

**CONSTRUCTIVE NUMBER SYSTEMS IN
MARORI AND BEYOND**

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Abstract

This paper examines complex number systems with unusual constructive strategies in languages such as Marori. One challenge that such systems present is the existence of a dual number category without dual morphology and a plural number category without plural morphology. This paper demonstrates that these number systems can be accounted for in a surprisingly straightforward way by proposing that they involve the composite binary features [+/-SG], [+/-PL], [+/-DU] and [+/-AUG]. Languages vary with respect to which features are activated and the nature of their composition and coding. This study highlights the significance of constructive number systems within the broader context of a unification-based theory of grammar as well as the theory and typology of agreement.

1 Introduction*

This paper discusses the unusual constructive number system, primarily as encountered in Marori (isolate, Trans New Guinea (TNG)). The proposed analysis is extended to similarly complex number systems in other languages such as Nen (Evans 2009) and Murrinh-Patha (Nordlinger 2011; Seiss 2011). Of particular interest in these languages is the constructive expression of specific number categories without dedicated number morphology, e.g. dual without dual morphology in Marori and plural without plural morphology in Nen.

Constructive (or constructed) number systems are the ones with distributive coding strategies where different sets of binary number features combine together to encode specific number values. In such systems, there can be a mismatch between number marking of the different elements involved, e.g. dual in Hopi involves plural associated with the subject and singular with the verb (Corbett 2000:169). In the case of dual in Marori, there is no mismatch: it is constructed by combining two underspecified (non-singular and non-plural) elements.

The complexity of the constructive number systems in these languages calls for a sophisticated way of representing number in a parallel-based model of grammar such as LFG.

Drawing insights from earlier work on number systems -- cross-linguistic findings (Corbett 2000) and feature space analyses and

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underspecification (Dalrymple, King, and Sadler 2009; Sadler 2010; Dalrymple and Kaplan 2000) -- I propose an analysis that maintains the basic idea of LFG's treatment of NUM in a unification-based AVM (attribute-value matrix) model. The novel aspect is in the way NUM features are structured and interpreted. It is proposed that the nature of NUM features (e.g., whether PL and/or SG features are present and whether they should be analysed as having binary values or not) be determined on language-specific evidence. Building on Croft (2003), the features are mapped onto categories on the semantic conceptual map of number.

The paper is organised as follows. After an overview of Marori morphosyntax in section 2, a detailed description of the number system in Marori and similar constructive systems in other languages are given in section 3. The proposed analysis is given in section 4, explicated first for Marori (4.1) and then extended to Nen (4.2) and Murrinth-Patha (4.3). Conclusions are given in section 5.

2 Marori syntax: an overview

2.1 Clausal structure

Marori is a non-configurational language. Its basic clause structure is informally shown in (1). The predicate unit typically consists of a lexical verb and a light or auxiliary verb. The lexical verb typically immediately precedes the auxiliary.

(1) [NP* VERB AUX.VERB] S

Marori has no VP constituent.¹ While typically coming before the verb, subject and object NPs can move around, including to a position after the verb. In the following examples, the recipient Albert can freely occur in different positions:²

¹ There is no standard orthography for Marori yet. This paper follows the Indonesian-like orthography commonly used by my Marori consultants, e.g. *y* represents the approximant /j/ and *ng* the velar nasal /ŋ/. Consonants with prenasals are written with more than one symbol, e.g. *mb*, *nd*, and *ngg*. Bilabial fricatives are written as *f* (voiceless) and *v* (voiced).

² Abbreviations used in the glosses: 1/2/3 'first/second/third person', A 'actor', ABS 'absolutive', AUX 'auxiliary', DET 'determiner', DU 'dual', ERG 'ergative', F 'female', FUT 'future', M 'male', NonPL 'non plural', NonSG 'non singular', O 'object', NrPST 'near past', PERF 'perfective', PL 'plural', POSS 'possessive', PROG 'progressive', REFL 'reflexive', SG 'singular', TAM 'tense, aspect and mood', PRES 'present', PST 'past', U 'undergoer'.

- (2) a. *Nawa tamba Albert=i nji=me-ben bosik sokodu.*
 1SG already Albert=U 3.give-AUX-1NPL.NrPST pig one
 'I already gave Albert a pig.'
- b. *Nawa tamba nji=me-ben bosik sokodu Albert=i.*
- c. *Albert=i nawa tamba nji=me-ben bosik sokodu.*
- d. *Albert=i nawa tamba bosik nji=me-ben sokodu.*

Grammatical relations are encoded by verbal agreement as well as marking on the argument NPs. Undergoer NPs receive the =i clitic, e.g. the recipient NP Albert in examples (2).

- (3) a. *na=i patar yu-nggo-f* b. *efi ramon(*=i) kundo-f*
 1SG=U cold 1SG-AUX-NrPST that womanrun.3SG-NrPST
 'I suffered from being cold.' 'She/the woman ran off.'

Free pronouns in Marori are not inflected for case to show their grammatical functions. They do, however, show different forms signifying a singular and non-singular number distinction, further discussed in 3.2 below.

2.2 Verbal morphology

The (auxiliary) verb is morphologically complex showing distributive exponence in the expression of argument roles (subject/actor or object/undergoer) and TAM. The morphological template is given in (4).

The template shows five verbal slots associated with arguments, including the (verbal) root. Broadly speaking, for a transitive verb, the prefixes (AFF1/AFF2) are associated with the undergoer whereas the suffixes (AFF3, AFF4) are associated with the actor. For an intransitive verb all the affixes can be associated with the sole core argument of the intransitive verb.

- (4) AFF1 - AFF2 - AUX.ROOT - AFF3 - AFF4
 (PERS) (NUM) (NUM) (ASP) (TNS/MOOD)
 (TNS) (GEN) (PERS)
 (PERS) (NUM)

AFF1 is filled in by the morpheme signifying PERS information of the S/O argument. Each PERS category has its own prefix: *y-* '1', *k-* '2' and \emptyset '3'.

The AFF2 slot is filled in by portmanteau morphemes signifying person, number and tense information. These are for example *ar-/or-*, which are used for non-singular first and second persons. However, for the present imperfective aspect, *or-* is used for plural whereas *ar-* for dual as shown in (5). These affixes combine with the pronominal affixes (e.g. *y-* '1', *k-* '2') giving rise to *yar-/yor-* and *kar-/kor-*.

- (5) *or*-1/2.PL.PRES or 1/2.NSG
 ar-1/2.DU.PRES or 1/2.NSG

The AFF3 slot is filled in by the aspectual morpheme (or verbal number), indicating extended aspect (atelic), e.g. *-ri* for the third person singular male, otherwise *-ra* as in *kunggo* ‘to nod once’ vs. *kungra* ‘to nod repeatedly’.

Finally, AFF4 is also the portmanteau suffix for (actor) subject. The suffix carries person, number and also possibly gender information, in addition to tense and mood. Thus, the first person (actor) subject varies, e.g., *-ru* for ‘future/irrealis’, *-du* ‘for (macro) present’, *-men/-mon* for ‘near past, extended aspect’ and *-ben/-bon* for ‘near past completed aspect’, *-maf/-mof* for ‘remote past, extended aspect’, and *-feri/-fori* for remote past, completed aspect. The different vowel quality is due to vowel harmony associated with gender, e.g. *kaswa=ma-mon* ‘hit=AUX.3F/PL-1SG.NrPST = I was hitting her/them’ vs. *keswe=mi-men* ‘hit-AUX.3F-1SG.NrPST = I was hitting him’.

The auxiliary root can be of different kinds depending on the transitivity and aspectual properties of the lexical predicate that it co-occurs with. For example, the dynamic non-positional intransitive predicate (e.g., with inchoative meaning such as ‘become small’) takes the auxiliary root *ngg*; the dynamic positional predicate (e.g. ‘stay lying’) takes *kuye*, and non-positional states such as ‘be hungry’ take *ra*.

The lexical verb itself may show verbal number reflecting aspectual properties. The verb root meaning ‘hit’ in non-completive aspect is *ksw-*, realised as *kaswa*, *keswe* etc. depending on vowel harmony. For hit with completive aspect, the root *tr-* is used, realised in different forms depending on the vowel harmony, e.g. *ter/tor* as in *ter=me-ben* ‘hit=AUX.3M-1NPL.NrPST = I hit him (once)’ and *tor=mo-bon* ‘hit=AUX.3F/PL-1NPL.NrPST = I hit her/it/them (once)’.

3 **Number system and the constructive number in Marori**

Morphologically, Marori distinguishes singular, dual and plural. However, considering the way number is expressed in the overall system in this language, especially the constructive strategy, plurals can be further distinguished between limited (‘paucal’) and large plurals. We can therefore argue that Marori has a five-way number system.

3.1 **Number on the (auxiliary) verb**

There are two kinds of number information associated with the verb. The first type is argument number agreement, i.e., number in formation associated with the arguments of the verb. This is realised by the morphemes in AFF2 and AFF4, and possibly by the vowel quality of the AUX root. This has been discussed in the preceding section, and is not repeated in this subsection.

However, there are a couple of points worth mentioning here in relation to argument number in Marori. Firstly, the main argument number (singular, dual and plural) is ‘equally’ morphologically marked on the verb. Secondly, the morphological marking can be either specified or underspecified. The specified number marking comes with dedicated number markers, e.g. specific morphology for SG, DU or PL. In Marori, this is restricted to the first person, non-past only. With other non-first person categories, the number marking is underspecified in the sense that it can be used for more than one number type. For example, *-ben* ‘1NPL.NrPST’ is underspecified: it is used for SG and DU.³ As we shall see in 3.3.1, underspecified number markers are important in constructive, distributive coding, e.g. non-plural and non-singular morphemes are needed in coding dual in Marori.

The second related kind of number information on the verb is what Durie (1986) calls verbal number. This is associated with plurality and aspectual properties of events. In Marori, this plural information is associated with the AFF3 position. Suffixes *-ri/-re/-ra/-ro* are used. Their distribution in the present habitual tense depends on the number of the object and subject, e.g. *kef-ri-du* ‘I eat something regularly’ vs. *kef-re-men* ‘We eat something regularly’ vs. *kaf-ra-du* ‘I eat things regularly’.

In addition, verbal number can also be expressed by distinct forms of the (auxiliary/lexical) verb root, e.g. the distinction between *tr-* ‘hit.once’ vs. *ksw-* ‘hit repeatedly/many times’ mentioned earlier.

3.2 Number on the argument NPs

Argument NPs contribute number information when they are realised by pronouns or demonstratives. Common and proper nouns are not inflected for number.

Pronouns in Marori show a distinction of singular (SG) and non-singular (NSG) forms, as seen in Figure 1.

Demonstratives in Marori likewise encode a SG/NSG distinction. The distinction, however, crosscuts three points of relative distance (‘proximal’, ‘semi-distal’, and ‘distal’), e.g. *kefi* ‘this’, *pafi* ‘that, near the addressee’, *nggafi* ‘that, semi distal’ and *nggwofi* ‘distal’.

Figure 1: Free pronouns in Marori

Person	Singular	Non-singular
1	<i>na/nawa</i>	<i>Nie</i>
2	<i>ka</i>	<i>Kie</i>
3	<i>efi</i>	<i>emnde/eme</i>

³Even for the first person where SG, DU and PL have distinct morphology, these morphemes are not exclusively NUM morphology. They are portmanteau morphemes expressing GEND, TNS and PERS in addition to NUM.

3.3 Constructive Number

3.3.1 Constructive Dual

Constructive DUAL in Marori is achieved by composing two number exponents, non-singular from the free argument and non-plural from the verb. This is exemplified in (6)b below, where the free pronoun *emnde* ‘3NSG’ and the non-plural verbal affix *-m* combine to form a dual interpretation. Without *yanadu* ‘two’, sentence (6)b is still interpreted as involving a dual subject. For clarity, the dual structure is contrasted with the SG and PL in (6)a and (6)c respectively.

- (6) a. *Efi yewrifam na=n bosik eyew ndam(∅-nda-m)*
3SG female 1SG=for pig see 3-AUX.3F-2/3NonPL.NrPST
‘She/the woman hunted a (female) pig for me.’
- b. *Emnde (yanadu)na=n bosik eyew ndam(∅-nda-m)*
3NonSG two 1SG=for pig see 3-AUX.3F-2/3NPL.NrPST
‘They (2) hunted a (female) pig for me.’
- c. *Emnde (usindu)fis na=n bosik eyew ndim(∅-ndi-m)*
3NonSG all yesterday 1SG=for pig see 3-AUX.3.M-2
/3PL.NrPST
‘They all (>2) hunted a (male) pig for me yesterday.’

The constructive dual in (7)a below makes use of the lexically-specified verbal number of the predicate:

- (7) a. *Emnde tanamba Merauke=ke kuye-∅*
3NSG now Merauke=LOC be.at.3NPL.REAL-2/3
‘They (2) are in Merauke now.’
- b. *Emnde tanamba Merauke=ke mingg-ri-∅*
3NSG now Merauke=LOC be.at.3PL.REAL-PL-2/3
‘They are (>2) in Merauke now.’

Note that the predicate ‘be.at’ with the locational/positional meaning shows a number opposition, *kuye* ‘be.at.NPL.REAL’ vs. *mingg* ‘be.at.PL.REAL’. Dual is constructed in (7)a, in which case the NPL verb *kuye* must be used with *emnde* ‘3NSG’. This is contrasted with the plural structure in (7)b.

Dual is not always encoded constructively, however. Dedicated dual morphology is used, but only for the first person macro-present.⁴ For

⁴ The term ‘macro-present’ refers to the type of tense in Marori used for events taking place at the moment of speaking (today) and the immediate time (‘yesterday’, and possibly ‘tomorrow’). With a proper adjunct showing repetition this tense can

example, the root *kuye* ‘be.at’ can be inflected with TAM morphology to show a distinct dual category, e.g. *kuye-den*:

- (8) a. *Nie kursi uyowe kuye-den*
 1NSG chair on.top be.at.NPL.REAL-1DU.PRES
 ‘We (2) sat/sit on the chair.’

There are three empirical points about constructive number in Marori. Firstly, only the analytic constructive dual pattern shown in (9)a is attested, not the pattern in (9)b. This is because, as discussed in 3.2, pronominal/demonstrative arguments in Marori only show a SG vs. NSG distinction, never a PL vs. NPL distinction.

- (9) Constructive dual in Marori:
 a. Attested ARG VERB (NSG) (NPL)
 b. Not attested ARG VERB (NPL) (NSG)

Secondly, pattern (9)a applies to subject, not object. This is because there is no morphological contrast showing NPL object on the verb in Marori. The number morpheme associated with object (AFF2 in (4)) is either underspecified NSG, or specified singular, dual or plural, depending on the tense (cf. (5)).

Finally, word-internal constructive number is also observed. This is particularly clear in relation to the second person. Examples:

- | | | |
|--------|---------------------------|----------------------------|
| (10)a. | <i>kesweme b.</i> | <i>kesneme</i> |
| | ksw=∅-∅-me-∅ | ksw=∅-n-me-∅ |
| | hit=3-2SG-AUX.3M-2NPL.IRR | hit=3-2NSG-AUX.3M-2NPL.IRR |
| | ‘You (SG) will hit him.’ | ‘You (2) will hit him.’ |
| |
 | |
| | c. <i>kesnemem</i> | |
| | ksw=∅-n-me-m | |
| | hit=3-2NSG-AUX.3M-2PL.IRR | |
| | ‘You (>2) will hit him.’ | |

The paradigm in (10) involves the lexical predicate *ksw* ‘hit’ in future/irrealis with the auxiliary *me* showing inflection for second person subject and third person male object. The second person subject is expressed by discontinuous morphemes, one exponent is before the AUX stem *me*, and the other is the (regular) final suffix morpheme:

also be used to signify habitual events. The translation, depending on the context, is therefore given in either the past or the present tense in English.

(11) The second person subject exponents in Marori as exemplified in (10):

	exponent1-AuxRoot-exponent2	
singular :	∅-	-∅
dual :	<i>n</i> -	-∅
plural :	<i>n</i> -	- <i>m</i>

Given the formal opposition shown in (11), the second person singular, dual and plural numbers are in fact all morphologically constructive.

3.3.2 Constructive paucal (limited plural)

Marori also has ‘limited plural’, similar to ‘paucal’ in Manam (Lichtenberk 1983; Turner 1986), Yimas, Fijian and other languages (see Corbett 2000: 22-26)). It is roughly translated as ‘a few’ in English. ‘Limited plural’ is contrasted with ‘large plural’, translatable as ‘a lot, in big number’, further discussed in 3.3.3 below. The limited and large plurals are also expressed constructively.

The constructive strategy to express limited plural is exemplified in (12)c. As seen from its contrast with dual and generic plural (12)a-b, limited plural is achieved by means of augmentation. In this case, the numeral *yanadu* ‘two’ is augmented by PL morphology on the verb (*-re*):

- (12)a. *ka-nam bosik yanadu te-∅-∅*
 2SG-POSS pig two BE.3-NonPL.PRES
 ‘Your pigs are two/you have two pigs.’
- b. *ka-nam bosik usin te-re-∅*
 2SG-POSS pig many BE.3-PL-PRES
 ‘Your pigs are many/you have many pigs.’
- c. *ka-nam bosik yanadu te-re-∅*
 2SG-POSS pig two BE.3-PL-PRES
 ‘Your pigs are few/you have few pigs.’

Augmentation can also be achieved by means of the augments *ndu* (roughly meaning ‘very’ or ‘only’), in addition to plural agreement morphology on the verb. The reference of the subject *yanadupurfam* in (13), for instance, is augmented by the presence of both *ndu* within the NP and the plural suffix *-re* (realised as *-fre* for phonological reasons):

- (13) *Yanadu purfam (ndu) awo=i ife-fre-f paya ke*
 Two person AUG kangaroo=U 3SG.see-2/3PL-NrPST forest Loc
 ‘(Very) few people saw a kangaroo (at a glance) in the forest.’

3.3.3 Large plural

Large plurals are also encoded by an augmenting strategy. The same augmenter *ndu* is used, or else, *famndu*. For example, *usin* ‘many’ is augmented to become *usinfamndu* or *usindu* ‘in a very large number’, as in (14)a-b. Neither large plural or limited plural use dedicated morphology, but rather make use of the available resources (e.g. plural morphemes) in a constructive way.

- (14)a. *Usin famndu turis kurfenj-re-n-Ø* *Bali mbe*
 many AUG tourist return-PL-HITHER-2/3NPST Bali to
 ‘A lot of tourists will come back to Bali.’
- b. *Na fis bosik=i yefya-mon usin-ndu paya ke*
 1SG yest pig=U 3nsU.see-3nsU.1sA.NrPST many-AUG forest Loc
 ‘I watched many pigs in the forest yesterday.’

There remains a question whether a large plural does indeed form a legitimate number category along with limited plural, on a par with singular and dual in Marori. While debatable, given the constructional opposition in the whole system (morphological as well as analytical), large and limited plurals are arguably number categories of their own right in Marori.

3.4 Constructive number in other languages

Other languages that have been reported to have complex three-way or multi-way number systems involving constructive strategies include Hopi (Hale 1997; Corbett 2000:169), Nen (Evans 2009), Murrinth-Patha (Nordlinger 2011; Seiss 2011), Manam (Lichtenberk 1983; Turner 1986). For reason of space, not all of these languages are discussed in this paper, but I believe the proposed analysis outlined in this paper can also be extended to these languages.⁵

Nen (Evans 2009) shows plural without dedicated plural morphology. Constructive plural in Nen makes use of non-singular and non-dual morphemes as seen in (15)c. In fact, all number categories are constructively encoded in Nen. Singular in (15)a and dual in (15)b are constructively determined by the combination of two number morphemes (prefixes and suffixes) on the verb.

- (15) Nen (Evans 2009)
- | | |
|---|--|
| a. <i>Mngwy-trom-ngr</i>
house 3sgU-be.erected-STAT:ND
‘A house is standing.’ | b. <i>mngw yä-trom-aran</i>
house 3nsgU-be.erected-STAT:D
‘Two houses are standing.’ |
|---|--|

⁵Hopi’s constructive number has been widely analysed in the literature (Harbour 2007; Sadler 2010, among others). My analysis of constructive number in this paper is in line with Sadler’s on Hopi. Hopi will not be further discussed in this paper.

number of the classifier stem one level up. Thus, *ngitha* will be glossed as AUG.F, an augments for female referents. Showing this explicitly, (16)b can be re-glossed as follows:

- b'. *bam-ngintha-ngkardu*
 3sS.SEE(13).nFut-AUG.F-see
 'They (2 female non-siblings) saw him/her.'

Other number formatives can therefore be re-analysed and re-glossed accordingly, e.g. *nitha* 'AUG.M', *ngime* 'AUG.F' and *neme* 'AUG.M'. The examples in (17) illustrate the contrast between dual and constructive paucal with *ngime* as the augments. As noted, the paucal makes use of the dual classifier stem *pubamka*.

- | | |
|---|--|
| (17)a. <i>pubamka-ngkardu</i>
3dS.SEE(13).nFut-see
'They (2 siblings) saw him/her.' | b. <i>pubamka-ngkardu-ngime</i>
3dS.SEE(13).nFut-see-AUG.F
'They (paucal, female non-siblings) saw him/her.' |
|---|--|

Furthermore, the number augments must carry with them constructional constraints. For instance, *ngitha* 'AUG.F' can only be used to augment the singular classifier stem (to construct dual) whereas *ngime* 'AUG.F' is only used to augment a dual classifier stem (to construct paucal).⁶

Another important point to note is about the absence of the augments. It is functional. That is, a structure with a singular classifier stem without an augments constructs a singular category whereas a singular stem with an augments constructs a dual category. For this reason, its absence is represented as \emptyset in Figure 2. It will be shown later in 4.3 that the absence of an augments means that the feature structure contains [-AUG], in contrast to the one with an augments where [+AUG] is present.

Further evidence that the absence of an augments is functional comes from the fact that the construction with a plural classifier stem without an augments is ambiguous, as seen in (18). This is expected, because the zero augments is taken to form a contrast in the paradigmatic system with other 'marked' types of number, namely with paucal non-sibling.⁷

- (18) *pubamkardu*
pubam-ngkardu
 3pS.SEE(13).nFut-see
 'They (paucal siblings/plural) saw him/her.'

⁶ This kind of constraint is easily imposed in LFG by means of a constraint on the functional equation.

⁷ It remains to be checked whether there is a category of large plural in Murrinth-Patha and how such a category is expressed in this language.

4 Analysis

Any analysis of the constructive number systems should address the following two related issues. The first one is the descriptive-typological issue of the overall system, in particular the nature of the (sub)category of plural. The second issue is the formal-theoretical challenge in capturing the complexities of the overall system. Of particular interest in LFG in relation to the formal-theoretical challenge is the precise explication of the structural layers involved, particularly the nature of NUM feature in the f-structure and its associated meaning.

In this section, I address these issues. The key points of the proposed analysis with respect to number features are as follows. Firstly, drawing insights from earlier work on number systems, cross-linguistic findings (Corbett 2000) and feature space analyses and underspecification (Dalrymple, King, and Sadler 2009; Sadler 2010; Dalrymple and Kaplan 2000), I treat the category of number as a system consisting of composite binary primitive features.⁸ Secondly, I provide an interpretation of these number features in terms of a semantic conceptual space, extending Croft's (2003) idea of semantic map.

I now turn to the discussion of each number system in the following order: Marori, Nen, and Murrinh-Patha.

4.1 Marori

Given the facts in Marori, as discussed earlier in this paper, I argue that there are three primitive number features in Marori, [+/-SG], [+/-PL] and [+/-AUG].⁹ The feature space is shown in Figure 3. The three binary features are established based on the language-specific coding evidence, e.g. the existence of morphological contrast of singular vs. non-singular.

Figure 3: Primitive number features in Marori

CATEGORY	FEATURES		
	[+/- SG]	[+/-PL]	[+/-AUG]
SINGULAR	+	-	-
DUAL	-	-	-
LIMITED PLURAL	-	-	+
GENERIC PLURAL	-	+	-
LARGE PLURAL	-	+	+

⁸ However, it is open to further empirical research whether number categories across languages can be treated this way.

⁹ This is not to claim that they are universal, especially the [+/-AUG] feature. Evidence that they are not universal features can be seen in languages that have no number system.

The configuration of the three number features accounts for the five-way number system in Marori. The language-specific coding evidence (morphological and constructional) for the configuration includes, for example, the fact that the singular number category is expressed by combining a singular morpheme ([+SG]) on the argument and a non-plural morpheme ([-PL]) on the verb (e.g. as seen in example (6)). No augmentation is present for the singular category; hence [-AUG]. Likewise, as discussed in section 3.3.1, dual is expressed by composing non-singular (-SG) and non-plural (-PL) morphemes without augmentation (-AUG).

The binary number features have a solid conceptual basis. This can be explained by using Croft’s semantic map. The key point is that the number system has a semantic cardinal basis, e.g. singular conceptually refers to ‘one’ (i.e. a single individual entity).¹⁰ Croft’s semantic map (Croft 2003:141), shown in Figure 4 originally designed to account for English, needs to be revised to account for complex number systems like Marori. The semantic map proposed for Marori is shown in Figure 5.

Figure 4: The semantic space of number in English

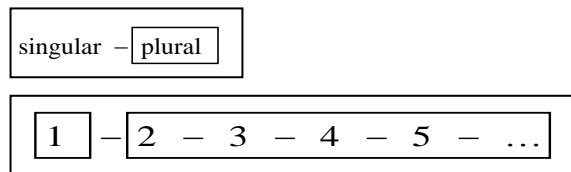
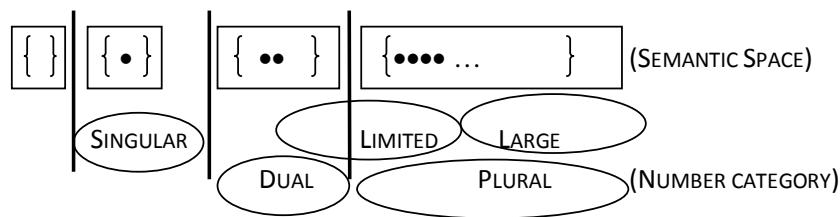


Figure 5: The semantic space of Number in Marori



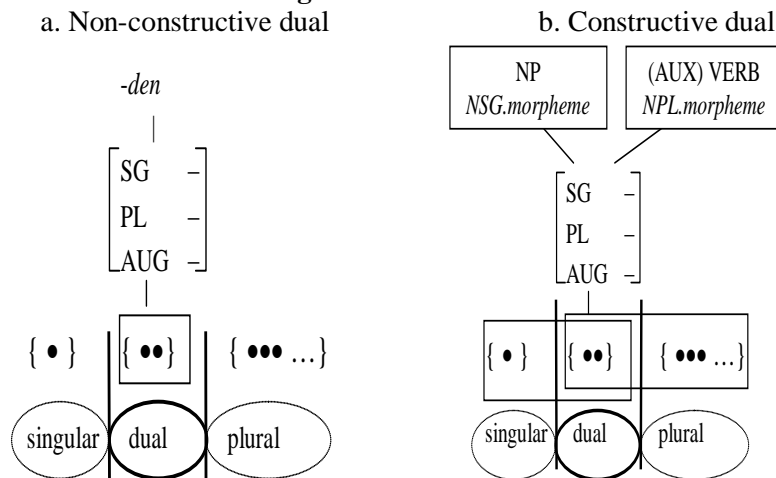
In the proposed semantic map for Marori (Figure 5), the cardinality of number is represented by individual dots within curly brackets (to represent memberships of individuals within the relevant number group). Importantly, I include the left-most group with curly brackets containing no dot (i.e. the empty set). This is, for example, to capture the concept in negation. Marori, like English, can have either singular/non-plural or

¹⁰Of course there is complication with reference to mass where individuality is not identifiable or not an issue.

plural/non-singular predicate-argument agreement for the case of no referents, e.g. as in English *there was no stone vs. there were no stones*.

The concept of dual with its related features is represented in Figure 6. As noted, dual refers to exactly two individuals, with the same feature structures (-SG, -PL, -AUG) irrespective of whether the expression involves a dual morpheme as in Figure 6a or without the dual morpheme (i.e. constructively) as in Figure 6b.

Figure 6: Dual in Marori



It should be noted that the negative value associated with an underspecified morpheme e.g. [SG -] of the NSG form (in the NP box in (7)b) means that the feature is present and the value is negative. It does not mean that the feature has no value. The negative value must be understood in the context of the semantic space shown in Figure 5. Thus, the combination of the agreement between the NSG ([SG -]) NP subject and the NPL [PL -] verb in (7)b means that the number of the subject is not singular and not plural (i.e. dual).

The proposed analysis can capture the constructive limited plural in terms of LFG's unification operation. Recall that the limited plural in Marori as described in 3.3.2 is achieved via the augmentation strategy. The augmentation involves the unification of the relevant features as seen in (19).

$$\begin{array}{rcccl}
(19) & yanadu & & ndu & yanadu=ndu \\
& \left[\begin{array}{cc} \text{PL} & - \\ \text{SG} & - \end{array} \right] & \text{U} & [\text{AUG} \quad +] & = & \left[\begin{array}{cc} \text{PL} & - \\ \text{SG} & - \\ \text{AUG} & + \end{array} \right] \\
& \text{'two'} & & \text{augmenter} & & \text{'few/several'} \\
& & & & & \text{(limited plural)}
\end{array}$$

The numeral *yanadu* ‘two’ is specified in its entry with the relevant number features, [-PL, -SG]. When it combines with the augmenter *ndu*, which carries [+AUG], the outcome is the limited plural number category as shown in (19).

Likewise, the augmentation to construct a large plural can be captured in terms of feature unification as shown in (20).

$$\begin{array}{rcccl}
(20) & usin & & ndu & usin=ndu \\
& \left[\begin{array}{cc} \text{PL} & + \\ \text{SG} & - \end{array} \right] & \text{U} & [\text{AUG} \quad +] & = & \left[\begin{array}{cc} \text{PL} & + \\ \text{SG} & - \\ \text{AUG} & + \end{array} \right] \\
& \text{'many'} & & \text{augmenter} & & \text{'very.many'}
\end{array}$$

4.2 Nen

Recall that Nen (Evans 2009) also has a multi-way constructive number system. It has no dedicated plural morphology, even though it has a plural category in its overall number system; see sub-section 3.4. In this section, extending Marori’s analysis to Nen, I demonstrate that the complex number system in Nen can also be straightforwardly captured in the proposed analysis with a slight difference in the composition of the feature space.

I propose that composite number features be adopted in Nen too, as shown in Figure 7. However, on the basis of language specific evidence of formal coding in this language (shown in the last column), only two features [+/-SG] and [+/-DU] are included in the system. In this proposed analysis, Nen has a neat, simple constructive system with two composite binary features [+/-SG] and [+/-DU] to produce a four-way system: singular-dual-limited plural-large plural.

Figure 7: The number system in Nen

CATEGORY	FEATURES		FORM
	[+/- SG]	[+/-DU]	
<i>Singular</i>	+	-	SG-NDU
<i>Dual</i>	-	+	NSG-DU
<i>Limited Plural</i>	+	+	SG-DU
<i>Large Plural</i>	-	-	NSG-NDU

The two plural constructions deserve some comments. The large plural is conceptually motivated. This language has NSG and NDU morphemes. Plurals are negatively defined. That is, plurals are groups of individuals, which are neither one nor two.

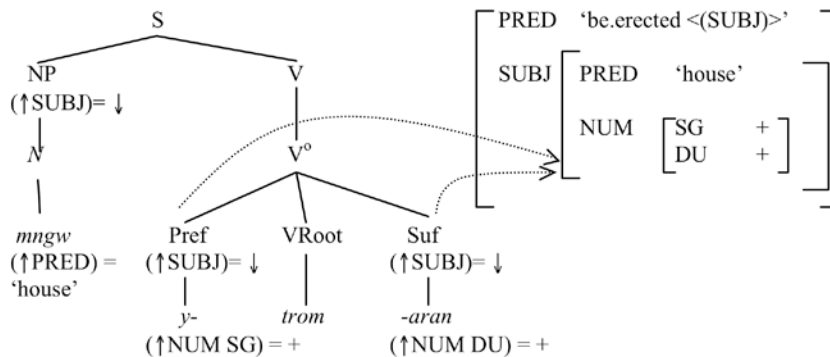
However, the coding of limited plural with the combination of SG-DU morphemes should be understood holistically in the context of the contrast in the paradigmatic feature space of Nen. That is, with two features and with binary values, there are eight slots forming four categories with [+SG, +DU] left, and this is used for the limited plural. It appears highly unpredictable at first thought, but it makes perfect sense in the constructive system, given the available morphological resources for the paradigm.

Given the feature space in Figure 7, the formation of number categories and number agreement in Nen can be accounted for in a surprisingly simple way in LFG. As an illustration, let us consider the earlier limited plural example in (15)d, repeated as (21)a. The entries for the relevant morphemes, *y-* and *-aran* are shown in (21)b-c.

- (21) a. *mngw* *y-trom-aran*
 ‘house 3sgU-be.erected-STAT:D
 ‘All the houses (limited in number) are standing.’
- b. *y-* b. *-aran*
 Pref Suf
 (↑NUM SG) = + (↑NUM DU) = +

Then, given the whole grammar imposing the features as shown in Figure 7, when *y-* and *-aran* enter into the verb formation, they construct a limited plural category. That is, each number exponent contributes a distinct feature, which then unifies with the other. The unified features ([+SG, +DU] in the f-structure) are interpreted as ‘few’. The c-structure and f-structure of sentence (21) are shown in Figure 8.

Figure8: c- and f-structures of sentence (21)a



4.3 Murrinh-Patha

The number system in Murrinh-Patha, as described in 3.4, is a five-way constructive system. A specific number category is encoded by a configuration of a classifier stem morpheme (showing singular, dual or plural morphological contrast) and an extra augments morpheme, which also carries kin-term sibling information.

Extending the Marori analysis to Murrinh-Patha, I propose an analysis of Murrinh-Patha where the notion of constructive number is made explicit, especially in relation to the augmenting strategy captured by the [+/-AUG] feature. To show the relevant features in the analysis explicitly, the number system in Murrinh-Patha given earlier as Figure 2 can be represented as Figure 9.

Figure 8: the number system in Murrinh-Patha

	CONSTRUCTED NUMBER CATEGORIES	NUMBER EXPONENTS	
		CLASSIFIER STEMS	EXTRA NUMBER FORMATIVES
(i)	<i>singular</i>	<i>singular</i> [+SG]	∅ [-AUG]
(ii)	<i>augmented dual non-sibling</i>	<i>singular</i> [+SG]	<i>ngitha</i> (F)/ <i>nitha</i> (M) [+AUG]
(iii)	<i>dual sibling</i>	<i>dual</i> [+DU]	∅ [-AUG]
(iv)	<i>augmentedpaucal non-sibling</i>	<i>dual</i> [+DU]	<i>ngime</i> (F)/ <i>neme</i> (M) [+AUG]
(v)	<i>pluralorpaucal sibling</i>	<i>plural</i> [+PL]	∅ [-AUG]

The composite number analysis is also adopted for Murrinh-Patha. The classifier stems carry positive values of SG, DU, and PL. The augments, as in Marori, carries the [+AUG] feature. The absence of an augments in the paradigm is associated with [-AUG]. Thus, a singular category in this language (line (i) in Figure 9) is a constructive number formation with [+SG, -AUG] specification. This contrasts, for example, with an augmented dual non-sibling which carries [+SG, +AUG] specification (line (ii) in Figure 9).

To illustrate the point of the analysis, consider the following sentence with the augmented paucal non-sibling number:

- (22) *pubamka-ngkardu-ngime*
3dS.SEE(13).nFut-see-AUG.F
'They (paucal female non-siblings) saw him/her.'

The entries for the two relevant number morphemes (the classifier stem *pubamka* and the augments *ngime*) are shown in (23).

analyzable as involving composite binary features: [+/-SG], [+/-PL], [+/-DU] and [+/-AUG]. The features are interpreted in terms of a conceptual semantic map and must be established on a language specific basis.

It has been demonstrated that there isn't a direct correlation between number categories, number coding and number features and that languages vary with respect to what features are 'activated' to encode particular categories.

It has also been demonstrated that complex number systems including constructive dual and limited plural can be accounted for in a surprisingly straightforward way in LFG.

This paper has highlighted an area of typological and theoretical research not yet well explored: the syntactic and semantic variation of number across languages, in particular a precise analysis of constructive strategies.

One theoretical point is the issue in relation to constructive number within the broader context of the theory of agreement. It is clear that agreement morphology is functionally more than simply ensuring compatibility of feature values. Rather, an agreement morpheme can introduce its own number features in order to construct a specific number category that is distinct from the number category of either of the contributory morphemes. This is exemplified by Murrinh-Patha where singular number feature appears as part of a constructive dual. In a unification-based grammar, the constructive strategy is a challenge to account for, given the mismatch between the morphological number and the constructive number. A proposal to deal with this has been outlined in 4.3.

Typologically, there is an issue of how to conceive the overall number system a language has. One of the questions is whether limited or large plural are legitimate number categories in a particular language. If yes, should they be treated on par with, or as a sub-type of, the existing number categories in the system? The answers to these questions are important for claiming whether a language has a three-, four- or five-way system. In this paper, I have treated different kinds of plurals as categories of equal status, at least in the languages discussed here. This is debatable and is open to further investigation and re-analysis. Whether other languages with similar multi-way number systems can be treated in the same way is a matter of future research.

6 References

- Arka, I Wayan. 2003. *Balinese morphosyntax: a lexical-functional approach*. Canberra: Pacific Linguistics.
- . 2006. Balinese. In *Encyclopedia of Language and Linguistics*, edited by K. Brown, 654-657. Oxford: Elsevier.

- Corbett, Greville G. 2000. *Number*. Cambridge: Cambridge University Press.
- Croft, William. 2003. *Typology and universals (second edition)*. Cambridge: Cambridge University Press.
- Dalrymple, Mary, and Kaplan, Ronald M. 2000. Feature indeterminacy and feature resolution. *Language* 76 (4):759-798.
- Dalrymple, Mary, King, Tracy Holloway and Louisa Sadler. 2009. Indeterminacy by underspecification. *Journal of Linguistics* 45:31-68.
- Dalrymple, Mary, and Mofu, Suriel. 2009. Plural semantics, reduplication, and numeral modification in Indonesian. Paper presented at AFLAXV. Sydney: <http://users.ox.ac.uk/~cpgl0015/indonesian.pdf>.
- Durie, Mark. 1986 The grammaticization of number as a verbal category. In *Proceedings of the 12th annual meeting of the Berkeley Linguistics Society*, edited by V. Nikiforidou, M. VanClay, M. Niepokuj and D. Feder.
- Evans, Nicholas. 2009. Complementarity, unification, and non-monotonicity: bound pronominals, free NPs and argument status in a double-marking language (Nen). Canberra, a handout at the workshop on Complexities in Grammar, ANU 18 December 2009.
- Foley, William A. 1991. *The Yimas language of New Guinea*. Stanford: Stanford University Press.
- Foley, William A. 1986. *Papuan Languages of New Guinea*. London: Cambridge University Press.
- Hale, Ken. 1997. Some observations on the contributions of local languages to linguistic Science. *Lingua* 100:71-89.
- Harbour, Daniel. 2007. *Morphosemantic number: from Kiowa noun classes to UG number features*. Dordrecht, the Netherlands: Springer.
- Lichtenberk, Frantisek. 1983. *A grammar of Manam, Oceanic Linguistics Special Publication No. 18*. Honolulu: University of Hawaii Press.
- Nordlinger, Rachel. 1998. *Constructive case: Evidence from Australian languages*. Stanford: CSLI Publications.
- . 2011. LFG and language documentation. Paper presented at LFG2011, at the University of Hong Kong.
- Nordlinger, Rachel, and Bresnan, Joan. 1996. Nonconfigurational tense in Wambaya. In *Proceedings of the first LFG conference*, edited by M. Butt and T. H. King. <http://csli-publications.stanford.edu/LFG/1/toc-lfg1.html>.
- Sadler, Louisa. 2010. Indeterminacy, complex features and underspecification. *Morphology* 21 (2):379-417.