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Another Note on Number*

Michael Barrie
(Sogang University)

Michael Barrie. 2016. **Another Note on Number.** *Studies in Generative Grammar*. 26-1, 97-113. Cowper (2005) presents an intriguing theory of number features in which she suggests that plural is more marked than dual, contrary to traditional wisdom (Corbett, 2000). Cowper's theory has been rebutted by Nevins (2007). In this squib I revisit the debate on number with data from Onondaga (Iroquoian), which support Cowper's analysis of number. I do not show, however, that plural is more marked than dual in the traditional sense. The results of this investigation show, as Cowper did, that plural is structurally more complex than dual; however, this does not imply that plural is typologically more marked than dual. Thus, I tease apart the notion of structural markedness and typological markedness. Nevins' arguments that dual is more typologically marked than plural still hold, even though plural is structurally more complex than dual. The broader implication here is that structural complexity and typological markedness are not necessarily correlated.

Keywords: number, Iroquoian, omnivorous agreement, dual, Cyclic Agree

1. Introduction

In number systems around the world, it is commonly acknowledged that dual is more marked than plural (Corbett, 2000). As Nevins (2007) re-iterates from previous studies, dual is acquired later than plural, is more likely to be lost than plural, and is found in fewer languages than plural. Also, the existence of dual

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in a language entails the existence of plural. Despite the relative markedness of dual number over that of plural, we will explore an analysis of number in which plural number is represented by a more complex feature geometry than that of dual number (Cowper, 2005).

This squib examines these issues in light of dual number in Onondaga, a Northern Iroquoian language spoken in central North America near Niagara Falls. Onondaga is a polysynthetic language, closely related to Mohawk, with extensive subject and object agreement (Barrie, 2005, 2015, Lounsbury, 1949, Woodbury, 2003). As will be explained below, Onondaga has both dual and plural number and exhibits what Nevins (2007) calls *omnivorous number*, which means number agreement is found for either the subject or the object. When dual and plural compete, plural wins out and triggers plural agreement on the verb. To be precise, if one argument is dual and the other is plural, then plural agreement is found on the verb.

Once we examine the facts using the various models of number described below, we will see that number in Onondaga shows support for Cowper's model of number. This has implications for our understanding of markedness, which we take up in the final section.

The discussion below makes use of the notion of structured Probes (Béjar, 2003, Béjar & Rezac, 2009), and the lack of the necessity for Agree to succeed (Béjar, 2003, Béjar & Rezac, 2009, Preminger, 2014). Within standard Minimalist assumptions (Chomsky, 1995, 2000) a Probe has an unvalued and uninterpretable feature that must be valued by a Goal. Thus, the Probe may have an unvalued phi-feature set that is valued by the subject. A structured probe is more precise in what it searches out. Assume the following features for person (Harley & Ritter, 2002).[1]

[1] Although this squib deals with number, the theory of Agree here is illustrated with person, since most of the literature on omnivorous agreement deals with person agreement.

(1) 1^{st} person 2^{nd} person 3^{rd} person

```
      π              π           π
      |              |
[participant]  [participant]
      |
  [speaker]
```

For instance, the Probe may look for only 1^{st} or 2^{nd} person by specifying the Probe as [π-participant], where the feature [participant] refers to the set of 1^{st} and 2^{nd} person. Thus, in such a situation, if the subject is 3^{rd} person and the object is 1^{st} person, then the Probe bypasses the subject and agrees with the object.

The core properties of Agree are illustrated here (Preminger, 2014). The Probe must find a matching Goal (a Goal with the same set of features) to Agree with. The Goal then values the Probe with its full set of features. Consider the following examples. The Probe (on the left) is specified [π -participant], and the Goals are on the right. Both subject and object are shown to illustrate how it is possible for either argument to value the Probe.

```
(2)      Probe          Subject         Object

 a.        π               π               π
           |                               |           ==> 2π
     [participant]                   [participant]

 b.        π               π               π
           |               |               |           ==> 2π
     [participant]   [participant]   [participant]
 c.        π               π               π
           |               |               |           ==> 1π
     [participant]   [participant]   [participant]
                           |
                       [speaker]
 d.        π               π               π
           |                                           ==> 3π
```
~~[participant]~~

In (2)a, the Probe searches for [π-participant] (i.e., 2^{nd} person). The subject does not have this feature set, so the Probe continues. It finds it on the object and successfully values the Probe as 2nd person. In (2)b, the Probe this time successfully finds the feature set on the subject, and the Probe stops searching. So far, this pattern gives rise to 2nd person agreement, regardless of whether it is the subject or the object that is 2nd person. This is an example of omnivorous agreement. The Probe searches a particular features set (here 2nd person) rather than a particular grammatical role (say, subject or object). Next, in (2)c, the Probe again finds a matching feature set on the subject. The subject then copies its person features on to the Probe, and the Probe is valued for 1st person. Finally, in (2)d, the Probe fails to find a matching Goal, so the [participant] feature is deleted, leaving a bare [π] feature, which gives rise to 3rd person agreement. One crucial property of the theory above is that it is formulable only with a feature geometry, hence privative features. Binary feature systems cannot be accommodated to this theory. See Béjar (2003), Béjar & Rezac (2009), and Preminger (2014) for more details, especially Preminger for discussion on how only structured Probes can accommodate omnivorous agreement effects, such as those shown below for Onondaga.

The gist of the analysis is as follows. A structured number Probe searches for a plural Goal to agree with. If it finds one, then plural agreement is found on the verb. If not, then dual agreement is possible, if there is a dual argument in the search domain. This entails that the features for dual are a subset of the features for plural, contrary to what is standardly assumed. This analysis crucially relies on Preminger's (2014) notion of failed agreement. That is, the Probe attempts to find a Goal to agree with, but if it doesn't find one, the derivation still proceeds.

The remainder of this squib is structured as follows. Section two presents the facts on number agreement in Onondaga. Section three presents current models of number focussing on feature geometric analyses. Section four analyzes the Onondaga data in light of the models presented in section three. Section five is a brief discussion and conclusion.

2. Number in Onondaga

We start with the description of number agreement in Onondaga. The following chart shows the observed number agreement for all possible 1st and 2nd person combinations. The top row indicates the number of the subject, and the left column indicates the number of the object. The interior cells, which are in italics and with the corresponding abbreviation, indicate the number agreement found on the verb. Two examples are given to illustrate.[2]

Table 1 Agreement with 1st and/or 2nd person arguments

object \ subject	singular	dual	plural
singular	*singular*		
dual		*dual* (du)	
plural			*plural* (pl)

(3) s-g-ni-gę-haʔ
2-1-du-see-hab
'I see you two.' or 'We two see you (sg).' or 'We two see you two.'

(4) s-g-wa-gę-haʔ
2-1-pl-see-hab
'I see you all.' or 'We two see you all.' or 'We all see you all.'
or 'We all see you two.' or 'We all see you (sg.)'

Descriptively, the pattern can be described as follows. If either the subject or the object is plural, then plural agreement is found. Otherwise, if either the subject or the object is dual, then dual number is found. Otherwise, no overt number agreement is found. As mentioned in the introduction, this pattern is referred to as omnivorous agreement. Crucially, the number agreement morpheme doesn't care whether it agrees with the subject or the object.[3] Note also that in the pattern shown above, plural trumps dual if both are present.

Moving on to 3rd person, the following chart shows number agreement with one 1st or 2nd person argument and one 3rd person singular masculine argument. The pattern here is rather straightforward. Either dual or plural agreement shows up, referencing the 1st or 2nd person argument, regardless of grammatical function. This pattern is not overly surprising given the pattern above. Again, two examples follow.

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[2] The following abbreviations are used. du = dual, f = feminine, hab = habitual, m = masculine, pl = plural, prfv = perfective, sg = singular.

[3] A reviewer asks what the function of number marking is, given that it references either the subject or the object. This is an excellent question for which I have no answer other than to note that this effect is not particular to Onondaga or even to Northern Iroquoian. It is found in a number of unrelated languages around the world.

Table 2 Agreement with 1^{st} or 2^{nd} person against 3^{rd} person singular masculine

	1^{st} or 2^{nd} singular	1^{st} or 2^{nd} dual	1^{st} or 2^{nd} plural
$3_{M.SG}$	*singular*	*dual*	*plural*

(5) a. he-s-ni-gę-haʔ
$3_{M.SG}$-2-du-see-hab
'You two see him.'
b. s-he-s-wa-gę-haʔ[4]
?-$3_{M.SG}$-2-pl-see-hab
'He sees you all.'

The last set of data, however, introduces an additional complication. This table presents the agreement pattern when one argument is either 1^{st} or 2^{nd} person and the other is 3^{rd} person feminine (singular or plural) or 3^{rd} person plural (masculine or feminine). For convenience, this argument is labelled $3_{F/PL}$, meaning 3^{rd} person feminine or plural (or both).

Table 3 Agreement with 1^{st} or 2^{nd} person with 3^{rd} person feminine and/or plural

1^{st} or 2^{nd} π	3F/PL
singular	*singular*
dual	*plural*
plural	

(6) a. k-he-gę-haʔ
1-$3_{F/PL}$-see-hab
'I see her.' or 'I see them.'
b. ye-c-hi-gę-haʔ
$3_{F/PL}$-2-pl-see-hab
'You two/all see her/them.' or 'She/they see(s) you two/all.'

The most noteworthy observation here is that the distinction between dual and plural is neutralized when one of the arguments is $3_{F/PL}$.

4 The function of the morpheme glossed ? here is unclear. In this example, it appears to be some kind of inverse marker, indicating a reversal in the grammatical relationship between 3^{rd} person and 2^{nd} person, but it doesn't appear elsewhere in the paradigm.

To conclude, we have the following number morphemes for Onondaga.

(7) a. dual ↔ ni-
b. plural ↔ wa-
c. plural ↔ hi- / __ $3_{F/PL}$

3. Number Features

As mentioned in the introduction, phi-features are organized into feature geometries (Harley & Ritter, 2002). We examine here a series of proposals for the geometry of number features. The first is Harley and Ritter's original proposal.

```
(8)   Singular    Plural      Dual
         #           #          #
                     |          |
                  [group]    [group]
                                |
                            [minimal]
```

This model proposes that the feature [group] forces a plural interpretation. The feature [minimal] is a dependent of [group] and forces a dual interpretation. This model captures the standardly accepted notion that dual is more marked than plural, in that the typologically more marked category (dual) is structurally more complex.

Cowper (2005) proposes a radical departure from the usual set of features for number based on the constructed dual in Zuni (isolate) and Hopi (Uto-Aztecan). The constructed dual employs a combination of a singular form and a plural form to give rise to a dual meaning. To form the dual in Hopi and in Zuni, the plural form of the subject noun combines with the singular form of the verb. The following Hopi example illustrates the form (Corbett, 2000: 169).

(9) puma wari
that.pl run.prfv.sg
'They two ran.'

Cowper proposes the following novel structures for number features in languages with dual and plural in (10)a, and languages with only plural in (10)b.

Languages which contrast only singular and plural require only one feature, [>1], to indicate plural number. Languages with dual number use [>2] to indicate plural number, while [>1] indicates dual number. Thus, the meaning of [>1] depends on how it contrasts with other features.[5]

(10) a.	Singular	Dual	Plural	b.	Singular	Plural
	#	#	#		#	#
		>1	>1			>1
			>2			

She also proposes the following vocabulary items (as per Distributed Morphology, Halle & Marantz, 1994, et seq). Note that the forms here for the noun 'that' and the verb 'run' are the full singular and plural forms, since the plural forms for both are suppletive. Suppletive plurals are quite common in Uto-Aztecan languages. For example, if the [>1] feature is found on the noun 'that' the suppletive plural form of the noun is inserted. Note also that the formalisms in (11) are instructions for which morphemes to insert at PF (during Vocabulary Insertion) and are not related to the meanings computed at LF.

(11) Nouns ('that'): [#] ↔ pam [>1] ↔ puma
Verbs ('run'): [#] ↔ wari [>2] ↔ yùuntu

The constructed dual in (9), then, surfaces as follows. The subject and verb in (12) are shown with their number features indicating dual number. Crucially, these are the number features that are interpreted at LF, giving rise to the meaning of dual number. Note that the English translations of the Hopi forms are used, not only for convenience, but also because the precise forms of the Hopi morphemes are not inserted until PF, so they are not yet known. At this stage, the subject consists of a phi-feature set for the subject pronoun with a dual feature, and an abstract verbal root meaning *run* with a dual feature. When the vocabulary items are inserted at PF the following happens. The subject NP

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5 A reviewer asks why [>2] must be a dependent of [>1] given that [>2] by itself should be able to give rise to a plural meaning. Although the reviewer is correct that a bare [>2] is simpler, it fails to account for the Hopi and Zuni facts that Cowper discusses. Furthermore, as we will see for the Onondaga data below, an articulated feature geometry is required to account for the omnivorous number agreement facts.

has the feature [>1], which, following (11), triggers the plural suppletive form to appear as the subject NP. The verb also has the feature [>1]; however, following (11), the plural suppletive form requires the feature [>2], which is absent, thus, [#] triggers the singular form to appear on the verb at PF.

(12)

that.dual	run.dual
#	#
|	|
>1	>1

Cowper goes on to show with additional data from Zuni that the original and revised feature geometries originally proposed by Harley and Ritter cannot account for these data.

Nevins (2007) counters Cowper's analysis by discussing a broad range of evidence that dual is more marked than plural. As Nevins points out, dual number is acquired later in children, tends to disappear historically, and is typologically rarer. He also notes that syncretisms typically occur in marked environments rather than in unmarked environments. Specifically for our purposes, he notes that while Zuni plural pronouns distinguish between objective and possessive Case, Zuni dual pronouns neutralize this Case distinction. Thus, Nevins concludes that any approach to dual number must proceed from the premise that dual is more marked than plural.

Nevins argues that the following features (originally proposed in Harbour, 2003) suffice to account for the constructed dual construction.

(13) Singular = [+singular, -augmented]
Dual = [-singular, -augmented]
Plural = [-singular, +augmented]

In doing so, he makes the unconventional claim that the negative values for the two features in question are marked. Specifically, he makes the following two markedness statements.

(14) a. [-singular] is marked
b. [-augmented] is marked in the context of [-singular]

With these features and markedness statements Nevins can derive the constructed dual construction in example (9) as follows. The verbal form *wari* is specified as [-augmented], so appears in singular and dual contexts. The nominal form *puma* is specified as [-singular], so appears in dual and plural contexts.

If one were to update the features here so that the marked features are positively specified or privative (as Nevins, 2011 subsequently argues), we get the following. Binary features are shown on the left and privative features are shown on the right.

(15) Singular = [-plural, -minimal]   Singular = []
Dual = [+plural, +minimal]   Dual = [plural, minimal]
Plural = [+plural, -minimal]   Plural = [plural]

These feature specifications align more closely with the notion of markedness Nevins wishes to capture; however, they are now identical to the feature geometry originally proposed by Harley and Ritter (2002) in that [minimal] entails [plural]. This, however, is exactly the same representation that Cowper showed is not tenable with the constructed dual.

This section has introduced three proposals for number, which will be evaluated against the Onondaga data on number in the following section.

4. Onondaga Number and Number Features

Recall from section 2 that we have the following vocabulary items that refer to number for 1^{st} and 2^{nd} person in Onondaga.

(16) a. dual ↔ ni-
b. plural ↔ wa-
c. plural ↔ hi- / __ $3_{F/PL}$ (recall this form is neutralized for dual/plural number)

Let's investigate now what kind of number system can account for these data. Recall that the omnivorous number agreement effects force us to adopt Béjar & Rezac's structured Probe theory. Furthermore, recall that structured Probes require a feature geometry, hence privative features. Unordered, binary features simply cannot capture omnivorous agreement.

We consider the model from Harley & Ritter (2002), which is also our revised model of Nevins' (2007) proposal in which privative features are assumed. If we assume the Probe is fully specified, then we predict dual agreement to be preferred over plural agreement, contrary to fact. On the other hand, if the Probe is specified only with [plural], then we expect dual agreement when both a dual argument and a plural argument are found.

Let's consider this analysis in detail. Consider the following possible structures for the number Probe.

(17)

	a.	b.
	#	#
	|	|
	[plural]	[plural]
	|	
	[minimal]	

The Probe in (17)a preferentially seeks out a Goal with dual number. Thus, even if an argument with plural number is present, dual number is predicted to control agreement. As discussed in section 2, if one argument is plural and the other is dual, then plural agreement is found. We consider now the Probe in (17)b. This Probe will preferentially seek out plural number, as desired. The correct result holds if the subject is plural or singular, but if the subject is dual and the object is plural, then (17)b incorrectly predicts dual agreement on the verb. This is illustrated below. The Probe is on the left, and the subject and object are on the right

(18)

	Probe	Subject	Object
a.	#	#	#
	|	|	|
	[plural]	[plural]	[plural]
			|
			[minimal]
b.	#	#	#
	|	|	|
	[plural]	[plural]	[plural]
		|	
		[minimal]	

In (18)a, the subject matches the features of the Probe, so establishes an Agree relation, and the search stops. Thus, the [minimal] feature on the object has no effect on agreement. Plural agreement arises as predicted. The problem is (18)b. Again, the subject matches with the Probe. However, the features of the subject

Goal are now copied to the Probe (shown by a dashed line), erroneously giving rise to dual agreement. Thus, the Harley & Ritter number system fails to account for the Onondaga facts.

It is difficult to adapt Nevins' (2007) binary approach to number to Béjar & Rezac's structured Probe theory since this theory requires a feature geometry. If the Probe is unspecified it fails to give rise to omnivorous number, since only the number features of the subject will value the Probe. If the Probe is [-singular, αaugmented], it will still only take on the values of the closest non-singular Goal, giving no way to capture omnivorous number, where plural is preferred over dual. We could assume that the Probe is specified [-singular, +augmented]. That way, the Probe will try to find a plural Goal. If it finds one, then plural agreement is found as the verb, as predicted. If not, it is difficult to see how dual agreement will arise. Some mechanism would have to be created that could change the value of the Probe from [+augmented] to [augmented] should no plural Goal be found. Likewise, should no dual Goal be found either, then the [-singular] feature on the Probe must change to [+singular]. It is unclear what kind of mechanism would be responsible for changing the features of the Probe, however. An entirely new theory of Agree would have to be developed to test the number features that Nevins' proposes against the Onondaga data. Finally, as mentioned above, adapting Nevins' features to privative values gives rise to the same system as Harley & Ritter, which was just shown not to work for Onondaga.

Finally, let us examine Cowper's feature geometry for number in light of the Onondaga facts. Let's assume the following structure for the Probe, along the lines of Béjar & Rezac (2009). Note we have enriched the Probe to include a Participant feature, since only the 1^{st} and 2^{nd} arguments trigger number agreement.

```
(19)      Probe
         /     \
        π       #
        |       |
      Part     >1
                |
               >2
```

Finally, let's assume the following vocabulary items.

(20) a. [>1] ↔ ni-
b. [>2] ↔ wa-
c. [>1] ↔ hi- / __ $3_{F/PL}$

We can now capture the facts from section 2 with this apparatus. The following chart gives all the possible scenarios discussed above for 1st and 2nd person arguments only. It is important to remember that under the mechanism of Agree proposed by Béjar (2003), Béjar and Rezac (2005) and Preminger (2014), failure to agree does not cancel the derivation. Crucially, the Probe must attempt to find a suitable Goal; however, if it doesn't find one, or if it finds a Goal with only a subset of the features it's seeking, then the derivation can proceed with the unmatched features simply deleted, Béjar & Rezac (2009) and Preminger (2014). For expository purposes, unmatched features on the Probe are crossed out, and features that value the Probe are boldfaced and underlined. Specifically, for the number facts here, I am assuming the Probe is on T rather than on *v*. This way, the Probe looks downward first to the subject. If it fails to fully agree with the subject then it keeps looking downward to the object.

Table 4 Agreement with 1st or 2nd person arguments

	Probe	Subject (1st or 2nd π)	Object (1st or 2nd π)
1	**#** ~~>1~~ ~~>2~~	**#**	#
2	**#** **>1** ~~>2~~	**#**	# **>1**
3	**#** **>1** **>2**	**#**	# **>1** **>2**
4	**#** **>1** ~~>2~~	**#** **>1**	#
5	**#** **>1** ~~>2~~	**#** **>1**	# >1
6	**#** **>1** **>2**	**#** **>1**	# >1 **>2**

7	**#** **>1** **>2**	**#** **>1** **>2**	#
8	**#** **>1** **>2**	**#** **>1** **>2**	# >1
9	**#** **>1** **>2**	**#** **>1** **>2**	# >1 >2

To understand this chart, let's run through a couple of the derivations. In the first derivation, the Probe is seeking a Goal with the features [#]-[>1]-[>2]. The subject has the feature [#], so it matches the [#] feature on the Probe and values it. The object has no additional features, so has no effect on valuation. Since the features [>1] and [>2] are not matched, they are deleted. This is an instance of Preminger's (2014) notion of failed agreement. In the second derivation, the Probe seeks the same set of features. Again, the subject only has the feature [#], so this feature matches and values the [#] on the Probe, and the Probe keeps looking. The object has the features [#]-[>1], so the [>1] feature matches the [>1] feature on the Probe and values it. There are no more potential Goals, so the remaining [>2] feature is deleted. Finally, consider the sixth derivation. The subject matches the [#] and [>1] features on the Probe, but not the [>2] feature, so only [>1] is valued. The Probe continues to look and finds the [>2] feature on the object, which matches and values the Probe.

The situation in which one argument is 1^{st} or 2^{nd} person and the other is 3^{rd} person masculine singular is more straightforward. Recall that we have proposed that the Probe is also specified with a [Participant] feature, so it bypasses any 3^{rd} person argument. Thus, whatever number features the 1^{st} or 2^{nd} person argument has they will value the probe, giving rise to the expected agreement.

Finally, recall that when one of the arguments is $3_{F/PL}$, the dual/plural distinction is neutralized. Let's examine first the three situations of interest—namely, where one argument is 1^{st} or 2^{nd} person and the other is $3_{F/PL}$. In the following representations only the number features are shown for ease of exposition. Again, unmatched features on the Probe are crossed out, and the valued feature that triggers vocabulary insertion is boldfaced and underlined.

(21)	Probe	$1^{st}/2^{nd}$ #	$3_{F/PL}$
	#	#	g
	|		|
	~~>1~~		$3_{F/PL}$
	|		
	~~>2~~		
	#	#	g
	|	|	|
	>1	>1	$3_{F/PL}$
	|		
	~~>2~~		
	#	#	g
	|	|	|
	>1	>1	$3_{F/PL}$
	|	|	
	>2	>2	

Given the vocabulary items in (20), we may expect competition between the insertion of the plural morpheme, *wa-*, (which values the [>2] feature) and the neutralized plural morpheme, *hi-*, (which values the [>1] feature in the context of $3_{F/PL}$). We assume that the satisfaction of contextual allomorphy supersedes the satisfaction for a more highly specified feature.

5. Discussion

The facts concerning omnivorous number in Onondaga described above support Cowper's feature geometry along with Béjar and Rezac's (2009) theory of structured probes. To repeat, the number probe in Onondaga attempts to agree with a plural argument. In the event it cannot find one, it attempts to agree with dual number. If both the subject and the object are singular, no overt agreement surfaces.

One issue raised by Nevins in response to Cowper's model of number is the issue of markedness. Nevins correctly points out that dual is traditionally considered more marked than plural number for the reasons mentioned in section 1. However, as Arsenault (2007) suggests, there is no obligation for typologically more marked elements to be more structurally complex, either in the shape of the feature geometry or in the number of features involved. Thus, despite the objections raised by Nevins (2007), positing a structure of the plural that is featurally more complex than the dual does not entail that the plural is more marked than the dual. Although structural complexity may correlate with typological markedness, it is not necessarily an absolute.

To briefly illustrate this point, let us discuss the case of acquisition. As Nevins mentions, the dual is acquired later than the plural. In the Harley & Ritter model in (8) this falls out naturally. The feature [minimal], which is dependent on the feature [group], is plausibly acquired later, thus dual number is also acquired later.[6] In Cowper's model of number in (10), however, the feature [>2] is dependent on [>1], so is plausibly acquired later. Recall, however, that in the absence of the feature [>2], the feature [>1] simply means plural. Thus, if one follows the same line of reasoning, dual is predicted to be acquired later in Cowper's system, too. Thus, one cannot simply correlate the general notion of markedness to structural complexity.

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[6] As a reviewer notes, the tacit assumption here is that features lower in the hierarchy are acquired later and features higher in the hierarchy are acquired earlier. While I am in no position to discuss the mechanics of acquisition, I mention this point here as a possible resolution between Nevins and Cowper. A reviewer also asks about the precise interaction between markedness and feature structure; however, it is beyond the scope of this squib to defend a particular theory of markedness.

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Michael Barrie
Department of English
Sogang University
Shinsu-dong1, Mapo-gu, 121-742
Room J902

mikebarrie@sogang.ac.kr

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