking and I-agreement occur for 'one/two boxes', but P-agreement and an unmarked noun occur in the plural. So, 'box' is an IIP noun:

(26) Jemez IIP class (Yumitani 1998: 126)
a. Nį́·- **t^{ʔ}æ** t^{y}ê·tɨbæ-**š** nį́· į̨l- k^{ʔ}á
that-**I** box- **I** I :1S:3**I**-lie.S/D
'That box is mine.'
'Those [two] boxes are mine.'
b. Nį̂·- **Ø** t^{y}ê·tɨbɑ-**Ø** nį́· į̨- g^{y}ó·
that-**Ø** box- **Ø** I :1S:3**P**-lie.P
'Those [several] boxes are mine.'

'Bread', by contrast, is an SIS noun: unmarked and with S-agreement

for one/many loaves, but inverse-marked for the dual. (The verb 'fall' suppletes for number, distinguishing the plural from the singular despite the presence of S-agreement in both. See Harbour 2007, ch. 4, for analysis of agreement∼suppletion mismatches in Kiowa; cf, also, note 4.)

(27) Jemez SIS class (Yumitani 1998: 100)

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

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

c. Bélá- **Ø Ø**- tʸí
bread-**Ø** 3**s**-fall.P
'[Several] loaves of bread fell off.'

Jemez SIS nouns appear in general to permit P-agreement, as an alternative to S-agreement, in the plural; for example:

(28) Jemez SIS∼SIP variation[12] (Sprott 1992: 91)

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

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

The difference between S-agreement and P-agreement in the plural is reminiscent of collective versus non-collective plurals in Kiowa: Sprott (1992: 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 (28), he notes that one informant is inclined to think of loaves of bread for (a) versus tortillas for (b), "Because when you're done with oven bread you have those breads sitting on the counter, but with tortillas it's just a stack". Discussing the same alternation for **hwúúla** 'hair', he says that P-agreement "fits a barber shop scene where the hair on the floor is

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

of different colors", whereas, for S-agreement, the hair "came from a single person". Strictly speaking, then, SIS is a subclass of SIP, with an optional [+group] specification. The situation constitutes only a minor divergence from the typology in table 5.

Finally, Sprott (p. 281) gives **sų̊ʔų̊**(**sh**) 'rain' and **tyų̊ų̊wesh** 'salt' as III nouns; similarly, **pʔǽ** 'water' and **gahwé** 'coffee' are SSS, and **tyį̊į̊** 'grass' and **hú** 'clothes', PPP. (Yumitani, p. 113, describes several different classifications for his speakers; such discrepancies are not confined to these nouns and may be explained by generational change; Sprott, pp. 55–56, Yumitani, p. 7.)

We have, therefore, demonstrated the validity of (21a): despite there seeming to be 64 mnemonically possible classes, the number that in fact exists is small, 14 to be precise. Moreover, to my knowledge, all descriptions of Kiowa-Tanoan languages report only classes in table 5, or dualless or (25)-related variants thereof (see especially Noyer 1992 for references and comparative discussion, and Sprott 1989 for thorough references). 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. The discussion concludes with some observations on the semantics of Class and the nature of Kiowa-Tanoan noun classification in crosslinguistic perspective.

3.2.1. Kiowa

The classes attested in Kiowa are listed in table 6. The discussion of their semantic naturalness follows Harbour (2007), which synthesizes, and expands on, the insights of several authors, most especially Merrifield (1959), Watkins (1984), and Takahashi (1984).

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

Table 6: *Kiowa noun classes*

Class and Features		**Semantic Characteristics**
SDP	∅	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
SSS	[+augmented +group]	non-granular mass nouns
PPP	[+augmented −group]	pluralia tantum nouns; granular mass nouns (for some speakers)

2003 for 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. Conversely then, [−augmented] is a measure of non-homogeneity. As independence of motion is one correlate 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 (one does generally name trees in that way that one names human individuals, for instance). 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 component parts [−augmented] and as collections [−singular].[13]

Non-shape-inductive objects (SDS) 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.[14] (I do not assume that all mass nouns in all languages are distinguished in this way; see Harbour 2009a and Tsoulas 2009.)

[13]Considering the features separately is important. Unless we do so, then the distribution of inverse marking on IDI nouns commits us to a specification of Class that essentially claims that these are conceptually inherently dual (the class features for this class are those that, under Number, yield the semantics of the dual). But hairs and tomatoes are not inherently dual, nor are salt and rain, the nouns with these class features in Jemez. Second, if features under Class are interpreted individually as applying to the head noun, then we are justified in excluding contradictory feature bundles from consideration in table 5; see note 11.

[14]There is a slight, though superficial, notational complication in using three-place cardinality-tracking mnemonics to talk of mass nouns. See Harbour 2007, ch. 2, for discussion.

Table 7: *Jemez noun classes*

Class and Features		Semantic Characteristics
SIP	∅	default
SIS	[+group]	collective counterpart of SIP
IIP	[−singular]	vegetation; 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

3.2.2. Jemez

The same coherence apparently holds for Jemez (reading into Sprott 1992, Yumitani 1998 and following also Noyer 1992). Indeed, many classes are identical in terms of features and identical or nearly so in terms of semantic profiles: the featureless class is the default, [−augmented] is the class for animates, [−singular] is the class for vegetation, artifacts and body parts. Similarly, granular and non-granular mass nouns comprise the same two classes in the two languages. Furthermore, the effect on agreement of [±group] nouns correlates with the same semantic properties as in Kiowa: [+group] with plurality forming a cohesive singular-like unit, [−group] with a singular item with salient components.

Nonetheless, there are some interesting difference between the two languages. Most obvious is the fact that the mnemonics corresponding the featureless, [−augmented], and [−singular] classes are SDP, SDI and IDP in Kiowa, but SIP, SII and IIP in Jemez. This follows straightforwardly from the different inverse conditions operative in the two languages, (13) and (25), leading to inverse marking in the dual in Jemez but not in Kiowa.

A more substantial difference concerns the inanimate nouns that are classmate with true animates in Kiowa. These include many motile objects, such as cars, stars, cutting implements, and various body parts, such as eyes and hearts. In Jemez, the class is more strictly animate and the few inanimates it admits are closely related to animates, for instance, ‘egg’, ‘corpse’, and ‘skeleton’ (Sprott 1992: 53–54). Sprott’s rather brief lists suggest that inan-

imate SDI nouns are classed as defaults (SIP) in Jemez (viz., 'leg', 'tooth', 'sun', 'moon', 'star') . For Yumitani, some of these (viz., 'moon', 'star') remain classmate with animates (as are 'pumpkin' and 'watermelon'); however, his lists confirm the tendency for Kiowa SDI inanimates to be SIP nouns in Jemez ('heart', 'axe', 'hammer', 'pocket knife'; words for 'doll' vary between the two across speakers). This correlation supports treatment of SIP as a featureless default (as against note 15, for instance): in diachronic terms, the addition or subtraction of a single feature is a smaller reclassification than the addition and subtraction of one or more. And, notwithstanding this reclassification around the margins, sight should not be lost of the fact that the semantic core of the [−augmented] class is the same in both languages and therefore that the explanation of the semantic nexus between class feature and semantic characteristics carries over from Kiowa to Jemez unaltered.

Similar considerations apply to the [−singular] class in both languages. Both comprise vegetation, artifacts, and body parts. In consequence, the justification for correlation between feature and semantic characteristics again carries over. That said, both Sprott (pp. 55–56) and Yumitani (p. 107) observe that it is hard to determine which vegetation, artifacts and body parts are classed as IIP and which are default SIP. Sprott, in particular, notes a generational shift from IIP to SIP membership. However, without more information than is available, it is impossible to determine whether these developments are principled. Yet, even if the shift turns out to be arbitrary, it would still be the case that there is a semantic nexus between feature and characteristic of the IIP class, even if that characteristic were merely a necessary, not sufficient, criterion of class membership.

The greatest difference between the two languages concerns the [−singular −augmented] class. As already noted, although this feature combination yields dual semantics if under Number, the nouns so classified are not inherently dual in either language and the class features can only be understood as each individually encoding characteristics of the nouns they classify. In Jemez, Sprott (pp. 96–97) found just two III nouns, **sų̨ʔų̨**(**sh**) 'rain' and **tyų̨ų̨wesh** 'salt' , which we can term 'weakly granular', as they occur in the natural but non-robust units of drops and crystals. Like Kiowa IDI nouns, hair and certain fruit, these are also mass-like, occurring non-individually (and so [−singular]) and yet having clear natural units (and so [−augmented]). Given that IDI and III nouns all share characteristics with other classes, it is unsurprising that their membership is nonconstant across the two languages. (That said, Yumitani, pp. 109–110, notes that at least

one Jemez speaker classes 'pear', 'cherry', 'onion' as III nouns. None are IDI nouns in Kiowa, but, like the IDI foods, all are small-to-mid-sized, round, and grow in clusters.) However, as for IIP *versus* SIP membership in the previous paragraph, the important point is whether there is a semantic nexus between class features and class characteristics, not whether those characteristics constitute necessary, rather than sufficient, conditions for class membership.

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.[15]

[15] An alternative analysis is available in terms of positive class features (see table below). (This analysis is similar to Noyer's, but avoids complications that arise in applying a Kiowa-like inverse condition to both languages. For instance, Noyer treats SIP as having Class [−F], thus triggering inverse whenever a feature is specified as plus; yet, if we [±group] add to the analysis (to deal with facts beyond Noyer's remit), the possibility that [−F] = [−group] must be ruled out by stipulation.) The alternative below is curious in lacking (like Noyer's account) 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 table 7; rather SIS∼SIP oppose for [±group], and IIS∼IIP for [±augmented]. Furthermore, the IIS combination [−augmented +group] is semantically odd, given that [±group] 'predicates' of [+augmented]. Semantic oddity also afflicts the treatment of III: if specified with plus values, it must be [+singular +augmented], which is contradictory (Harbour 2007). Either this contradictority must be accepted or a lone minus classification, [−singular −augmented], must be retained from table 7. Adopting this alternative analysis, the optimal exploitation result is retained, but an interesting difference emerges between the languages, as Noyer observes: Kiowa classifies using mostly minus, Jemez, primarily plus.

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

3.2.3. The semantics of Class

In light of the foregoing discussion, it is useful to clarify the semantic nature of Class in Kiowa-Tanoan. The key point about noun classification in this family is its interaction with cardinality. This is achieved by using number features both for Number and Class. However, as already emphasized, the interpretation of the features in these positions is not identical. Under Number, the features yield the cardinalities singular, dual, and plural; they impact on the model-theoretic semantics. Under Class, they encode abstract properties of nouns, namely, their natural, or default, distribution in the real world; their semantics is subsumed by that of the head noun and so behave as model-theoretically inert. The dual function of number features should not trouble us, however: if there are more concepts than features (Fodor 1977, Grimshaw 2005), then many-to-one relationships between concepts and the features that syntactically encode them may well result (see, e.g., Adger and Harbour 2007a on person features and Harbour 2010 on relationship between number and aspect).

The resulting class system is distinct from that of Indo-European (though possibly similar to Bantu; see Harbour 2007, ch. 6). Consider, for instance, German *Eiche* 'oak'. This triggers the agreement typical of female things, such as *Frau* 'woman', *Kellnerin* 'waitress', *Kuh* 'cow'. So, morphosyntactically, one requires *Eiche* to bear the same gender features as *Frau* and the like. However, as oaks are not anatomically female, the gender features must be semantically vacuous (as opposed to that of 'waitress'). This is what the notion of 'formal feature' (e.g., Corbett 2000) is intended to capture: morphosyntactically ert, model-theoretically inert.

However, this behavior, though reminiscent of Kiowa-Tanoan Class, is distinct from it: Kiowa-Tanoan class features, though they may be model-theoretically inert, are not conceptually so. They express part of the conceptual content of the nouns that they classify. The German example in particular underscores this. Many tree names cluster in the feminine: *Asche* 'ash', *Birche* 'birch', *Buche* 'beech', *Tanne* 'pine', ... However, these could just as easily be masculine (*der Asch*, *der Birch*, *etc.*), as, indeed, *Baum* 'tree' itself is. In Kiowa, by contrast, the fact that one pine is not readily distinguishable from another means that these lack an important criterion of individuality and hence have the class feature [−singular]. (Forms of precipitation present a similar case. *Hagel* 'hail', *Regen* 'rain', *Schnee* 'snow' and so on cluster in the masculine; however, they could equally well be neuter,

as *Wasser* 'water' is. In Kiowa, forms of precipitation are conceived of as forms of water with which they are, in consequence, classmate.) So, semantic clusters arise in particular classes for principled reasons rather than as accidents.

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:

(29) *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 three notions of privativity. All 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, that the SII class has a positive specification for [±singular], the IDP class, a negative specification, and the SDP class, a 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 [$\bar{\alpha}$F] corresponding to zero:

(30)

Binary	→	*Privative*
[αF]		[F′]
[$\bar{\alpha}$F]		$\emptyset$
$\emptyset$		$\emptyset$

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

An 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 1991[1968]).

(31)

Binary	→	*Privative*
[αF]		[+F″]
[$\bar{\alpha}$F]		[−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]:

(32)

Binary	→	*Privative*
[αF]		[F′]
[$\bar{\alpha}$F]		[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. It defeats the purpose of 'going privative' by merely dressing up a binary distinction in the notation of privativity. I regard this as pseudoprivativity; it is, nonetheless, considered briefly in section 4.4.

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 latter, more restrictive option. (Pseudoprivativity does, of course, capture the natural classes of the bivalent analysis; however, it falls foul of natural classes when it comes to the inverse.)

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:

(33)

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.[16]) This feature composition captures the composite nature of the dual (note 4) 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.

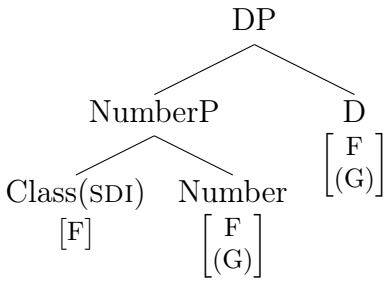
However, generating inverse is not trivial. Above, it arose simply by copying cardinality features from Class and Number onto D and then spelling out feature/value conflict, [−F +F] for Kiowa, [αF αG] for Jemez, in a uniform fashion. With valueless features, such conflicts cannot arise. The only solution 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:

(34) *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.

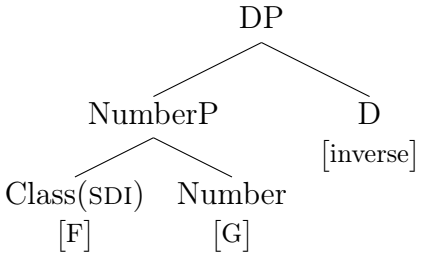
[16] The logical alternative of defining the numbers in terms of analogues of [+augmented] and [+singular], has the implausible consequence of correlating the marked number, dual, with the least marked, indeed empty, representation. See Nevins (2006) and Sauerland (2008) for recent discussion of the dual and its markedness. (In relation to note 4, observe that an inventory of undecomposed numbers, {[singular], [dual], [plural]}, would lose all natural classes.)

(35)



For the plural, however, Number is [G]. Copying alone, without (34), would value D as [F G], triggering D-agreement. However, given (34), and the obvious fact that Class $\not\subseteq$ Number ([F] $\not\subseteq$ [G]), we have:

(36)



It is easily verified that (34) yields the correct inverse marking and agreement types for SDP, IDP and IDI nouns, given the classifications ∅, [G], and [F G].

The SDP, SDI, IDP and IDI classes between them exhaust the possible classes generated by {[F], [G]}. So, to capture the SII class, and others, a second inverse condition is required (discussion of the meaning and plausibility of these conditions, and of the feature [inverse], is deferred until section 4.2.2):

(37) *Inverse by inequality*
D is valued as [inverse] when Class ≠ Number

For SII, we specify that Class is [F] and that D valuation is subject to (37). For the singular, Number is [F], therefore Class = Number, and D is valued straightforwardly as [F]. However, for the dual and plural, [F] = Class ≠ Number = [(F) G]. Consequently, (37) 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 (34) or by inequality (37). Even with the new feature and the two conditions, however, we still do not have descriptive adequacy, as nothing generates the SDS and PPP (pluralia tantum) classes.

In the bivalent account, SDS and PPP 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. 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 only one feature, one class is lost: without [gr] = [+group], there is no SDS, without [oup] = [−group], no PPP.

An alternative solution—the best I can devise without losing empirical coverage or positing novel, unmotivated features—is to introduce a diacritic on class features, which I shall call **^{x}-notation**. That is:

(38) *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 $[C^x] \overset{\not\subseteq}{\neq} [N]$, 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 (again, evaluation of this approach is deferred until section 4.2.2).

The SDS class is $[F^x]$, subject to inverse by exclusion. So, for singular or dual, D simply replicates Number: that is, (34) does not apply, because $[F] \subseteq [F\ (G)]$ and, so, Class = $[F^x] \subseteq [F\ (G)]$ = Number. However, for the plural, given that $[F] \not\subseteq [G]$, we have Class = $[F^x] \not\subseteq [G]$ = Number. So, (34) 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.

Using (38), it is possible to capture the PPP class, too: 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 Class = $[G^x]$ = [G] = Number; so, (37) does not apply and D is valued as [G]. However, for singular and dual, Class ≠ Number: [G] ≠ [F (G)], so $[G^x] \neq [F\ (G)]$. So, (37) 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, the only class missing from a descriptively adequate account of Kiowa. A reasonable initial guess is to combine IDP and SDS: [F^x G] subject to inverse by exclusion. However, (34) applies whenever Class $\not\subseteq$ Number, that is, whenever [F^x G], or equivalently, [F G] $\not\subseteq$ Number. Thus, (34) 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 (34) 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.

(39) 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).[17]

Consider the inventory of classes now generable. As shown in table 8, there are in total 18 possibilities, given the nine class features [(F$^{(x)}$) (G$^{(x)}$)] and the two inverse conditions, (34) and (37). All Kiowa classes are generated. The Jemez classes SIP, SIS, IIS, however, are not. Undergeneration can be repaired if inverse marking on Jemez nouns realizes not only [inverse], but also dual, [F G].

(40) *Jemez inverse: privative version*
[inverse]/[F G] $\Leftrightarrow$ I

Essentially, this maps D in (39) onto I, creating the missing mnemonics, SIP, SIS, IIS, from SDP, SDS, IDS. By recreating the effect of (25) 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?

[17] 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 would be valued as [inverse].

Table 8: *Typology of classes: privative features I*

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

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 (34)/(37), and how it is valued instead. It is, however, inferior in several regards.

First, the privative feature system overgenerates by 50%. The following classes are predicted to be possible in Kiowa/Jemez: PDP/PIP, PDI/PII, PDS/PIS (table 8). 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 of only two thirds of possible classes across the whole family, makes the system, or the family, seem arbitrary.

Second, the privative system loosens the connection between feature semantics and noun class semantics. Great care was taken in the bivalent account to tie the features of each noun class to the semantic properties of the nouns that the class subsumes. Here, however, 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.

Third, 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? More-

over, 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 $\emptyset\sim[-\mathrm{F}]\sim[+\mathrm{F}]$ distinction permitted by bivalent features is superfluous. If we need compensatory devices, creating a new three-way distinction, $\emptyset\sim[\mathrm{F}]\sim[\mathrm{F}^{x}]$, 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.

Fourth, the two different inverse conditions lack motivation and are quite questionable. 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 (34) and (37). Consequently, there is no natural motivation on this account for one inverse, let alone two. Now, there is the interesting observation, concerning table 8, that count nouns (modulo the first person) can be exclusively derived using (34) and mass nouns, using (37). However, it is impossible to capture this semantic partitioning of the two conditions so long as the conditions themselves lack semantic motivation.

Fifth, the idea of an [inverse] feature is itself problematic. The proposal has been made before (Noyer 1992, Harbour 2003), but it is clearly inferior to the bivalent approach pursued above. That 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. Moreover, [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.

Finally, to gain descriptive adequacy with regard to Jemez, a device to force syncretism between dual and inverse, (40), was required. Empirically, the idea is reasonable, as the two syncretize elsewhere in the language; contrast (23b, c) with (26a). However, implementation of this syncretism is

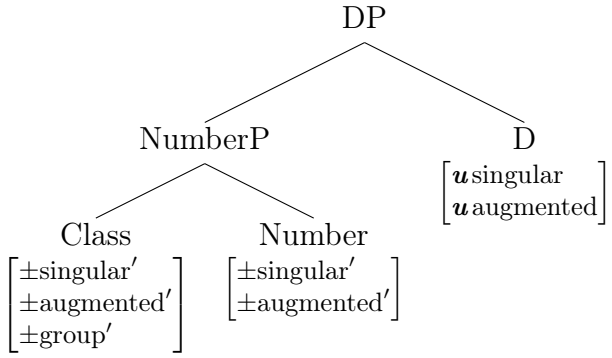
opaque: [inverse] and [F G] are featurally disjoint, which ought to predict the impossibility of syncretism, unless their realization is an elsewhere form. However, this requires claiming that zero realization of D, for singular, plural and mass nouns, is more marked than inverse/dual marking. A similar 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 (25). For recent discussion of the markedness of the dual, see Nevins 2006 and Sauerland 2008.)

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:

(41)



Zero specification, corresponding to the parentheses in (9), is not permitted. Allowing both the Kiowa and Jemez inverse conditions yields the 16 possibilities in table 9. Total absence of Class only generates one further class, SDP, and so, even permitting the semantically questionable [−augmented ±group] and [+singular +augmented] in (41), there are insufficiently many distinct classes: ten falls four short. The only possibility is to enrich the system with further features and conditions concerning their effect on valuation of

Table 9: *Typology of classes: privative features II*

Features			Inverse	
[±singular′]	**[±augmented′]**	**[±group′]**	**(13)**	**(25)**
+	+	+	SSS	SSS
+	+	−	PPP	PPP
+	−	+	SIP	SIP
+	−	−	SIS	SIS
−	+	+	SSS	SSS
−	+	−	PPP	PPP
−	−	+	IDP	IIP
−	−	−	IDS	IIS

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.

4.4. Pseudoprivativity

Pseudoprivativity, as noted at the outset and signified by its name, is conceptually problematic, being bivalence in privative guise. Faced with the foregoing failures, however, one might be tempted to revisit it. So, it is worth briefly observing that it is also empirically problematic, when faced with the inverse.

To see this, suppose that [+singular] and [−singular] were represented as features [A] and [B], and [+augmented] and [−augmented], as [C] and [D].[18] Then the Kiowa inverse, say, would arise whenever D bears [A B], or [C D], or any larger bundle containing these. However, so far as the morphology is concerned, these are just arbitrary feature combinations and it would be just as plausible for the inverse to arise when D bears [A C] or [B D], that is, for singular and plural. The problem is that there is no way for morphology,

[18]This sketch assumes presence∼absence privativity. Plus∼minus privativity would amount to positing [±A] for [+singular] and [±B] for [−singular], that is, two features for one semantic contrast, with [±A] = [∓B]. This duplication of information represents a clear loss of insight and the analytic option is not taken further.

which is in a different module from semantics, to 'look inside' the features and 'appreciate' that [A] and [B] are opposites, but that [A] and [C] are not; in a bivalent system, the complex nature of the symbols [+F] and [−F] enables precisely such comparisons.

As a possible way around this, one might suppose that the features on D yield the inverse whenever Class is not a subset of Number, mimicking the inverse by exclusion of (34). However, application of that principle here is problematic, for two reasons. First, (34) concerned syntactic valuation: the content of two heads determined the content of a third, with which they were in an Agree relation. The version to be adopted here, by contrast, concerns the pronunciation of that third head after the Agree relation has taken place, and, oddly, it claims that the content of that head is irrelevant to its pronunciation, rather, whether a subset relation holds between two other heads is. That said, oddity is not tantamount to untenability. However, the second problem is that this approach can only work if the Phase Impenetrability Condition (Chomsky 2000) is abandoned. Inverse marking, or more precisely, the features that trigger it, must percolate from D to demonstratives, relative clauses markers (C, on the analysis of Adger, Harbour, and Watkins 2009), and the verbal agreement prefix (Asp, v and Appl, on the analysis of Adger and Harbour 2007a, Adger, Harbour, and Watkins 2009). According to Phase Impenetrability, C, Asp, v, and Appl cannot have access to the content of Class and Number, internal to phasal D.

Thus, empirical matters are not improved by resorting to conceptually problematic pseudoprivativity.

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 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;

(d) explains, in conjunction with the differing inverse conditions (13) and (25), 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;

(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, $\emptyset$∼[−F]∼[+F], that this permits.

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