Descriptive and Explanatory Markedness

Daniel Harbour
harbour@alum.mit.edu

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Abstract. The wide empirical coverage of two number features, [±singular] and [±augmented], is used to show that (Greenbergian) category-internal markedness, (geometric) feature markedness, and value markedness are, respectively, epiphenomenal, untenable, and too simplistically formulated to be currently evaluated.

Keywords. Feature geometry, features, markedness (implications), number, person

1. Introduction

I wish to advance three nonstandard, interconnected theses about morphosyntactic markedness. The varieties of markedness I will be concerned with are the following. *Category-internal markedness*, of the type originally discussed by Greenberg (1966), concerns cooccurrence requirements within a given morphosyntactic category. For instance, within the categories person and number, inclusive first person must cooccur with exclusive first person, and dual must cooccur singular; *inclusive∼other and *dual∼other are not possible person and number systems. *Feature markedness*, a notion pursued by Noyer (1992) and Harley and Ritter (2002), is exactly parallel to category-internal markedness, but applies to features. A feature G can only be active (within a particular domain of) a language, if feature F is also active (within the same domain). Finally, *value markedness*, pursued by Noyer (1992) and Nevins (2008), claims that one of feature's values is more or less redundant and/or that the other value is more frequently the target or context for operations of simplification.

Clearly, these varieties of markedness are not of like ilk. The first is empirical, concerning the concepts of descriptive linguistics. The second and third are theoretical, concerning the entities of theoretical linguistics. As Greenberg's generalizations about number and person have been maintained by more extensive typological studies (Noyer 1992, Corbett 2000, Cysouw 2003, Siewierska 2004), the utility of category-internal markedness seems indisputable. However, if the features and values that generate categories merely recapitulate the descriptive notion of markedness, then markedness appears to be an irreducible, possible inexplicable, theoretical artefact.[1]

I wish to dissent from this view. Specifically, I propose the following rubric of explanation for category-internal markedness. If $X \rightarrow_L Y$ (*e.g.*, presence of X = dual in L implies presence of Y = singular, or presence of X = first person inclusive in L implies presence of Y = first person exclusive), then this is because X is featurally complex, X = $[\alpha\text{F}\ \beta\text{G}]$, say. This affords L the feature set $\{[\pm\text{F}], [\pm\text{G}]\}$, and, hence, the feature combinations [+F +G], [+F −G], [−F +G], and [−F −G]; one of these is, I claim, Y. Thus, my primary claim is that category-internal markedness arises naturally from feature combinatorics and feature semantics.

[1]This is especially the case, if—unwisely, as I shall urge below—one's feature values are not abstract, as are '+' and '-', but recapitulate the descriptive categories, as do [number : dual] or [person : inclusive]. In this case, feature markedness and value markedness directly recapitulate the descriptive category-internal markedness.

However, I claim, further, that combinatorial freedom that generates all four combinations of {[±F], [±G]} in *L* affects also the parametrization of feature activity in *L*. That is, activation of [±F], [±G], and other features, are mutually independent parameters. This is, of course, in direct opposition to the notion of feature markedness (and 'filters' and 'geometries'), which holds that some features, [±G], say, can only be active if other features, [±F], say, are too. Such combinatorial freedom, in fact, undermines feature markedness in three distinct ways: conceptually (as just outlined, section 4.1), typologically (in that there is no 1-1 correspondence between typological patterns and feature inventories, section 4.2), and semantically (in that features used for person or number, say, turn out to have a semantics more general than parochial notions of markedness would have us believe, section 4.3).

Furthermore, the resulting system rapidly begins to challenge simplistic associations between feature values, markedness, and zero exponence (section 5). Examples of such claims are that the plus is marked and minus unmarked, or that zero exponence is indicative of lack of markedness.

My core claims are, therefore, the category-internal markedness, feature markedness, and value markedness are, respectively, epiphenomenal, untenable, and too simplistically formulated.

For purposes of manageability, discussion will be primarily confined to just two number features, introduced in section 2.1. This narrow focus yields surprisingly wide coverage (sections 2.1–2.2) and provides adequate foundations for the discussion of markedness that follows. Person, and other numbers, receive somewhat briefer discussion (in sections 4.1 and 4.3 respectively). However, the position defended below is based on extensive previous work on various feature families (person, deixis, number, aspect, case). In indicating where parallel, or generalized, results obtain, a greater quantity of self-citation is necessary than I would otherwise think desirable; for this, I apologize in advance.

2. Background

This section introduces the two features, [±singular] and [±augmented], on which the discussion of markedness that follows will be based. The presentation proceeds in two parts. First (section 2.1), I lay out the foundational result, due to Noyer (1992), that these two features cover a surprising variety of different number systems and do so whilst capturing Hale's (1973) and Silverstein's (1976) insight that the dual shares characteristics of both singular and plural. Second (section 2.2), I show that the coverage of the very same features extends to two of the most recalcitrant numbers, the trial and unit augmented. With these results in hand, we can proceed, in the subsequent sections, to assess the status of the varieties of markedness defined in the introduction.

2.1. Two features

Early grammatical theory, following Chomsky (1965), posited person and number features that recapitulated traditional grammatical labels, such as [dual] and [third]. However, by the time of Hale (1973) and Silverstein (1976), it began to be appreciated that these 'labels' are internally complex. For instance, Silverstein gave the following decomposition of number categories:

Silverstein's decomposed numbers
[−plural +restricted] = singular
[−plural −restricted] = dual
[+plural −restricted] = plural

The crucial point about such decompositions is that they make natural classes of the traditional descriptive categories. For instance, {singular, dual} is the natural class defined by [−plural] and {dual, plural} is the natural class defined by [−restricted]. If one's features are {[singular], [dual], [plural]}, then no such natural classes emerge.

Now, in his dissertation, Noyer set himself the task of devising two feature inventories, one for person, one for number, that would account for all the varieties of person and number attested crosslinguistically. In this section, we will focus on three number systems: singular∼plural, minimal∼augmented, and singular∼dual∼plural. In light of the Hale-Silverstein decomposition of the dual, one might expect these to require up to four features: two for systems containing the dual, and one each for the other two systems. Noyer's surprising discovery was that there were in fact only two: straightforward semantic composition shows that singular∼dual∼plural is the 'featural sum' of singular∼plural and minimal∼augmented. To demonstrate this result, we must first exemplify all three number systems and define the features mentioned above.

As a preliminary, consider two different pronominal systems with a clusivity contrast, that is, where first person forms vary according to inclusion/exclusion of the hearer. These may have, amongst other distinctions, singular∼plural number, as in Svan, or singular∼dual∼plural numbers, as in Tongan. (The highlighting may be momentarily ignored.)

Upper Svan agreement

	Singular	Plural	
1IN	—	l-	**-d**
1EX	xw-	xw-	**-d**
2	x-	x-	**-d**
3	*var.*		-x

Tuite 1995:10, adapted

Tongan subj. possessive emphatic pronouns

	Singular	Dual	Plural
1IN	—	ha'a-tau-**a**	ha'a-tau-**tolu**
1EX	ha'a-ku	ha'a-mau-**a**	ha'a-mau-**tolu**
2	ha'a-au	ha'a-mou-**a**	ha'a-mou-**tolu**
3	ha'a-na	ha'a-nau-**a**	ha'a-nau-**tolu**

Churchward 1953:131, adapted

These grammatical patterns are doubtless familiar, or at least unsurprisingly, to most readers. However, languages with a clusivity contrast may exhibit a number system ‘half-way’ between the Svan and Tongan systems. In such minimal∼augmented systems, as they are known, the dual is restricted just to the inclusive, as shown below for Winnebago (though Ilocano, Thomas 1955, is the first case to have been discussed as such):

Winnebago agreement I

	Singular	Dual	Plural
1IN	—	hin-	hin- -wi
1EX	ha-	. . . . ha- -wi	
2	ra-	. . . . ra- -wi	
3	∅-	. . . . ∅- -ire	

Winnebago agreement II

	Minimal	Augmented
1IN	hin-	hin- **-wi**
1EX	ha-	ha- **-wi**
2	ra-	ra- **-wi**
3	∅	∅- -ire

Noyer 1992:194

If we attempt to describe such languages using the traditional labels *singular*, *dual*, and *plural*, we obtain a result that is triply unsatisfactory. First, the dual occurs exactly once in the language. Second, it occurs precisely where it borders on redundancy, namely, in connection to the speaker-hearer *dyad*; we do not find languages in which, for instance, the dual is restricted to the first person exclusive, or second person. Third, in the case of Winnebago, it forces the single morpheme, -*wi*, to have a numerically heterogeneous distribution: plural in some cases, dual/plural in others.

All these problems resolve themselves naturally if we think in terms of minimal versus non-minimal, satisfaction of person specification. For instance, the speaker-hearer dyad is the minimal first person inclusive; the author singleton is the minimal first exclusive. This conception is represented in the right-hand table. Observe that this accords Winnebago -*wi* a numerically homogeneous distribution, on a par with Svan -*d* and Tongan -*a*, -*tolu*.

We have, therefore, three different clusive systems: the singular∼plural system of Svan, the singular∼dual∼plural system of Tongan, and the minimal∼augmented system of Winnebago. Now, given that the plural has different numerical ranges in Svan and Tongan, one might think that these languages present a total of six distinct number categories (the singular being presumably the same in Svan and Tongan). Noyer showed, however, that only two features are necessary to capture all of these. Now, part of this ecomony is the simple result of using bivalence (or some similar mechanism), in virtue of which minimal and augmented can be captured as opposite specifications of a single feature, namely, [+augmented] and [−augmented] respectively. However, the extent of the featural economy goes beyond this, as the Tongan system arises from simultaneous activation of the features independently required, and hence motivated, by Svan and Winnebago.

To see this, let us first posit the feature [±singular] for Svan:

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

b. $[\![-\text{F}]\!] = \neg[\![+\text{F}]\!]$

Informally, [+singular] applied to a predicate P picks out atomic elements that satisfy P. It should be evident that, for the first person exclusive (*i.e.*, for P = 'contains the speaker'), [+singular] picks out just the speaker; similarly, for the second or third persons, it picks out an individual hearer, or an individual non-speaker, non-hearer. However, for the first person inclusive, [+singular] picks out no one at all, as this person specification demands at least the speaker-hearer dyad, which is non-atomic, that is, [−singular]. (The interpretation of minus as negation is specified in (1b); it applies to all features.) Thus, in Svan, all inclusives are on a numerical par: all are plural.

Second, let us posit the feature [±augmented] for Winnebago:

(2) $[\![+\text{augmented}]\!] = (\lambda \text{P})\,(\lambda x\!: \text{P}(x))\,\exists y\ [\text{P}(y) \wedge y \sqsubset x]$

Informally, [+augmented] applied to a predicate P picks out non-minimal elements that satisfy P, that is, elements that have a subelement that also satisfies P.[2] For the first person exclusive (P = 'contains the speaker'), [−augmented] picks out just the speaker, as the singleton set of the speaker contains no proper subsets of which 'contains the speaker' is true. Any larger set, such as the dyad of the speaker and their parents, contains the proper subset of the speaker and one parent, of which 'contains the speaker is true'; such elements, then, are [+augmented]. Like considerations apply to the second and third persons. For the first person inclusive, by contrast, [−augmented] picks out the speaker-hearer dyad, as this dyad contains no proper subsets of which 'contains both speaker and hearer' is true. Any larger set, such as the hexad (or pentad or tetrad) of speaker and hearer and their parents, will contain, as a proper subset, the speaker-hearer dyad; such elements, then, are [+augmented]. Thus, in Winnebago, the speaker-hearer dyad is numerically distinguished from all other first person inclusive elements.

Now, if a language activated both the features needed for number in Svan and Winnebago, then it would have at its disposal the four feature combinations shown with informal paraphrases below:

(3)
a. [+singular −augmented] = singular
(atoms without atomic subelements)
b. [−singular −augmented] = dual
(non-atoms without non-atomic subelements)
c. [−singular +augmented] = plural
(non-atoms with non-atomic subelements)
d. [+singular +augmented]—contradiction
(atoms with atomic subelements)

[2]That the element satisfies P is represented as a presupposition (λx: P(x)). See note 5.

As a more formal demonstration, consider the dual:

(4) $[\![-\text{singular} \; -\text{augmented}]\!]$

$= [\![-\text{augmented}]\!]([\![-\text{singular}]\!])$

$= (\lambda \text{P})(\lambda x : \text{P}(x)) \; \neg\exists y[\text{P}(y) \wedge y \sqsubset x]((\lambda x)[\neg \text{atom}(x)])$

$= (\lambda x : \neg \text{atom}(x)) \; \neg\exists y[\neg \text{atom}(y) \wedge y \sqsubset x]$

The final formula is true of non-atomic x for which there is no proper subelement y that is also non-atomic. As only dyads, and not triads or larger elements, have only atoms as their proper subelements, the formula picks out just dyads; that is, it is a dual. The other three combinations can be computed similarly (Harbour 2007).[3]

Now, clearly, the contradictory (3d) can have no use. So, the feature system {[±singular], [±augmented]} generates the three-way contrast singular∼dual∼plural, which is precisely the Tongan system. Note, furthermore, that these number features yield the natural classes that were crucial to Hale's and Silverstein's work: [−augmented] = {singular, dual}, and [−singular] = {dual, plural}. Thus, Noyer's insight is that three distinct number systems, and up to six distinct number categories, can be captured using just two features, and that these features yield a dual composed to yield the natural classes observed in earlier research.

[3]Two further tacit assumptions are made, both of them, I believe, the null hypotheses. First, as shown, the order of composition is $[\![\pm\text{augmented}]\!]([\![\pm\text{singular}]\!])$; the reverse yields a system identical to [±augmented] alone (Harbour 2006a). Second, full specification is assumed. That is, it is assumed that the features {[±singular], [±augmented]} give a language maximally four feature combinations; the language does not have, say, a minimal [−augmented], by virtue of underspecifying [±singular]. (This is not to exclude the possibility that [±singular], or other features, might be syntactically underspecified, but simply to claim that this leads to no new interpretive possibilities.)

2.2. Extension

Although this result is striking in itself, it is not yet sufficient to frame the discussion of markedness. For this, we must extend the account to two further number categories, the trial and unit augmented. Interestingly, despite the recalcitrance these numbers have shown to featural decomposition, we can, in fact, do this without adding new features to the system. The key to capturing them lies in the use of conflicting feature specifications, that is, the cooccurrence of [+F] and [−F] on a single head. This apparently strange idea has its roots in Harbour (2005, 2007), where it was shown for Kiowa-Tanoan that such conflicts regularly arise owing to use of number features both for noun classification and number and that they have numerous detectable consequences throughout the morphosyntax. Now, in that earlier work, the meaning of such conflicts of such specifications was not addressed, as they only arose as a result of Agree, that is, at loci of phonological, not semantic, interpretation. Nonetheless, the comparison is instructive as it proves that [+F −F] to be structurally possible. However, there is semantic advantage to be taken of such feature specifications: they directly yield the trial and unit augmented.

To see this, and to understand how some instances of [+F −F] can be anything other than flatly contradictory, despite the definition of feature negation (1b), let us first consider the nature of the plural in a singular∼dual∼plural system:

(5)
$$
\begin{aligned}
&[\![\, -\text{singular } +\text{augmented} \,]\!] \\
&= [\![\, +\text{augmented} \,]\!]([\![\, -\text{singular} \,]\!]) \\
&= (\lambda \mathrm{P})(\lambda x : \mathrm{P}(x))\ \exists y[\mathrm{P}(y) \wedge y \sqsubset x]\ ((\lambda x)[\neg \text{atom}(x)]) \\
&= (\lambda x : \neg \text{atom}(x))\ \exists y[\neg \text{atom}(y) \wedge y \sqsubset x]
\end{aligned}
$$

This corresponds to the plural because it is satisfied by elements, x, that are non-atomic (by the presuppositional clause) and that have subelements, y, that are also non-atomic; these conditions are met by triadic, or larger, x, because we for $x = a \sqcup b \sqcup c$, we can take $y \sqsubset x$ to be the non-atomic $a \sqcup b$; this is not possible dyadic x, because any proper subpart of a dyad is an atom.

With this in hand, we can now derive the trial by adding [−augmented] to the features in (5):

(6) $$\llbracket -\text{singular} +\text{augmented} -\text{augmented} \rrbracket$$
$$= \llbracket -\text{augmented} \rrbracket (\llbracket -\text{singular} +\text{augmented} \rrbracket)$$
$$= \llbracket -\text{augmented} \rrbracket ((\lambda x : \neg\text{atom}(x))\ \exists y[\neg\text{atom}(y) \wedge y \sqsubset x])$$
$$= (\lambda \text{P})(\lambda x : \text{P}(x))\ \neg\exists y'[\text{P}(y') \wedge y' \sqsubset x] \quad (\lambda x : \neg\text{atom}(x))\ \exists y[\neg\text{atom}(y) \wedge y \sqsubset x])$$
$$= (\lambda x : \neg\text{atom}(x) \wedge \exists y[\neg\text{atom}(y) \wedge y \sqsubset x])^{4} \quad \neg\exists y' \exists y[\neg\text{atom}(y') \wedge y' \sqsubset y \wedge y \sqsubset x]$$

The formula is satisfied by elements, x, for which no subelements, y', of subelements, y, are non-atomic. Equivalently, eliminating the double negation, the formula is satisfied by elements x, for which all subelements, y', of subelements, y, are atomic. This property is satisfied only by triads, such as $a \sqcup b \sqcup c$, for which any three-link chains must terminate in an atom, as in $a \sqsubset a \sqcup b \sqsubset a \sqcup b \sqcup c$. For tetrads, or any larger ensemble, such as heptads or nonads, the property clearly does not hold. Therefore, [−singular +augmented −augmented] is a trial.[5]

[4] In the last step of this calculation, I assume that the presuppositions of the internal and external formulae are simply 'added together' by conjunction. That is, $\llbracket -\text{augmented} \rrbracket$ creates a presupposition of $\llbracket -\text{singular} +\text{augmented} \rrbracket$. However, that formula, $(\lambda x : \neg\text{atom}(x))\ \exists y[\neg\text{atom}(y) \wedge y \sqsubset x]$, already contains the presupposition $(\lambda x : \neg\text{atom}(x))$. These create the joint presupposition $(\lambda x : \neg\text{atom}(x))\ \exists y[\neg\text{atom}(y) \wedge y \sqsubset x])$.

[5] Atomic and dyadic x also satisfy the property of lacking non-atomic subelements of subelements. However, the formal formula, as opposed to the informal in-text paraphrase,

Consider now what happens if we add feature recursion to a minimal∼augmented system, like that of Winnebago:

(7) $[\![+\text{augmented} \ -\text{augmented}]\!]$

$$= [\![-\text{augmented}]\!]([\![+\text{augmented}]\!])$$
$$= (\lambda \mathrm{P}')(\lambda x : \mathrm{P}'(x)) \ \neg\exists y'[\mathrm{P}'(y') \wedge y' \sqsubset x]((\lambda x : \mathrm{P}(x)) \ \exists y[\mathrm{P}(y) \wedge y \sqsubset x])$$
$$= (\lambda x : \mathrm{P}(x) \wedge \exists y \ [\mathrm{P}(y) \wedge y \sqsubset x]) \ \neg\exists y'\exists y[\mathrm{P}(y) \wedge y \sqsubset y' \wedge y' \sqsubset x]$$

In the calculation in (7), it is assumed that the internal formula has already composed with some predicate, P; hence the absence of the internal λP. To appreciate the semantic value of (7), we must consider two different values for P.

First, suppose that P is a predicate like 'dog(x)' or '$\boldsymbol{i}\in x$' ('contains the speaker'). Then only dyadic x satisfies the formula and its presuppositions: triadic x contains chains such as $y \sqsubset y' \sqsubset x$, the lowest element of which is satisfies P (is a dog / contains the speaker); dyads and atoms lack such chains; but atoms are ruled out by the presupposition $\exists y[\mathrm{P}(y) \wedge y \sqsubset x]$. For such P, then, we have a dual.

Second, suppose that P is the predicate '$\boldsymbol{i}\sqcup\boldsymbol{u}\in x$' ('contains the speaker and hearer'). Then the formula is only satisfied by triadic elements of the form $\boldsymbol{i}\sqcup\boldsymbol{o}\sqcup\boldsymbol{u}$, where $\boldsymbol{o}$ is a non-speaker, non-hearer: anything larger permits chains $\boldsymbol{i}\sqcup\boldsymbol{u} \sqsubset \boldsymbol{i}\sqcup\boldsymbol{o}\sqcup\boldsymbol{u} \sqsubset \boldsymbol{i}\sqcup\boldsymbol{o}\sqcup\boldsymbol{o}'\sqcup\boldsymbol{u}$, the bottom element of which still satisfies P; triads $\boldsymbol{i}\sqcup\boldsymbol{o}\sqcup\boldsymbol{u}$ and dyads $\boldsymbol{i}\sqcup\boldsymbol{u}$ lack such chains; but dyads are ruled out by the presupposition $\exists y[\mathrm{P}(y) \wedge y \sqsubset x]$. For such P, we have a trial.

Thus, we have precisely a unit augmented: trial for first person inclusive, dual otherwise. This is illustrated by the dative pronouns of Rembarrnga:

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carries presuppositional requirements on x that atoms and dyads do not satisfy, namely, $\neg\text{atom}(x)$ and $\exists y[\neg\text{atom}(y) \wedge y \sqsubset x]$. The use of presuppositions to achieve this restriction is adapted from a suggestion of Orin Percus'. It solves a problem that has been bugging me for years.

Rembarrnga dative pronouns

	Minimal	Unit Augmented	Augmented
1IN	yʉkkʉ	ngakorr**bbarrah**	ngakorrʉ
1EX	ngʉnʉ	yarr**bbarrah**	yarrʉ
2	kʉ	nakor**bbarrah**	nakorrʉ
3M	nawʉ	barr**bbarrah**	barrʉ
3F	ngadʉ	barr**bbarrah**	barrʉ

McKay 1978, 1979

Observe that, just like Svan -*d*, Tongan -*a*, -*tolu*, and, most especially, Winnebago -*ri*, the number morpheme -*bbarrah* occupies a homogeneous position, despite its numerical heterogeneity.

We thus see how powerful the features [±singular] and [±augmented] are. Not only is each one independently motivated, by, respectively, singular∼plural and minimal∼augmented systems, but, in combination, they are sufficient to generate the dual, and, with feature recursion, the trial and unit augmented. We are now sufficiently armed to address the varieties of markedness outlined in the introduction.

3. Category-internal markedness

The central explicanda in the domain of category-internal markedness are observations like Greenberg's concerning the dual, namely, that *dual∼other is not a possible number system in the way that singular∼other—or, equivalently, singular∼plural, or plural∼other—is. Rather, if a language has a dual, then it must also have a singular—and, hence, plural/other—giving the total system singular∼dual∼plural. Greenberg noted several further category-internal markedness relations, which have since been confirmed and expanded on by Corbett (2000). A selection is shown below:

(8) a. Trial implies dual (*trial∼other, *trial∼singular∼other, *trial∼minimal∼other, ... ; *trial∼dual∼other)

b. Unit augmented implies augmented (*unit augmented∼other)

c. Paucal implies other number distinction(s) (*paucal∼other)

d. Greater paucal implies (basic) paucal

e. Greater plural implies (basic) plural

Now, Noyer gave no a featural decomposition of the trial, unit augmented, or paucal (or of greater paucal/plural, of which he was, it seems unaware), nor has subsequent work on the featural basis of typology (most notably Harley and Ritter's) provided one. However, as we have seen, Noyer's feature system naturally extends to both trial and unit augmented. (For reasons of space, I leave cardinally inexact numbers, such as paucal, aside, except for brief mention in section 4.3.)

A major consequence of the feature inventory explored above is that it immediately yields category-internal markedness relations affecting singular, dual, trial, plural, minimal, unit augmented, augmented: all follow naturally from facts concerning the semantic, and featural, composition. That is, such markedness relations are derivative, not primitive, within the system we have developed. To see this, we run through several examples below.

Consider first the dual. In Svan and Winnebago, dyads are subsumed under other categories: under [−singular] for Svan, and under [+augmented] for Winnebago, excepting the speaker-hearer dyad, which is [−augmented]. To pick out all and only dyads requires the feature combination [−singular −augmented]. This in turn requires activation both of [±singular] and of [±augmented], which generates two further non-contradictory feature bundles: singular and plural. The featural resources required for dual are simultaneously the resources for singular and plural. Thus, one cannot have the former without having also the latter. This is precisely the content of

Greenberg's observation.

Exactly the same reasoning applies to the markedness of trial and unit augmented. For the trial, one requires the same feature inventory as for the dual, together with feature recursion, the possibility of which I shall notate with a star after the feature. Thus, languages with a cardinally exact trial have the feature inventory {[±singular], [±augmented]*}. Recall that it was assumed that the number values of language is determined by full specification (note 3). I interpret full specification together with feature recursion as requiring that feature bundles be specified at least once for each feature, and as permitting double specification of any starred feature. This yields six feature combinations. However, only four are non-contradictory:

(9)
a. [+singular −augmented] = singular
   (atoms without atomic subelements)
b. [−singular −augmented] = dual
   (non-atoms without non-atomic subelements)
c. [−singular +augmented] = plural
   (non-atoms with non-atomic subelements)
d. [−singular +augmented −augmented] = trial
   (non-atoms with non-atomic subelements)
e. [+singular +augmented]—contradiction
   (atoms with atomic subelements)
f. [+singular +augmented −augmented]—contradiction
   (atoms with atomic subelements of subelements?)
   (atomic unit augmented?)
   ...

This immediately gives us the desired conclusion about the category-internal markedness of the trial, namely, that a system with the resources to create a trial also has the resource for a singular, dual, and plural. Therefore, such systems as *trial∼other, *trial∼dual∼other, and *trial∼minimal∼other are impossible.

A parallel result obtains for the unit augmented too. The feature system of such languages is {[±augmented]*}, that is, the feature [±augmented] with feature recursion. This permits precisely three combinations:

(10) a. [−augmented] = minimal
(minimal elements satisfying a predicate, P)
b. [+augmented] = augmented
(non-minimal elements satisfying P)
c. [+augmented −augmented] = unit augmented
(non-minimal elements satisfying P,
without non-minimal subelements satisfying P)

Again, this means that a system with the resources to create a unit augmented also has the resources for a minimal and an augmented. Therefore, such systems as *unit augmented∼other or *unit augmented∼singular∼other are impossible.

We have, therefore, arrived at a striking result. Simply by devising two features to account for the relatively straightforward pronominal systems of Svan and Winnebago, we have not only arrived at the featural resources for the more complicated systems of Tongan, Larike, and Rembarrnga, but have done so in a way that automatically derives all the correct category-internal markedness relations. I argue in other work that the same holds for other number categories, Harbour 2006a, as well as for person, Harbour 2006c. If correct, then this analysis of category-internal markedness succeeds in reducing it entirely to independent properties of the features that generate the numbers (and persons) in question.

4. Feature markedness

4.1. From filters to geometries

As remarked at the outset, Noyer (1992) already had the insight that the features needed to decompose the dual in the manner argued for by Hale (1973) and Silverstein (1976) were those required singly for singular∼plural and minimal∼augmented number systems. However, he did not formulate this as a means to explain category-internal markedness. Rather, he instituted a set of filters, inspired by Calabrese's (1987) work on phonology, that essentially recapitulated Greenberg's generalizations. For instance, the structure below is to be read as 'a language can active a lower category (*e.g.*, dual) only if it has activated the higher category (*viz.*, singular)':

(11)

singular
|
dual

More fully, given the previous sections, we can write:

(12)

singular	minimal
|	|
dual	unit augmented
|	
trial	

However, this overlay of filters is clearly redundant: the principles of feature activation and semantic composition clearly do all the necessary work.

It is natural therefore to wonder why Noyer himself did not formulate the combinatorial principle as the driving force behind category-internal markedness. I think there are two reasons. The first is that he had not yet appreciated the utility of feature recursion and of value mismatches. As a result, his theory lacked the featural resources to generalize his result concerning the dual. The second is that the person features he posited actually overgenerated if combinatorially free. Specifically, the inventory [±participant] ('does (not) include (either) the speaker or hearer'), [±speaker] ('does (not) include the speaker'), [±hearer] ('does (not) include the hearer'), if unconstrained, generates the unattested conflation of first person inclusive with second person (Zwicky's 1977 *syou* problem), when [±participant] and [±hearer] are operative without [±speaker] (see, *e.g.*, Harley 1994, Nevins 2003, Harbour 2006c). The filters served to rein in this overgeneration by claiming that a first person exclusive distinction could not be made in the absence of a first person inclusive, as in:

(13)

first
|
second
|
inclusive/
exclusive

However, the resulting system was somewhat unsatisfactory, in that it required not only a feature inventory, but made separate reference to the semantic yield—singular, dual, and so on.—of the feature system itself: the result is, essentially, a surface constraint on outputs.

An interesting attempt to create a more parsimonious system is that Harley and Ritter (2002). There, instead of the features forming an unstructured inventory and their semantic yield being structured by implication relations, the features themselves were structured by the implication relations. Thus, the problem of overgeneration for person would be solved by making it impossible for {[±participant], [±hearer]} to be a legitimate feature system in the absence of [±speaker]:[6]

(14)

[±participant]
|
[±speaker]
|
[±hearer]

This structure encodes that the feature [±hearer] can only be active if the feature [±speaker] also is, thus ruling out the problematic feature set. Such feature structures have enjoyed considerable popularity, with many families of features, including person, gender, conjugation class, and case, being afforded articulated internal organization and dependencies (*e.g.*, Oltra-Massuet 2000, Harley and Ritter 2002, Béjar 2003, Trommer 2008). Such ensembles of filters are generally 'geometries' (following work by Bonet 1991).

However, feature geometries face several problems. Most gravely, although more parsimonious than the filter-based explanation, they are not more explanatory: they merely trade unexplained category-internal markedness relations (implications between features' semantic yield) for unexplained feature-markedness relations (implications between the features themselves). As emphasized in the preceding section, an explanation of category-internal markedness follows naturally from the feature definitions and basic combinatorics. However, as this issue is explored more fully elsewhere (see Harbour 2006a on number and 2006c on person), I do not pursue it here. Instead, I wish to focus on a second claim of Harley and Ritter's concerning marked-

[6] I set aside that Harley and Ritter (2002) use privative rather than bivalent features. Note that privativity precludes feature recursion, so that the trial and unit augmented are no longer featurally identifiable (they are, in fact, not incorporated into Harley and Ritter's system). For further arguments against privativity and in favor of bivalence, see Harbour (2005).

ness, namely that feature markedness statements are merely default relations that languages can choose to override.

4.2. The typological inferential fallacy

The point of the claim that feature markedness statements are merely defaults is to account for skewed typological distributions: if there is a default order of feature activation that most languages follow, then most languages will share one of several stock person and number systems, and divergences will be rare. Harley and Ritter use this to account for a part of the person system of various Algonquian languages (a pseudo-*syou* system); but McGinnis (2005) argues, correctly, in my opinion, that this is unwarranted. However, rather than get involved in the analysis of particular cases, I wish to point out a consequence of the analysis of number features above, in virtue of which the inference from typological patterns to feature sets becomes highly problematic. It is, in a word, a matter of underdetermination: different feature sets can generate exactly the same number, or person, system. In some cases, other evidence may be available to determine which feature set a language actually deploys. However, in the absence of such evidence, it is not possible to infer, or bolster, notions of feature markedness on the basis of typological distributions.

To illustrate the problem, consider the three-way number contrasts of Tongan and Rembarrnga. Tongan, with {[±singular], [±augmented]}, contrasts singular∼dual∼plural. Rembarrnga, with {[±augmented]*}, contrasts minimal∼unit augmented∼augmented. However, within the pronominal system, this difference is only apparent because the languages further contrast inclusive and exclusive first person. Without the clusivity contrast, the systems collapses:

Featurally distinct, yield-identical systems: singular∼dual∼plural

singular	= [+singular −augmented]
dual	= [−singular −augmented]
plural	= [−singular +augmented]
{singular, dual}	= [−augmented]
{dual, plural}	= [−singular]

singular	= [−augmented]
dual	= [−aug. +aug.]
plural	= [+augmented]
{singular, dual}	= [−augmented]
{dual, plural}	= [+augmented]

One might think to differentiate these systems in terms of the natural classes they define (especially given that the early motivation for feature decomposition of the dual was to make it party to two distinct natural classes; Hale 1973, Silverstein 1976). However, as the tables show, the two systems collapse in a particularly vexing way: both yield the natural classes of the Hale-Silverstein decomposition, {singular, dual} and {dual, plural}.

Now, in some special cases, languages may offer extra evidence that is compatible with just one feature set. An example of such a language is Jemez (Sprott 1992, Yumitani 1998). Jemez contrasts singular∼dual∼plural, but does so without clusivity. Like all Kiowa-Tanoan languages, it possesses a number marker, the 'inverse', which suffixes to some nouns to produce the dual/plural and to others to produce the singular/dual. In brief, the analysis of inverse marking is that noun class features in Kiowa-Tanoan are, in fact, number features. More number features are located, of course, on Number. D copies features both Class and Number. When these conflict, they are realized as inverse: [+F −F] ⇔ INV. (For greater detail, see Noyer 1992, Harbour 2005.)

Now, the fact that Jemez has specialized means of pronouncing feature conflicts permits one to determine that it deploys {[±singular], [±augmented]}, rather than {[±augmented]*}. To see this, observe that the only conflict that can arise if the number system consists of [±augmented] with feature recursion is [+augmented −augmented]. This is the specification for dual. So, inverse and dual are featurally identical in this system and are therefore predicted to behave identically. This is, however, wrong: the dual and inverse, though at times syncretic, are distinguished in many contexts throughout the language. Thus, Jemez uses {[±singular], [±augmented]} (a conclusion reached by independent argumentation in Harbour 2005).

Now, many languages, including Damana (Chibchan), Hua (Gorokan), Nganasan (Finno-Ugric), and Sanskrit (Indo-European), possess dual number in the absence of clusivity. If it is only such arcane grammatical properties as the Kiowa-Tanoan inverse that force the learner to posit one feature set over another, then we must accept that speakers with extensionally equivalent E-grammars may yet have featurally divergent I-grammars. This may extend to languages, like English and Japanese, with a simple singular∼plural contrast but without a clusivity contrast: these could be equally well served by [±singular] or [±augmented].[7]

We are forced, then, to the following realization. For complex pronominal systems, such as those involving the trial or unit augmented, there may well be only one possible feature set with the appropriate numbers as its semantic yield. However, for simpler, more typologically common cases, distinct feature sets can yield identical systems and so there is no simple inference from the system to the features that generate it. That is, we might naively expect that [±singular] generates singular∼plural systems and that [±augmented] is restricted to minimal∼augmented systems; and, indeed, if the languages in question possess a clusivity contrast, the inference is valid. However, without such a contrast, no such inference can be made. In consequence, typologically typicality reveals little, if anything, about feature markedness.

[7] Alternatively, properties of the semantics of plurals, collectives, mass nouns, and so on, might differ in the two systems in a principled way. For arguments in this direction, see Watanabe (2007) and Tsoulas (2008), and Harbour (2008) for more general comments.

4.3. Feature generality

The problem afflicting the inference from typological patterns, via feature sets, to feature markedness is, in fact, even more acute than just argued. The locus of the problem lies in the seemingly entirely innocent assumption that what lies behind number systems is number features. Of course, it was argued above that number systems are indeed the semantic yield of feature sets and it was further argued that two features permit analysis of numerous distinct number systems. Now, if that were all these two features were used for, then it would be reasonable to call them number features. However, these features have a far wider set of uses, beyond countable number, and, so, to attempt to determine which features-used-for-number are marked, purely on the basis of number-based usage, is far too parochial.

One set of uses for [±singular] and [±augmented] remains in the nominal domain but moves beyond countable number. On the one hand, as indicated above, in the discussion of Jemez, they have been argued to be used for noun classification in Kiowa-Tanoan (Noyer 1992, Harbour 2005, 2007). In a not unrelated vein, they have been argued to be used for syntactic differentiation of varieties of mass nouns and to measure phrases (Watanabe 2007, Tsoulas 2008, and Harbour 2007, 2008). This last application of the features is particularly important. If arguments are to be made about feature markedness based on rareness of use, then their occurrence in so common a domain as mass and measure terms suggests that their usage is far from rare at all.

A more striking version of this result comes from Krifka's (1992) work on aspect and Aktionsart. Amongst the basic concepts of his theory are atomicity and strict cumulativity. Allowing for some slight changes in notation, to ease comparability, these may be defined as:

(15) a. $\mathrm{ATOM} = \lambda x\ \neg\exists y[y \sqsubset x]$

b. $\mathrm{SCUM} = \lambda \mathrm{P}\forall x\forall y[[\mathrm{P}(x) \wedge \mathrm{P}(y)] \rightarrow \mathrm{P}(x \sqcup y)]$

$$\wedge\ \exists x \exists y[\mathrm{P}(x) \wedge \mathrm{P}(y) \wedge x \neq y]$$

Now, the equivalence between [+singular] and ATOM is trivial, as the former simply assumes the notion of atomicity in its definition. The equivalent of SCUM in the current system is not as immediately obvious. To see that it is [+augmented], note, first, that SCUM is biclausal, as highlighted by the line-break. The first clause asserts closure under addition ($\sqcup$) and, within the pronominal domain, it holds trivially: person and gender predicates, such as 'contains the speaker' or 'contains no males', and basic nominals, such as 'dog(x)', are all additive (the sum of two ensembles containing the speaker, or no males, again contains the speaker, or no males; the sum of two ensembles of dogs is again an ensemble of dogs). In other words, any P taken by [±augmented] is additively closed. In consequence, we are interested in the equivalence between the and basic nominals (15b) and [+augmented], assuming that P in both cases is closed under addition.

Demonstration of the equivalence is straightforward (Harbour 2006b). If [+augmented] is true, then one has an element a, satisfying the presupposition $\mathrm{P}(a)$, for which there is some b such that $\mathrm{P}(b)$ and $b \sqsubset a$. It follows from $b \sqsubset a$ that $a \neq b$. So, we can write $\mathrm{P}(a) \wedge \mathrm{P}(b) \wedge a \neq b$, or, by existential quantification, $\exists x \exists y[\mathrm{P}(x) \wedge \mathrm{P}(y) \wedge x \neq y]$, which is that last line of (15b). Conversely, if we have a and b such that $\mathrm{P}(a)$ and $\mathrm{P}(b)$ and $a \neq b$, then, by the additive closure of P, we also have $\mathrm{P}(a \sqcup b)$. Given that $a \sqsubset (a \sqcup b)$, we can write $\mathrm{P}(a) \wedge \mathrm{P}(a \sqcup b) \wedge a \sqsubset (a \sqcup b)$, or, by existential quantification, $\exists y[\mathrm{P}(a) \wedge \mathrm{P}(y) \wedge y \sqsubset a]$. Lambda-extraction of a, and treatment of $\mathrm{P}(a)$ as a presupposition, yields the definition of [+augmented].

That morphologists working on number systems and semanticists working on aspect systems should have converged on essentially identical features is, in my opinion, a very striking result. Before discussing its relevance to feature markedness, I wish briefly to indicate an extension of the equivalence between nominal number and verbal aspect. The extension concerns additive closure. It was noted above that person and gender features and basic nominals are closed under addition. This statement excluded the interaction of additive closure with other numbers.

Now, for cardinally exact numbers, such as the singular, it is similarly redundant: the first person singular, having a unique referent, is closed under addition; the third person singular, having multiple referents, is not. However, this leads to no new distinctions, as first and third person are already distinguished on the basis of person. (Matters are similar for the minimal and unit augmented.)

However, the notion of additivity can be used to divide the plural into two domains, one additively closed, the other open. If we take the boundary between these two to be numerically low, then the closed portion contains only pluralities with few individuals, that is, it is a paucal. Its complement is a plural. If we take the boundary to be numerically high, then the open portion contains only large pluralities, that is, it is a greater plural. Its complement is, again, a standard plural. This suggests a further featural parallel between number and aspect, namely, that the notion of additivity is the featural requisite for identifying the paucal and greater plural.

If the discussion of noun classification, mass and measure, and aspect and Aktionsart is on the right track, then [±singular] and [±augmented] play semantic roles well beyond the domain of countable nominals with which we began (section 2.1), with which we began. As a result, it seems hopelessly parochial to argue for absolute markedness relations purely on the basis of the role they play in number systems. Any such putative markedness claims must be assessed against featural analyses of the other phenomena just discussed. This is probably possible, but, until the requisite research is conducted, contentions and conclusions are quite premature. Alternatively, if we wish to confine attention to number, then we can only concern ourselves with contextual markedness, which is an entirely different notion from feature markedness, as a feature marked in context C can be unmarked in context C′ (that is, contextual markedness is context-dependent), and such considerations will no longer yield universal orders of activation.

5. Value markedness

In light of the preceding brief comment on contextual markedness, I wish briefly to consider the implications that foregoing discussion holds for notions of value markedness. The discussion is intended to be more indicative than conclusive. Nonetheless, there is evidence enough to challenge some frequently held ideas about how pluses and minuses correlate with markedness.[8]

There is a frequent tendency to view plus as marked and minus as unmarked. Silverstein (1976) made an early attempt to maintain this position, though, interestingly, he was unable to do so completely (pp. 199, 227–228). Amongst more recent versions of the idea is the claim that only plus values are stored in the lexicon, and that minus values are inserted automatically (Wunderlich 2001). However, such claims are straightforwardly contradicted by what we have seen above. For instance, the three numbers of a minimal∼unit augmented∼augmented system, would be stored, respectively, as [ ]∼[+augmented]∼[+augmented]. This conflates unit augmented with full augmented and so the correct number of differences is no longer available. A similar result affects the numbers in a singular∼dual∼trial∼plural system, which would be stored as [+singular]∼[ ]∼[+augmented]∼[+augmented]. Again, there is a failure to maintain adequate distinctions, as trial and plural, collapse. Rather, we must conclude that minus values are just as much

[8]Of course, the notion of value markedness presupposes that features have values. Against the use of purely privative features, see note 6.

part of stored information as plus values are. (The same conclusion can be reached on the basis of Kiowa-Tanoan noun classification, mentioned above; Noyer 1992, Harbour 2005, 2007.)

Another common idea is that there is a correlation between lack of markedness and zero exponence (Benveniste 1966, Silverstein 1976, Cysouw 2003, *inter* many *alia*). Zero for third person and zero for singular number are taken to be instances of this. Notice that these are claims about correlations between category-internal markedness and zero exponence. Given that category-internal markedness was argued to be a consequence of more general principles, zero exponence should, ideally, be similarly reducible. However, attempts to translate such statements into claims about feature combinatorics and semantic composition, or value markedness, make matters decidedly opaque. For instance, in Kiowa, the singular, especially of the third person, is indeed the number most prone to zero exponence. Now, Kiowa, possessing a clusivity contrast in a singular∼dual∼plural system, must represent singular as [+singular −augmented]. However, the actual default number in Kiowa, used for impersonal predicates, object-less transitives, and abstract nouns (Watkins 1984), is plural, which has the exact opposite feature specification as singular, [−singular +augmented]. This suggests that the sense of markedness that applies to targets of zero exponence is distinct from that which applies to defaults.

Moreover, in neither of these cases is it possible to draw a simple correlation between plus and marked, or minus and unmarked, which therefore implies that value markedness is again distinct from both of these notions. Now, one might try to defuse this last conclusion by redefining the features. For instance, if one defines [±non-augmented] as the negation of [±augmented], then plural becomes [−singular −non-augmented]; one can then claim that default number derives from unmarked/minus values. The problem with this, however, is that, in Kiowa, certain syncretisms target [−non-augmented] over

[+non-augmented] (that is, we have the odd situation in which a plural becomes a dual; Harbour 2007). Such syncretisms then apparently favor a marked plus over an unmarked minus. (Backtracking to replace [±singular] with [±non-singular] is of no help, as there equally operations that favor the marked plus over the unmarked minus of this new feature.) Given such representational alternatives, such syncretisms are inconsistent with the claim that marked values are more prone to morphological simplification that unmarked ones (*e.g.*, Noyer 1992, Nevins 2008).

The comments are not intended to offer any concrete conclusions. Rather, they are intended to make apparent the problems that surround any simple association along the lines of plus∼marked, minus∼unmarked. Rather, underspecification (in the lexicon), proneness to zero exponence, defaulthood, and proneness to morphological simplification appear to be distinct notions, which must be independently investigated before any reduction or conflation is attempted (as also argued by Haspelmath 2006, Nevins 2008, Sauerland 2008). However, it only makes sense to ask such questions in the context of a soundly grounded inventory of features, of the type which I hope to have offered above.

6. Conclusion

Above, I have presented a fragment of a theory of number features, together with some indication of how the general design of the theory extends to other varieties of number, and to person. Within this theory, the notion of category-internal markedness (Greenberg 1966) appears to be entirely derivative, emerging naturally from the feature definitions and basic combinatorics. This explanation calls into question such devices as filters and geometries and substantially undermines the soundness and utility of the notion of feature markedness. Moreover, this line of inquiry calls into question any simple correlations between feature values and markedness. This is not to say that no such correlations exist, but that they must be carefully argued for, on the basis of fully justified feature inventories and in the context of proper differentiation of the relevant concepts. For the most part, so far as I can tell, this has yet to be done.

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