# Case Stacking in Realizational Morphology

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**Abstract**

Case stacking, the phenomenon whereby a single word may bear multiple cases reflecting its relation to a number of different syntactic elements, is an important phenomenon both for the development of theories of inflectional morphology and for our understanding of the relation between morphology and syntax. However, to date it has received virtually no attention from theoretical morphology. Working within the inferential-realizational framework of paradigm function morphology (PFM), we provide a morphological analysis of the phenomenon of case stacking as found in the Australian Aboriginal languages Kayardild (Tangkic) and Martuthunira (Pama-Nyungan). We argue that the standard assumptions concerning morphological property sets in PFM are too weak to satisfactorily accommodate case stacking morphology, and we propose that (in some languages) the morphological property sets which define paradigm cells are structured rather than the simple objects of the standard view. We show how this provides a comprehensive analysis of the complex case and number stacking facts and further, allows for a straightforward (although non-trivial) mapping between the morphology and the syntax as outlined in Sadler and Nordlinger (2004).

## 1 Introduction

Although well-established in the typological and descriptive literature (e.g. Dench and Evans 1988, Evans 1995a,b, Dench 1995a,b, Plank (ed) 1995, Evans 2003, inter alia), and more recently in theoretical work on the morphology-syntax interface (Andrews 1996, Nordlinger 1998, Malouf 2001), the phenomenon of case stacking, dramatically illustrated in (1), has received little attention from theoretical morphology (a brief discussion in Anderson (1982:599) being a notable exception).[1] This phenomenon, whereby a single word is inflected for more than one case feature reflecting its relations to successively higher syntactic constituents, is of singular significance to our understanding of the domain of inflectional morphology, illuminating both the nature of the morphosyntactic property set and the nature of the interface between syntax and morphology. In (1) the most deeply embedded nominal 'pouch' carries

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three case markers, each one reflecting a successively higher syntactic relationship. First 'pouch' is inflected with its relational locative case, then with the proprietive case indicating that the locative nominal is embedded with the proprietive NP 'joey in (its) pouch', and finally with the accusative case, marking the whole proprietive NP as being contained within the object NP 'the euro with a joey in its pouch'.[2]

(1) *Ngayu nhawu-lha ngurnu tharnta-a mirtily-marta-a*
I saw-PST that(ACC) euro-ACC joey-PROP-ACC
*thara-ngka-marta-a.*
pouch-LOC-PROP-ACC
'I saw the euro with a joey in (its) pouch.' (Martuthunira, Dench 1995a:60 (3.15))

Case stacking highlights the ability for morphology to encode complex syntactic structures. For example, the sequence of case markers on the final word *thara-ngka-marta-a* 'pouch-LOC-PROP-ACC' in (1) specifies three levels of embedding in the syntax: a locative NP embedded within a proprietive NP embedded within an accusative NP. This shows that the role of inflectional morphology, and its interaction with the syntax, is more complicated than that which follows from the simple and common assumption that (a subset of) inflectional features are just transparently available in the syntactic structure. It requires theoreticians to develop a more articulated view of the mapping from morphology to syntax to take account of morphologically-expressed syntactic structural constraints, as for example in Nordlinger (1998).

Furthermore, the phenomenon of case stacking also poses a number of challenges for paradigmatic, inferential-realizational approaches to inflectional morphology (e.g. Anderson 1992, Stump 2001). While careful descriptive studies have clearly established that case stacking morphology really *is* part of the inflectional morphology of these languages (rather than belonging to the derivational morphology or to the syntax), nonetheless the stacking behaviour seems prototypically incremental and the fact that each affix appears to make an independent and discrete contribution to the hierarchical syntactic structure appears to lend itself most naturally to an incremental, morphemic (word-syntactic) view of word structure. Moreover the fact that a word can bear multiple values for a case feature is apparently at variance with the notion of feature values standing in paradigmatic opposition; and the fact that a nominal can bear variously one, two, three or more case values contradicts the assumption in these approaches that there exists a (single) complete well-formed feature bundle for each wordform of a particular category or subcategory. Given the advantages of these paradigmatic, inferential-realizational

[2] A 'euro' in this context is a native Australian animal, a type of small kangaroo, and not an item of European currency!

approaches in other respects (see, for example, Spencer 2004 for detailed discussion), it is crucial that they are able to provide appropriate analyses of stacking morphologies, which appear at first sight quite challenging for such otherwise attractive theories.

In this paper we show how a fully explicit account of case stacking morphology can be given in the inferential-realizational framework of Paradigm Function Morphology (Stump 2001). In doing so, we not only show how this theory can be extended to account for the phenomenon of case stacking, but also provide the first explicit account of case stacking data within a contemporary framework for inflectional morphology (a brief discussion in Anderson 1982 being a notable exception).

An advantage of the inferential-realizational approach to the stacking data adopted here is that the separation between morphological features and morphological exponents permits us to give a simple account of several aspects of the data which are problematic for alternative views of inflectional morphology. These include approaches which associate form and function in lexical entries for affixes (the morphemic view (e.g. Selkirk 1982, Lieber 1992)) or in vocabulary item listing (the Distributed Morphology view (Halle and Marantz 1993)), and also purely syntactic approaches to inflectional morphology in which the order of (inflectional) elements follows from relations in the syntactic tree (Baker 1985).

While we do not discuss the nature of the mapping from morphology to syntax here, the morphological analysis which we develop in this paper complements and is fully compatible with the approach to the morphology-syntax interface sketched out in the analysis of case stacking in Lexical-Functional Grammar (LFG) in Nordlinger (1998) and Sadler and Nordlinger (2004). The morphological feature bundles associated with fully inflected wordforms may simply be mapped to sets of syntactic constraints describing LFG f-structures in order to provide a modular, natural and explanatory account of the morphosyntax of case stacking. For this aspect of the analysis, the reader is referred to Sadler and Nordlinger (2004) for detailed discussion.

The rest of this paper is structured as follows. For readers unfamiliar with the empirical domain, Section 2 provides a brief introduction to the essential data from a number of Australian Aboriginal languages. No new data is introduced here (this is not the purpose of the current paper), and we draw primarily on (Dench and Evans 1988, Dench 1995a, Evans 1995a). In section 3 we develop our proposal for the analysis of stacking systems within Paradigm Function Morphology, providing an analysis of Kayardild nominal morphology, based on the description in Evans (1995a). This section introduces our main theoretical proposal concerning the structure of morphosyntactic property sets in PFM. Finally, in section 4 we show how the present account in PFM captures several aspects of the data which would be problematic on morphemic or syntactic

views of inflectional morphology.

# 2 The Data

## 2.1 Case stacking

Although relatively unusual, the phenomenon of case stacking is attested in a number of different language groups cross-linguistically (see Plank 1995 for extensive discussion).[3] The most common and straightforward examples of case stacking involve genitive-marked NPs which also carry the case marker of their heads (also known as 'Suffixaufnahme' (e.g. Plank 1995)), as in the following example from Guugu Yalanji:[4]

(2) *Dicki-ndamun-du kaya-ngka*
Dick-GEN-ERG dog-ERG
'Dick's dog'

In this example the genitive phrase *Dicki-ndamun-du* contains two case markers. The first – genitive – marks the grammatical role of the nominal itself, while the second – ergative – shows agreement with the case of the head noun which the genitive phrase modifies. Thus, this one nominal is encoding a complex syntactic relationship, namely that it is part of a genitive NP which is embedded within a higher ergative NP.

In some languages this case agreement extends to other adnominal NPs also. In the following example from Warlpiri, the modifying nominal *ngapa* 'water, waterhole' carries both the locative case marker, which indicates its semantic role, as well as the dative case marker, which marks it as modifying the dative argument *yankirri-ki* 'emu-DAT'. If it were, in fact, the ergative subject (here *ngarrka-ngku* 'man-ERG') that was located at the waterhole, the locative NP would need to be marked with the ergative case, instead of the dative.

(3) *ngarrka-ngku ka-rlajinta yankirri-ki luwa-rni*
man-ERG PRES-3SG.DAT emu-DAT shoot-NONPAST
*ngapa-ngka-ku*
water-LOC-DAT
'The man is shooting at the emu at the waterhole' (Warlpiri, Hale 1982:267, (87b))

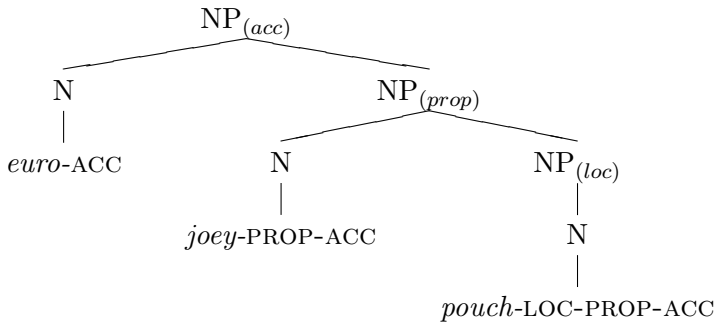
[3] A reviewer notes that case stacking is apparently limited to agglutinative morphologies. This appears true, for the most part, although Börjars and Vincent (2000) discuss possible instances of case stacking in the more fusional system of Classical Armenian, and so may not be true universally.

[4] This example is taken from Plank (1995:65), but is attributed to Hershberger (1964).

In the vast majority of examples, the order of case markers turns out to be strictly iconic – each subsequent case marker in the morphological string relates to a successively higher level of syntactic structure (see Evans (**?**) and section 4 for some discussion of the one known exception to iconic ordering). This can be illustrated by considering the syntactic structure associated with the complex object NP in the following example from Martuthunira, repeated from (1) above. The (simplified) structure of this NP can be represented as in (5). The functional information associated with this complex NP can be represented as in (6).[5]

(4) *Ngayu nhawu-lha ngurnu tharnta-a mirtily-marta-a*
I saw-PST that(ACC) euro-ACC joey-PROP-ACC
*thara-ngka-marta-a.*
pouch-LOC-PROP-ACC
'I saw the euro with a joey in (its) pouch.'

(5)




(6)
$$\begin{bmatrix} \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{ACC} & & \\ \text{ADJ}_{prop} & \begin{bmatrix} \text{CASE} & \text{PROP} & \\ \text{ADJ}_{loc} & \begin{bmatrix} \text{PRED} & \text{'POUCH'} \\ \text{CASE} & \text{LOC} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The case name subscripts associated with each NP in (5) indicate the case feature that is relevant for each layer of syntactic structure illustrated in (6).[6]

[5]We have used English glosses as the labels in this phrase structure tree to make it clearer for the reader to follow. We have also omitted the demonstrative since it has no bearing on the present issue.

[6]The label ADJ in the f-structure denotes the ADJUNCT grammatical function.

As is illustrated most clearly by the most deeply embedded nominal 'pouch-LOC-PROP-ACC', the position of a case marker in the morphological string corresponds systematically to the level of structure to which it refers. The case marker closest to the stem – here LOC – reflects the innermost level of structure (the immediate NP in (5) to which the nominal belongs, or the f-structure corresponding to the nominal itself in (6)); the next case marker (PROP) reflects the next highest level of structure, and the outermost case marker relates to the topmost level of structure (i.e. the superordinate NP).

This relationship between morphological sequence and syntactic structure is highlighted by the fact that changing the order of the case markers significantly influences the interpretation of the nominal, as demonstrated by the following two noun phrases from Martuthunira:

(7) *kapunmarni-wirriwa jirli-marta-wirriwa*
shirt-PRIV arm-PROP-PRIV
'without a shirt having sleeves'

(8) *kapunmarni-marta jirli-wirriwa-marta*
shirt-PROP arm-PRIV-PROP
'having a shirt without sleeves' (Dench and Evans 1988:7)

In these examples the opposite orderings of the case markers on the modifying nominal 'arm (sleeve)' reflect the different syntactic structures of the NP: in (7) the innermost case marker (and NP) is proprietive (meaning 'having sleeves'), and the outermost is privative ('without (something) having sleeves') (9); in (8), on the other hand, the innermost case marker (and NP) is privative ('without sleeves') and the outermost proprietive ('having (something) without sleeves') (10).

(9)
$$\begin{bmatrix} \text{CASE} & \text{PRIV} \\ \text{ADJ}_{prop} & \begin{bmatrix} \text{PRED} & \text{'ARM'} \\ \text{CASE} & \text{PROP} \end{bmatrix} \end{bmatrix}$$

(10)
$$\begin{bmatrix} \text{CASE} & \text{PROP} \\ \text{ADJ}_{priv} & \begin{bmatrix} \text{PRED} & \text{'ARM'} \\ \text{CASE} & \text{PRIV} \end{bmatrix} \end{bmatrix}$$

The most extreme examples of case stacking are found in the Tangkic language Kayardild (see Evans 1995a). In addition to permitting several case markers in core (adnominal or relational) functions, along the lines of the Martuthunira examples discussed above, Kayardild additionally has case markers in modal

function, in which case morphology partially specifies temporal and modal information at the level of the clause (see Evans 1995a for detailed discussion). Modal case markers are attached to all non-subject constituents of the clause, and (except for with direct objects to which they attach directly) follow any relational and adnominal case markers. Consider the following example.

(11) *Ngada yalawu-jarra yakuri-na thabuju-karra-nguni-na*
I catch-PST fish-M.ABL brother-GEN-INST-M.ABL
*mijil-nguni-na.*
net-INST-M.ABL
'I caught the fish with brother's net.' (Evans 1995b: 400, (10))

In this example the modal ablative case (M.ABL) marks the clause as having past tense (in conjunction with the tense marking on the verb), and is attached to all non-subject constituents of the clause. It attaches directly to the direct object nominal 'fish', and follows the regular case marking for the constituents of the instrumental NP 'with brother's net'. The word *thabuju-karra-nguni-na* illustrates the combination of two case markers in core function with a case marker in modal function. The genitive case marks 'brother' as the (adnominal) possessor argument of 'net'. The instrumental case marks 'brother-GEN' as belonging to the instrumental NP 'with brother's net', and the modal ablative case (M.ABL) marks the nominal 'brother-GEN-INST' as belonging to a clause with past tense.

Kayardild also has complementizing case, by which case markers are used to mark interclausal relations on complementized clauses. Example (12) illustrates the addition of a complementizing case to the example in (11). Here the oblique case (C.OBL) appears on every element in the subordinate clause because that clause is an object argument of the matrix verb *mungurru*.

(12) *Ngada mungurru, maku-ntha yalawu-jarra-ntha yakuri-naa-ntha*
I know, woman-C.OBL catch-PST-C.OBL fish-M.ABL-C.OBL
*thabuju-karra-nguni-naa-ntha mijil-nguni-naa-nth.*
brother-GEN-INST-M.ABL-C.OBL net-INST-M.ABL-C.OBL
'I know that the woman caught the fish with brother's net.' (Evans 1995b:406,(35a))

Here we see an example of a single nominal inflected with four case markers: *thabuju-karra-nguni-naa-ntha* 'brother-GEN-INST-M.ABL-C.OBL' has the same three case markers that it did in (11), but in addition is marked with the oblique case indicating that it belongs to a subordinate clause which functions as a clausal complement of the matrix verb.[7]

[7]The fact that the case stacking data we have presented in this section is syntactically iconic in interpretation might suggest to the reader the plausibility of an analysis along syn-

Finally, Kayardild has 'associating (oblique) case' (Dench and Evans 1988, Evans 1995a), which marks all non-subject constituents belonging to a nominalised clause (a clause headed by a nominalised verb).

(13) *Bil-da jani-n-da bartha-wuru-ntha kunawuna-wuru-nth.*
they-NOM search-NMZ-NOM track-PROP-A.OBL child-PROP-A.OBL
'They are looking for the child's footprints.' (Evans 1995a:112 (3-41)).

We return to a discussion of associating case in section 4.

## 2.2 Interaction of Case and Number

To make matters still more complicated, in some Australian languages number marking interacts with multiple case marking in an interesting manner (Dench and Evans 1988). Following the general pattern of iconicity, by which the order of case markers reflects the syntactic structure, the interpretive scope of the number marking depends on where it occurs in the morphological structure. Consider the following examples from Martuthunira:

(14) *thanuwa-ngara-marta*
food-PL-PROP
'having all the food.' (Dench 1995b:393, (28))

(15) *thanuwa-marta-ngara*
food-PROP-PL(NOM)
'many having the food.' (Dench 1995b:393, (27c))

In (14) the plural marker follows the nominal stem, modifying the nominal itself ('all the food'), this is then marked with the proprietive case ('(someone/something) having all the food'). In (15), on the other hand, the proprietive case marker is closest to the stem ('having the food') and is followed by the plural marker. In this case the plural marker has scope over the whole proprietive marked NP, not just the nominal itself ('the many (someones/somethings) having the food'). The different syntactic structures associated with these two nominals are as shown in (16) and (17) respectively.

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tactic lines, especially given that the inflectional morphology of these languages is in general regular and agglutinative. It would take us too far afield from our concerns in this paper to give here detailed arguments why this is not a good approach (but see Nordlinger 1998 for some further discussion). We draw the reader's attention, however, to the difficulty of motivating layers of functional projections and hierarchical structure in radically non-configurational languages with free word order, and to the cases of anti-iconic ordering discussed in section 4.

(16)
$$\begin{bmatrix} \text{ADJ}_{prop} & \begin{bmatrix} \text{PRED} & \text{`FOOD'} \\ \text{CASE} & \text{PROP} \\ \text{NUM} & \text{PL} \end{bmatrix} \end{bmatrix}$$

(17)
$$\begin{bmatrix} \text{NUM} & \text{PL} \\ \text{ADJ}_{prop} & \begin{bmatrix} \text{PRED} & \text{`FOOD'} \\ \text{CASE} & \text{PROP} \end{bmatrix} \end{bmatrix}$$

As the Kayardild example below shows it is possible to get multiple number marking, with each modifying a different referent according to its position in the morphological string.

(18) *maku-yarr-nurru-naba-walad-a*
woman-DU-ASSOC-ABL-MANY-NOM
'the many belonging to (those) having two wives' (Evans 1995a:123)[8]

(19)
$$\begin{bmatrix} \text{CASE} & \text{NOM} \\ \text{POSS} & \begin{bmatrix} \text{NUM} & \text{PL} \\ \text{CASE} & \text{ABL} \\ \text{ADJ}_{assoc} & \begin{bmatrix} \text{PRED} & \text{`WIFE'} \\ \text{NUM} & \text{DU} \\ \text{CASE} & \text{PROP} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In this example we have both multiple number marking and multiple case. The dual marker modifies the stem ('two wives'); the associative marker then follows ('(someone/those) having two wives'). The ablative marker following the associative here indicates possession ('(things) belonging to (someone/those) having two wives'), and is followed by the number marker *walad* 'many' which modifies the highest level of structure ('the many (things) belonging to (someone/those) having two wives'). This is then followed by the relational case marker, which in this case is the nominative. Similarly, double number marking is found on Martuthunira nominals, though naturally, examples in the materials available are rare.

[8]This form is provided in Evans (1995a) without the final nominative case marker. However, Nick Evans (pc) confirms that when used in context, the nominative (or another) relational case marker would need to be present, as in the example here.

(20) *Ngunhu-tharra kanyara-tharra warrirti-ngara-marta-tharra yirna*
that-DU(NOM) man-DU(NOM) spear-PL-PROP-DU(NOM) this.ACC
*muyi-i yanga-lalha ngurra-arta-rru.*
dog-ACC chase-PAST camp-ALL-NOW
'Those two men with spears chased this dog to camp.' (Dench pc)

In this example the nominal *warrirti* 'spear', which modifies the subject NP, is inflected with two number markers and two case markers. The first two markers concern the nominal itself; they mark it as being plural and having proprietive function. The second two are in agreement with the head noun that is being modified; they show the head noun to be dual and to have nominative case.

This data illustrates clearly the need for a theory of inflectional morphology to allow a single inflected word form to have more than one instance of certain morphosyntactic features (namely, case and number). Furthermore, since the interpretation of the various case and number features is crucially dependent on their position in the morphological string, it is important to have a theory of the morphology/syntax interface sophisticated enough to accurately capture this relationship. In the following section we show how the inferential-realizational framework of paradigm function morphology (PFM) can be extended to provide a morphological analysis of case stacking.

## 3 Case Stacking in PFM

An increasing number of morphologists concerned with matters of inflectional morphology adopt some variety of realizational approach to (inflectional) morphology, based on the concepts of lexeme and paradigm, and viewing morphology as a separate and autonomous component of the grammar with its own set of principles and constraints. To date, the case stacking data has not yet been addressed in any realizational framework. Given the weight of the arguments in favour of realizational approaches to morphology (see for example, Stump (2001: Ch. 1) or Spencer (2004) for discussion), it is crucial that the paradigm-based realizational approach can account also for the properties of this type of inflectional morphology.

In this respect, two aspects of this data are of particular importance. The first is that this data shows that an inflected wordform may be multiply inflected for the same morphological property, showing that morphological features can be multiply instantiated. Note that it is important that these are *inflectional* features – that is, we are not dealing here with derivational morphology in which only one of the Case features is relevant to the derived stem. On the contrary, each Case feature is syntactically relevant (each participating in concord, for example). This is of theoretical importance (both to the framework of

Paradigm Function Morphology and to theories of word formation more generally) since it suggests that morphological feature bundles are more complex than normally assumed.

The second is that not only are all of the Case features syntactically relevant, but they interact in a particular and quite complex fashion, such that Case feature $n + 1$ is relevant to the syntactic structure described by (or associated with) Case feature $n$. In a sense, the inflectional morphology appears to 'build' syntactic structure as it goes. We have illustrated this property in the previous section, and formal accounts of the syntactic contribution of (stacked) case markers are given in Andrews (1996), Nordlinger (1998) and Sadler and Nordlinger (2004). This complex interaction between inflectional morphology and syntax shows that the general assumption of a trivial mapping between morphological features (or morphosyntactic features, as they are generally referred to in PFM) and the syntax is incorrect. While it is beyond the scope of this paper to discuss it more fully here, the morphological analysis which we present here supports a straightforward interface to an LFG syntactic component, as outlined in Sadler and Nordlinger (2004).

The characteristic property of inferential theories of inflectional morphology, such as PFM, is that the relation between the root of a lexeme and the set of fully inflected wordforms (the members of the paradigm for the lexeme) is given by rules or realizational formulae. This contrasts with decompositional approaches in which individual morphosyntactic properties (such as past tense, gender, and so on) are associated with affixal material in (sub-)lexical entries. The characteristic property of a realizational approach is that exponents are *licensed* by the association of a set of morphosyntactic properties with a root. On the opposing incremental view, words acquire morphosyntactic properties solely by virtue of the attachment of affixes. In PFM there is therefore a strict separation of form and (morphological) function.

A core component of the approach is the specification of a paradigm by declaring what all the complete well-formed feature bundles (for a given category) are. This involves the enumeration of the morphosyntactic features together with the permissible values and the specification of any applicable feature co-occurrence restrictions. The set of inflected forms of a word is the product of a Paradigm Function which maps a pair <r, $\sigma$> to a cell in the paradigm $<$ f(r), $\sigma >$, where $r$ is the root, $f(r)$ is the inflected form of the root and $\sigma$ is the set of morphosyntactic properties associated with the inflected form of the word.

Morphological operations are organised in Rule Blocks containing Realization Rules, which spell out sets of morphosyntactic properties, and Rules of Referral, which deal with syncretism by specifying that a given set of properties $\sigma$ is realized by the same function which realized a different set of properties $\sigma'$ (for example, second person singular forms might be syncretic with third per-

son singular forms in some paradigms). Within each rule block, the Identity Function Default returns the input form as output form in the absence of a more specific function, accounting for zero realizations. An important claim about the nature of inflectional systems which is at the heart of PFM is the assumption that competitor rules within a rule block are ordered by specificity (cf. Elsewhere Principle): within a rule block, the narrowest rule appropriate to a feature bundle is the one which applies.

In the following sections we build up our analysis of the case stacking data, focussing particularly on Kayardild since it exhibits the most complex system of case marking. In section 3.1 we first present the sets of case features and values for Kayardild, and formulate a preliminary version of the paradigm function for Kayardild, ignoring for the time being the issues of multiple core case marking and number marking. In section 3.2 we propose a reformulation of the feature theory of PFM to cover the full set of data including multiple core case and in 3.3 we account for the interaction with (multiple) number marking.

### 3.1 Case Functions and Values

As we have seen, in languages such as Kayardild several different functions of case markers can be distinguished, the most straightforward being the core (adnominal and relational) uses of case. Additional functions include modal case, in which the case marker defines clausal temporal properties, complementizing and associating case. Examples of Kayardild case stacking include (11) and (12) above. The example (11) illustrates a typical case of stacking: the nominal *thabuju-* 'brother' is marked with genitive case (as a possessor argument of the nominal 'net'), with instrumental case (concordial with the case of the nominal predicate it is an argument of), and the modal ablative (contributing to the temporal specification of the clause in which it occurs). For the moment we leave to one side the further complication of interleaving with Number, to which we return shortly.[9] The table in (21) lists the various case functions and the case values available in these different functions in Kayardild.

[9]It should be noted that despite the fact that the data we use exhibits only (!) stacks of up to four case markers, it cannot be concluded that there is any grammatically-determined upper bound to the stacking of core case markers. Indeed there are good reasons to assume that from the point of view of the grammar itself, the phenomenon is infinite, with the operative constraints being at the level of performance.

(21) Case Functions and Values (Kayardild)

| **Case Function:** | **Cases Available** |
|---|---|
| **Case**$_{(Core)}$**:** | Assoc, Gen, Instr, Priv, Util, Orig, Conseq, Nom, and all cases available for Case$_{(Modal)}$ |
| **Case**$_{(Modal)}$**:** | All, Abl, Prop and all cases available for Case$_{(Complementizing)}$ |
| **Case**$_{(Complementizing)}$**:** | Loc, and all cases available for Case$_{(Associating)}$ |
| **Case**$_{(Associating)}$**:** | Obl |

Turning now to matters of exponence, a crucial point is that precisely the same forms for each case are used in all functions (though of course, not all cases are available in all functions), suggesting that from a morphological point of view we would want the same morphological operation to be responsible for the introduction of each form for a particular case irrespective of its function. Firstly, then, we propose a Case Rule Block for Kayardild to provide the relevant forms, containing rules which can be given a general informal characterisation as in (22):[10]

(22) *The realization of Case:Ablative (Locative, Genitive, and so on) in the paradigm function of X, where X is of category N, is* Xnaba *(*Xya*,* Xkara*, and so on), modulo any applicable morphophonological processes.*

These realization rules "spell out" well-formed morphological feature bundles containing specific morphological case features as the appropriate form. Note however that "spelling out" does not imply that morphological features are "used up" in any sense, rather the presence of a given feature in a feature bundle sanctions the application of the rule. In the notation of Stump (2001) these informal rules are formalised as follows:

(23) **Case Rule Block**
(a) $\mathrm{RR}_{Case,\{Case:Abl\},N}$ ( < X, $\sigma$ >) $=_{def}$ < X'naba, $\sigma$ >
(b) $\mathrm{RR}_{Case,\{Case:Loc\},N}$ ( < X, $\sigma$ >) $=_{def}$ < X'ya, $\sigma$ >
(c) $\mathrm{RR}_{Case,\{Case:Gen\},N}$ ( < X, $\sigma$ >) $=_{def}$ < X'karra, $\sigma$ >
(d) $\mathrm{RR}_{Case,\{Case:Instr\},N}$ ( < X, $\sigma$ >) $=_{def}$ < X'nguni, $\sigma$ >
(e) $\mathrm{RR}_{Case,\{Case:Assoc\},N}$ ( < X, $\sigma$ >) $=_{def}$ < X'nurru, $\sigma$ >

Table (21) lists the different functions of Case in Kayardild together with the set of values permissible in that function, and is naturally viewed as specifying

[10] We use initial capitalization and lower case to indicate morphological features, reserving small capitals for functional (syntactic) features. When we are using the terms purely descriptively they occur in lower case with no initial capitalization.

the permissible values of different *case features*. That is, Kayardild distinguishes between the morphological features of $\text{Case}_{Core}$, $\text{Case}_{Ass}$ (associating case), $\text{Case}_{Mod}$ (modal case) and $\text{Case}_{Comp}$ (complementizing case). As a first approximation, then, we might propose that the paradigm function for the Kayardild nominal applies the $\text{Case}_{Ass}$ rule block to the output of the $\text{Case}_{Core}$ rule block, the $\text{Case}_{Mod}$ rule block to the output of the $\text{Case}_{Ass}$ rule block, and the $\text{Case}_{Comp}$ rule block to the output of the $\text{Case}_{Mod}$ rule block. Each of these rule blocks (the Core Case rule block, the Modal Case rule block and so on) would contain a rule of referral to the general Case Rule Block, which would capture the fact that the *form* of the Ablative case, or the Oblique case, is the same across all the different *functions* of this case.[11] For example, the Modal Case Rule Block would contain the single referral rule (in addition to the identity function default) described informally in (24) and shown in (25).

(24) *To realize any value $\alpha$ of the feature $\text{Case}_{Mod}$, apply the most specific applicable rule from the Case rule block.*

(25) $\text{RR}_{Mod,\{Case(Mod):\alpha\},N}$ $(< \text{X}, \sigma >) =_{def} <\text{Y},\sigma >$,
where $\text{Nar}_{Case,\{Case:\alpha\}}$ $(<\text{X}, \sigma >) = < \text{Y}, \sigma >$[12]

On this view, and still abstracting away from Number, which is also marked morphologically on the Noun, an initial (and not yet complete) specification of the paradigm function for the Kayardild Noun could be as follows:

(26) *The value of the Paradigm Function for the Kayardild nominal, when applied to the pairing of a lexeme of category N and a complete set of morphosyntactic properties for N ($\sigma$), is defined as the result of applying the narrowest applicable rule from the $\text{Case}_{Core}$ rule block, followed by the narrowest applicable rule from the $\text{Case}_{Ass}$ rule block, followed by the narrowest applicable rule from the $\text{Case}_{Mod}$ rule block, and finally by the narrowest applicable rule from the $\text{Case}_{Comp}$ rule block.*

(27) **Paradigm Function for the Kayardild nominal**
Where $\sigma$ is a complete set of morphosyntactic properties for lexemes of category N:
$\text{PF}(<\text{X}, \sigma >) =_{def} \text{Nar}_{Comp}$ ( $\text{Nar}_{Mod}$ ( $\text{Nar}_{Ass}$ ( $\text{Nar}_{Core}$ $(< \text{X}, \sigma>)$)))
(Preliminary Version, to be superseded)

[11] The account we propose here of the multiple functions of Kayardild case morphology is similar in spirit to the use of parallel rule blocks in Stump (2001) for the extensive overlap in forms between Lingala subject and object agreement morphology on the verb. In Stump's account of Lingala, the rule blocks for subject and object agreement markers refer (to spell out most forms) to a more general agreement block.

[12] The notation $\text{Nar}_{RuleBlock,\{Feature\}}$ captures the fact that rule application is governed by the Elsewhere Condition.

### 3.2 A More Complex Feature Theory

While the morphological analysis sketched out above accounts neatly for the different functions of case in Kayardild, and the fact that they all share the same case forms, it does not yet cover the full range of the case stacking data, for it does not permit more than one instance of any of the distinct case features ($\text{Case}_{Core}$, $\text{Case}_{Ass}$, $\text{Case}_{Mod}$, and $\text{Case}_{Comp}$) we have posited. The rules in each separate rule block compete to fill a specific slot within the inflected word, and under normal assumptions, a paradigm function (for a word of a particular type), applies a given rule block only once in the specification of a given word form.[13] The paradigm function given in (27) therefore allows only for a single instance each of $\text{Case}_{Core}$, $\text{Case}_{Ass}$, $\text{Case}_{Mod}$, and $\text{Case}_{Comp}$. Indeed, multiple values for one and the same feature are in fact ruled out by the feature theory which is crucial to determining the well-formedness of morphological feature bundles (and therefore to defining paradigm cells), which takes features to be functions from attributes to (possibly) complex values. The approach is also less than compact both in the number of rule blocks it requires and in the statement of the paradigm function itself. These considerations motivate a more radical proposal based on a more complex feature theory for languages, such as the case stacking languages, which permit multiple instances of a single attribute. Therefore, in addition to the atom-valued and set-valued features of Stump (2001), we propose that case stacking languages also allow a further more complex type of morphosyntactic property.[14] Specifically, we propose that certain features permit sets directly as members of the morphosyntactic feature set (and so on recursively). That is, while the inflectional systems of most languages involve morphological descriptions having only atom and set-valued features (as in (28a)), the inflectional systems of case stacking languages such as Kayardild and Martuthunira permit recursive morphological descriptions (as in (28b)).

[13] This should not be confused with the frequent situation in which a rule block which is *not* itself called in the paradigm function of a lexeme is nonetheless the target of several different rules of referral, situated in rule blocks which do constitute the paradigm function. Such is the case in Stump's treatment of Lingala, where the same set of forms can function as subject and object markers (see Stump (2001:144-9)), and in our rules of referral such as (25) above.

[14] We are indebted to Greg Stump for discussion of the material in this section, for feedback on a previous version of this paper, and in particular for a concrete suggestion on restructuring the morphosyntactic property set which has significantly influenced the approach we present in this section. In previous unpublished work (**?**) we explored the possibility of an alternative analysis using Rule Block iteration in case stacking languages, and making the iterated $\text{Case}_{Core}$ feature list-valued, capturing the fact that it is possible for a single nominal to contain more than one instance of core case. While such an approach can account adequately for the purely morphological facts, it does not enable the clean and modular separation of inflectional realization proper from the mapping of (complex) syntactic information which is supported on the present account.

(28) (a)
$$\begin{bmatrix} \text{NClass} & 1 \\ \text{Agr} & \begin{bmatrix} \text{Pers} & 1 \\ \text{Gen} & \text{Fem} \\ \text{Num} & \text{Sing} \end{bmatrix} \end{bmatrix}$$

(b)
$$\begin{bmatrix} \text{Case} & \text{Loc} \\ \begin{bmatrix} \text{Case} & \text{Abl} \\ \begin{bmatrix} \text{Case} & \text{Nom} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The proposal, then, is that in case stacking languages such as Kayardild the set $\sigma$ of morphosyntactic properties paired with a nominal root in a morphological paradigm is recursively structured. The set $\sigma$ of morphosyntactic properties associated with Kayardild nominal roots in morphological paradigms may contain property sets such as (but not limited to) those shown in (29a–d) and admitted by the following definition in (30):

(29) a. {Case$_{Core}$:X}
{Case$_{Ass}$:X}
{Case$_{Mod}$:X}
{Case$_{Comp}$:X}

b. {Case$_{Mod}$:Y, {Case$_{Comp}$:X }}
{Case$_{Core}$:Y, {Case$_{Mod}$:X}}
{Case$_{Core}$:Y, {Case$_{Ass}$:X}}

c. {Case$_{Core}$:W,{Case$_{Mod}$:Y, {Case$_{Comp}$:X}}}
{Case$_{Core}$:W,{Case$_{Core}$:Y, {Case$_{Mod}$:X}}}

d. {Case$_{Core}$:Z, {Case$_{Core}$:W,{Case$_{Mod}$:Y }}}
{Case$_{Comp}$:X}

(30) (i) {Case$_x$} is a well-formed property set of cardinality 1, where $x$ is Core, Ass, Mod, or Comp); (*you can have just one case*)
(ii) if $\tau$ is a well-formed property set of cardinality n then { Case$_x$:$\alpha$, $\tau$ } is a well-formed property set of cardinality n+1, provided that: (*recursive condition*)
(a) $x$ is Core, Ass or Mod; (*Comp only comes last, and there can be only one Comp*)
(b) if $x$ is Mod then there is no $\beta$ such that $\tau$= {Case$_{Mod}$:$\beta$...} or {Case$_{Ass}$:$\beta$...} or {Case$_{Core}$:$\beta$...} (*Mod cannot be followed by Mod or Ass or Core*)
(c) if $x$ is Ass then there is no $\beta$ such that $\tau$= {Case$_{Ass}$:$\beta$...} or {Case$_{Core}$:$\beta$...} (*Ass cannot be followed by either Ass or Core*)

Together, the feature:value specifications, the recursive property set definition and the feature co-occurrence restrictions define the set of well-formed feature bundles (instances of $\sigma$) for the Kayardild noun. The restriction to just one modal case is captured directly in the definition of the case property set. Again, by this definition there can be only one instance of Complementizing case, and it can only be the outermost element in a nested Case structure. The recursive definition places no upper bound on the number of instances of Core case in a wellformed inflected word. Particular systematic combinatorial gaps, which *could* correspond to well-formed syntactic structures but happen not to exist, are ruled out by feature co-occurrence restrictions stated over the feature space and in this way the paradigmatic space is defined.[15] For example, in Kayardild, associating, modal, and complementizing case never co-occur with nominative case. This is captured with feature co-occurrence restrictions prohibiting these case features from co-occuring with a nominative case feature:[16]

(31) If $\sigma$ is an extension of $\text{Case}_{Ass} = \alpha$ or $\text{Case}_{Mod} = \alpha$ or $\text{Case}_{Comp} = \alpha$ then $\sigma$ is not an extension of $\text{Case}_{Core}$=Nom.

Similarly, we can capture the fact that associating case and complementizing case are never marked on the same nominal with the feature co-occurrence restriction in (32):

(32) If $\sigma$ is an extension of $\text{Case}_{(Ass)} = \alpha$ then $\sigma$ is not an extension of $\text{Case}_{Comp}$=$\beta$.

In a paradigm-based realizational approach to inflectional morphology, we would expect the morphological component itself to be responsible for generating only well-formed sequences of affixes on nominal stems. The possibility of using the specification of the feature theory and feature co-occurrence restrictions to specify which feature-bundles are wellformed distinguishes a paradigmatic approach from the morpheme-based sketch of Kayardild case morphology provided in Nordlinger's (1998) essentially syntactic account.[17] Within the word, however, this incremental, morphemic approach overgenerates, permitting any sequencing (and interleaving) of core, modal and complementizing cases, while the syntactic component plays a filtering role: the

[15] In the absence of further feature cooccurrence restrictions, the paradigm is essentially the cartesian product of feature values for all appropriate attributes (assuming atom-valued features).

[16] Feature co-occurrence restrictions such as this must be checked on the multiset which results from flattening out the structured property set.

[17] The major insight of Nordlinger's approach to case stacking concerns the mapping to the syntax and specifically how the syntactic information associated with the case morphology combines to specify complex syntactic structures. For a treatment of the morphosyntactic interface which combines the insights of Nordlinger (1998) with the current analysis of the morphology proper, see Sadler and Nordlinger (2004) .

syntactic information associated with "incorrect" combinations of case markers must fail to define grammatical structures. Our own account specifies the allowable sequence of core, associating, modal and complementizing case in the morphology. Nonetheless, an interesting issue arises as to whether unattested sequences of core cases should ruled out morphologically, or generated morphologically but filtered out by the fact that they do not correspond to licit syntactic structures. Discussion of this issue would take us beyond the scope of this paper, but note that many illicit combinations (such as NOM-PROP) can be straightforwardly ruled out in the morphology by distinguishing two subsets of core cases, adnominal and relational.

Having introduced the feature theory and the feature co-occurrence restrictions, what remains is to specify how the structured property set for case is realized. We redefine the paradigm function in terms of a single rule block (to realize the nested feature set), which we will call for the moment StackCase:

(33) *The value of the Paradigm Function for the Kayardild nominal, when applied to the pairing of a lexeme of category N, and a complete set of morphosyntactic properties for N ($\sigma$), is defined as the result of applying the narrowest applicable rule from the $Case_{StackCase}$ rule block.*

(34) Where $\sigma$ is a complete set of morphosyntactic properties for lexemes of category N: PF(<X, $\sigma$ >) $=_{def}$ $\text{Nar}_{StackCase}$ (< X, $\sigma$> )
(Second Preliminary Version, to be superseded)

It is the rule block StackCase which is responsible for spelling out the recursive Case feature. Recall that the rules of the Case Rule block realize attribute:value pairs such as {Case:Abl} (see (23)). The key rule in the block StackCase is (36a) which refers to the appropriate rule in the Case rule block to realize the first member of the structured property list and then makes a recursive call to StackCase. (36a) can be paraphrased as in (35):

(35) *To spell out a recursive feature set whose first member is $Case_{\gamma}$:$\alpha$ and the rest of which is $\{\beta\}$, apply the most specific applicable rule from the Case rule block which realizes Case:$\alpha$ and then call StackCase on the derived stem and the remainder of the structured property set.*

That is, the "special" property of the realization rule (36a) is that it makes reference to a (recursively) structured feature ($\text{Case}_{\gamma:\alpha,\beta}$), and in particular calls StackCase on $\beta$, where "standard" rules make reference to atom-valued or simple features. Rule (36b) is the non-recursive case, and can be thought of as spelling out the most deeply embedded case feature. It simply refers to the appropriate rule in the Case rule block to spell out whatever the case value is.

(36) a. $\mathrm{RR}_{StackCase,\{Case_{\gamma}:\alpha,\beta\},N}$ (< X, $\sigma$ > ) =$_{def}$
Nar$_{StackCase}$ (< X', $\beta$ > ),
where Nar$_{Case}$ (< X, {Case: $\alpha$ } > ) = < X', {Case: $\alpha$ } > )

b. $\mathrm{RR}_{StackCase,\{Case_{\gamma}:\alpha\},N}$ (< X, $\sigma$ > ) =$_{def}$
Nar$_{Case}$ (< X, {Case: $\alpha$ } > )

Notice that rules in the case block are defined over sets containing features such as Case:Abl, but the rule block StackCase is defined over sets containing features such as Case$_{\alpha}$:Abl. This means that the rules of exponence for the different case values are independent of the case function (as Core, Associating, Modal and so on), as before.

To make this clear we work through an example, the derivation of the word *thabuju-karra-nguni-na* 'brother-GEN-INSTR-M.ABL' from example (11) above. The root-morphosyntactic property set ($\sigma$) pairing in this case is (37) and the paradigm function is defined in (34).

(37) < *thabuju*,{Case$_{Core}$:Gen,{Case$_{Core}$:Instr,{Case$_{Mod}$:Abl }}} >

The paradigm function applied to this root-property set pairing calls for the narrowest applicable rule from the StackCase rule block to be applied to the pairing. Of the rules in the StackCase rule block the narrowest applicable rule is (36a). Rule (36a) in turn calls for the application of the narrowest rule from the Case rule block to apply to the pairing < thabuju, {Case:Gen}>. This is the rule (23 c) and the stem produced by this rule application is *thabujukarra*. The first call to (36a) now requires the application of the narrowest applicable rule from the StackCase rule block to the pairing < *thabujukarra*, {Case$_{Core}$:Instr,{Case$_{Mod}$:Abl }}>. This is the first recursive call to StackCase. Of the rules in the StackCase rule block the narrowest applicable rule is (36a). (36a) in turn calls for the application of the narrowest rule from the Case rule block to apply to the pairing < *thabujukarra*, {Case:Instr}>. This is the rule (23 d) and the stem produced by this rule application is *thabujukarranguni*. The (second) call to (36a) now requires the application of the narrowest applicable rule from the StackCase rule block to the pairing < *thabujukarranguni*, {Case$_{Mod}$:Abl }>. This is the second recursive call to StackCase. At this point, the narrowest applicable rule is (36b) which calls for the application of the narrowest applicable rule from the Case rule block to the pairing <*thabujukarranguni*, {Case:Abl}>. The relevant rule is (23a) and the wordform produced by this rule application (modulo the applicable morphophonological operations) is *thabujukarrangunina*.

To summarize, we have accounted for the occurrence of multiple case marking in Kayardild and other languages by introducing recursive structure into morphological property sets. The different functions of morphological case correspond to different subtypes of case feature, but these different subtypes

crucially share a common form. In the recursive case, the structured property set is realised by applying a complex realization rule from the rule block StackCase which applies the appropriate case realization rule to the member of the set and calls StackCase on the rest of the set. The separation of form from function permits us to capture directly the observation that the different uses of Case in Kayadild share the same form while still providing the right sort of input for the morphology-syntax interface. Still abstracting away from Number for the moment, the cells in morphological paradigms have the innermost case property at the top of the structured case feature (as in (37)). It is these cells which are related to syntactic descriptions in the interface between morphology and syntax (see Sadler and Nordlinger (2004)).[18]

### 3.3 Interactions with Number

As noted in section 2.2, there are interesting interactions between multiple case markers and number in Kayardild and Martuthunira. The examples (14) and (15) from Martuthunira in section 2.2 above show that number marking is interpreted differently as a function of its ordering with respect to the proprietive case marker. Similar examples from Kayardild are the following (Evans 1995a:123):

(38) *maku-wala-nurru*
woman-MANY-ASSOC
'having many wives'

(39) *maku-nurru-walad-a*
woman-ASSOC-MANY-NOM
'the many having wives'

In (38) the realization rule for the core Case:Assoc applies to the output of the realization rule for Number, and as the translation shows, Number is interpreted as inside the scope of the associative case (as expected from a principle of iconicity). In (39), the order is the reverse, with Number appearing outside of the core Case:Assoc, and interpretively outside of its scope. Furthermore, an inflected nominal may contain more than one instance of number marking; we repeat below as (40) the example of double number marking in Kayardild introduced in section 2.2:

[18]Note, however, that the relationship between these structured morphosyntactic property sets and syntactic descriptions is not trivial. In the morphology-syntax interface each morphosyntactic feature is "unpacked" and mapped onto a set of syntactic constraints which capture the individual contribution of each case/number marker to different parts of the larger syntactic structure (cf Malouf (2001) who is required to transport stacked case features into the syntactic component as well).

(40) *maku-yarr-nurru-naba-walad-a*
woman-DU-ASSOC-ABL-MANY-NOM
'the many belonging to (those) having two wives' (Evans 1995a:123)

These examples show both that the stacking behaviour is not limited to case but also extends to number marking, and that the number feature is interpreted with respect to whatever level of (syntactic) structure is partially specified by the stem to which it attaches. Thus for example, the dual number feature in (40) ultimately relates to the syntactic structure of the nominal stem *maku-* 'woman', while the 'many' number feature is interpreted syntactically with respect to a larger syntactic structure containing an ablative adjunct. Thus number marking and its interaction with case marking is relevant both to the morphological analysis and to the specification of the interface with the syntax.[19]

Data on multiple number marking in Martuthinira and Kayardild is sparse, but what we have suggests that Number may optionally be marked before each core Case. Thus the following would be well-formed paradigm cells for

[19]Number marking in Kayardild also exemplifies a further property common to the morphological systems of Australian (and other) languages, but which is not to be adequately captured in PFM as outlined in Stump (2001), namely the possibility of optional inflectional features. In PFM, as with other paradigmatic approaches, the notion of *complete* feature bundle is crucial to the statement of paradigm functions — properties which are defined for a given category must be present with some value in the feature bundle unless ruled inappropriate by a feature co-occurrence restriction. (Of course, this does not entail any particular *exponence* for any particular feature value, given the role played by the Identity Function Default (IFD).) For example, on this view, English nouns are either singular or plural, but the singular form involves the IFD. However, there do seem to be some truly optional inflectional properties: number marking on nouns in many Australian languages is optional in the sense that nouns which are not marked for plural or dual may still receive non-singular interpretations. For such (unmarked) nouns, it does not seem appropriate to assume that the morphological feature bundle *is* specified for Number: this is at odds with the assumption that Number is part of every complete (nominal) feature bundle. A technical solution which makes this consistent with the assumptions of PFM is available by taking the Number Block to be obligatory (in the normal way), associating the (morphological) Num:Sing feature with the IFD and then permitting the morphology-syntax interface to interpret morphological Sing as ambiguous between singular and non-singular interpretations. This is possible once the morphological features are disassociated from the syntactically or semantically relevant features (as for example, in Sadler and Spencer's (2001) distinction between m-features and s-features, or Ackerman and Stump's (2004) distinction between morphological paradigms and content paradigms). This disassociation would allow us to maintain the notion that Number is obligatory in the morphological paradigm space, but is associated with a non-trivial (i.e. non-identity) mapping to the syntax. This certainly less than elegant solution effectively treates optional number marking as an interface issue. However we take it that a more adequate (but more radical) solution is in fact to admit the existence of truly optional morphological features where this is supported by the data. For the Kayardild data under discussion here, the optionality of number marking will in fact follow from the recursive feature definition we will propose. However the more general issue of truly optional Number and other properties (in languages where there is no evidence for a recursive structure to the morphological feature set) remains.

the Kayardild nominal root *maku* 'woman':[20]

(41) < *maku*, { Num:Pl,{Case$_{Core}$:Assoc}} >
< *maku*,{Case$_{Core}$:Assoc,{Num:Pl,{Case$_{Core}$:Nom}}}}>
< *maku*,{Num:Du,{Case$_{Core}$:Assoc,{Case$_{Core}$:Abl,{Num:Pl,
{Case$_{Core}$:Nom}}}}} >

We then need to reformulate the rules in the rule block StackCase to take account of the Number feature, by referring to either the Case or the Number rule block. We rename StackCase as StackFeat since it is now more general. In words:

(42) • *to apply StackFeat to a structured property set, apply the most specific applicable rule from the Number block to the outermost property set and apply StackFeat to the nested property set and the derived stem*
• *to apply StackFeat to a structured property set, apply the most specific applicable rule from the Case block to the outermost property set and apply StackFeat to the nested property set and the derived stem*
• *to apply StackFeat to a simple property set, apply the most specific applicable rule from the Case rule block*

(43) StackFeat Rule Block
(a) RR$_{StackFeat,\{\alpha,\beta\},N}$ (< X, $\sigma$ > ) =$_{def}$ Nar$_{StackFeat}$ (< X′, $\beta$ > ),
where Nar$_{Num}$ (< X, { $\alpha$ } > ) = < X′, { $\alpha$ } >
(b) RR$_{StackFeat,\{Case_\gamma:\alpha,\beta\},N}$ (< X, $\sigma$ > ) =$_{def}$
Nar$_{StackFeat}$ (< X′, $\beta$ > ),
where Nar$_{Case}$ (< X, { Case: $\alpha$ } > ) = < X′, { $\alpha$ } >
(c) RR$_{StackFeat,\{Case_\gamma:\alpha\},N}$ (< X, $\sigma$ > ) =$_{def}$
Nar$_{Case}$ (< X, {Case: $\alpha$ } > )

The number rule block contains the following rules (as well as the IFD):

(44) **Number Rule Block**
(a) RR$_{Num,\{Num:Many\},N}$ ( < X, $\sigma$ >) =$_{def}$ < X'walad, $\sigma$ >
(b) RR$_{Num,\{Num:Du\},N}$ ( < X, $\sigma$ >) =$_{def}$ < X'yarr, $\sigma$ >

The feature theory is also reformulated to permit recursion through Number and Case in the appropriate fashion.

(45) (i) {Case$_x$} is a well-formed property set of cardinality 1, where $x$ is Core, Mod or Comp or Ass; (*if you have only one thing, it's got to be a case*)

[20]There are no morphosyntactic properties expressed on the Kayardild nominal other than Case and Number.

(ii) If $\tau$ is a well-formed property set of cardinality n, then:
{Case$_x$:$\alpha$, $\tau$ } is a well-formed property set of cardinality n+1, provided that:(*recursive condition*)
(a) X is Core, Ass or Mod; (*Comp only comes last, and there can be only one Comp*)
(b) if X is Mod then there is no $\beta$ such that $\tau$= {Case$_{Mod}$:$\beta$...} or {Case$_{Ass}$:$\beta$...} or {Case$_{Core}$:$\beta$...} (*Mod cannot be followed by Mod or Ass or Core*)
(c) if $x$ is Ass then there is no $\beta$ such that $\tau$= {Case$_{Ass}$:$\beta$...} or {Case$_{Core}$:$\beta$...} (*Ass cannot be followed by either Ass or Core*) (iii) for any well-formed property set $\tau$ of cardinality n, { Num:$\alpha$, $\tau$ } is a well-formed property set of cardinality n+1, provided that $\tau$ is of the form {Case$_{Core}$:$\beta$, $\tau'$}

As before, the following Feature Co-occurrence Restriction must hold of the multi-set corresponding to the flattened property set:

(46) (c) all well-formed feature bundle multi-sets contain one instance of Case$_{Core}$

Finally returning to the paradigm function, we may reformulate (34) as (47).

(47) Where $\sigma$ is a complete set of morphosyntactic properties for lexemes of category N: PF(<X, $\sigma$ >) =$_{def}$ Nar$_{StackFeat}$ (< X, $\sigma$>)

Consider for example the wordform *maku-wala-nurru* 'woman-MANY-ASSOC'. The root-morphosyntactic property set (*sigma*) pairing in this case is (48).

(48) < *maku*,{Num:Many,{Case$_{Core}$:Assoc}} >

The paradigm function appplied to this root-property set pairing calls for the narrowest applicable rule from the StackFeat rule block to be applied to the pairing. Of the rules in the StackFeat rule block the narrowest applicable rule is (43a). Rule (43a) in turn calls for the application of the narrowest rule from the Num rule block to apply to the pairing < maku, {Num:Many}>. This is the rule (44a) and the stem produced by this rule application is *makuwala* (with applicable morphophonological operations). The first call to (43a) now requires the application of the narrowest applicable rule from the StackFeat rule block to the pairing < *makuwala*, {Case$_{Core}$:Assoc}>. This is a recursive call to StackFeat. Of the rules in the StackFeat rule block the narrowest applicable rule is (43c), which calls for the application of the narrowest applicable rule from the Case rule block. This is rule (23e) and the wordform produced by this rule application (modulo the applicable morphophonological operations) is *makuwalanurru*.

# 4 Empirical Consequences

The primary aim of this paper has been to give a fully explicit realizational analysis of what must be one of the most incremental-looking instances of inflectional morphology in the literature. In this final section we show how the separation between morphological form and function which is at the heart of our realizational, morphological approach has a number of empirical advantages over morphemic views (in which form and function are not separated) and over potential syntactic accounts (in which inflectional affixes would be introduced in the syntactic tree, thereby potentially accounting for the iconic ordering effects by means of syntactic principles). To do this we briefly discuss two issues (i) the existence and treatment of case substitutions and portmanteau forms and (ii) the existence and treatment of anti-iconic case orderings. A more complete discussion of the range of relevant data can be found in Dench and Evans (1988).

In Kayardild, any sequence of LOC + OBL case features requires the use of special portmanteau form *-kurrka*. An example showing the use of the portmanteau form for a core locative in combination with a modal oblique is shown in (49).

(49) *kunawuna bilarri-nyarra nguku-ntha wuruman-kurrk*
child(NOM) spill-APPR water-MOBL billy-LOC.MOBL
'The child might spill the water in the billycan' (Dench and Evans 1988:42 (89))

Crucially, however, this portmanteau form occurs irrespective of which function either case is performing. Thus, it occurs for *any* sequence of LOC and OBL, whether they be two $\text{Case}_{Core}$ features, or $\text{Case}_{Core}$ followed by $\text{Case}_{Mod}$ (as above), or $\text{Case}_{Mod}$ followed by $\text{Case}_{Comp}$, and so on.

On a morpheme-based account, in which form is inextricably tied up with function, this would require the positing of multiple portmanteau affixes (all with the form *-kurrka*); each one representing a different combination of functions. On this view the fact that these portmanteaux are all identical in form is purely coincidental. Clearly, however, this is not the case.

On our account, on the other hand, this type of portmanteau is straightforward. Given the separation of form and function in our realizational account, combined with the fact that we capture the identity of case forms under different case functions by means of a rule of referral to a general Case Block (irrespective of function), the treatment of these sorts of portmanteaux involves simply the addition of one portmanteau realization rule in the StackFeat rule block. Alongside the rules in (43), we add the following:

(50) (d) $\mathrm{RR}_{StackFeat,\{Case_{\gamma}:Loc,\{Case_{\delta}:Obl,\{\beta\}\}\},N}$ ($<$ X, $\sigma >$ ) $=_{def}$
$\mathrm{Nar}_{StackFeat}$ ($<$ X', $\{\beta\}$ $>$ ), where X$' = <$ X-kurrka, $\sigma >$

This rule simply ensures that the realization of any sequence Case:Loc followed by Case:Obl in the paradigm function of X will be *Xkurra*, irrespective of case function.

A second deviation in expected morphological form concerns the fact that some case sequences require an alternative form to be substituted for a member of the sequence. In the following example, the form which usually expresses the associative case is substituted for the form of the locative, despite the fact that the function remains the same:

(51) *ngada kurri-ju dangka-wu yubuyubu-nurru-wuru*
I.NOM see-FUT man-MPROP road-ASSOC-MPROP
*(*yubuyubu-ya-wuru)*
(road-LOC-MPROP)
'I will see the man on the road' (Kayardild, Dench and Evans 1988:38 (79))

Again, this can be treated simply at the level of form or realization. The morphological function which occurs here is the LOC function, but in this context it is realized by the form of the associative. This too may be handled by a specific rule in the StackFeat rule block — since rules are ordered by specificity, this will take precedence over the more general rules whenever its input conditions are met. Examples of contextually determined case substitutions, and portmanteau forms are unproblematic on the approach we propose here.

A more interesting challenge is posed, however, by the issue of deviation from iconic ordering. Iconic ordering follows directly on our proposal from the architecture of the interface between morphological function (features) and syntactic function (features) (Sadler and Nordlinger 2004). There is, however one known example of anti-iconic ordering in case stacking in Kayardild, which is discussed in Dench and Evans (1988) and Evans (1995a, b), and involves the interaction of modal and associating (oblique) case. Recall that the associating case marks all non-subject constituents belonging to a nominalised clause (a clause headed by a nominalised verb). This is exemplified in (52) repeated from (13) above:

(52) *Bil-da jani-n-da bartha-wuru-ntha kunawuna-wuru-nth.*
they-NOM search-NMZ-NOM track-PROP-A.OBL child-PROP-A.OBL
'They are looking for the child's footprints.' (Evans 1995a:112 (3-41)).

The syntactic information associated with the associating case is that the clause in which it appears is nominalized. When a nominalized clause functions as a

subordinate clause, its constituents must *also* take the modal case of the main clause. Since this modal case refers to the main clause, it relates to syntactic structure outside of the nominalized clause and thus, our expectation of iconic ordering would lead us to expect modal case to follow the associating oblique case. But in fact what is found is the opposite (anti-iconic) ordering of these case markers (see (53)):

(53) *Ngada kurri-jarra niwan-jina kurdama-n-kina nguku-naa-ntha*
I(NOM) see-PST 3.SG-M.ABL drink-NMZ-M.ABL water-M.ABL-A.OBL
*wuruman-urru-naa-nth*
billy-ASSOC-M.ABL-A.OBL
'I saw him drinking the water in the billy.' (Evans 1995a:112 (3-44))

This anti-iconicity is clearly problematic for a syntactic analysis of case morphology in which the affixes appear in the syntactic tree, for the affixes appear *in the wrong order*. On our separationist, morphological approach, with the clear distinction between morphological features and exponence, the difficulty disappears. In accordance with the feature theory, the morphosyntactic feature set is structured such that the modal case is embedded inside associating case, as would be expected given the mapping to the syntax. The rules of exponence can then simply realize them in the opposite order, by means of a specific realization rule in the rule block StackFeat.

Thus, this realizational approach to case stacking has a number of empirical advantages over other accounts which don't clearly separate morphological form from morphological function, and morphological function from syntactic function. Our approach captures both the iconic effects found in the majority of case stacking examples, while allowing us to straightforwardly account for the one case of deviation from this iconicity. It also allows for a natural account or portmanteaux affixes and affix substitution.

# 5 Conclusion

The complexity of the case and number stacking data is such that it challenges virutally any theory of inflectional morphology. Its complexity is increased by the fact that it does not concern morphology alone, but requires a sophisticated model of the interface between morphology and syntax beyond that which is usually assumed by theories of inflectional morphology. We have shown how a comprehensive account of both case stacking and its interaction with number in Australian languages such as Kayardild and Martuthunira can be accounted for within a realizational model of inflectional morphology. To account for the recursive nature of case marking in these languages we proposed an extension to the framework of Paradigm Function Morphology such

that some morphosyntactic features (in some languages) may be recursively structured, allowing for multiple, nested, instances of a single morphosyntactic property. This approach is then able to account straightforwardly for both the complex case stacking patterns, including the stacking of a single case feature ($\text{Case}_{Core}$), as well as the interaction between case and number stacking. Furthermore, the morphological feature bundles associated with fully inflected wordforms on this view may simply be mapped to sets of syntactic constraints describing LFG f-structures in order to provide a modular, natural and explanatory account of the morphosyntax of case stacking (see Sadler and Nordlinger 2004). Finally, through the separation of form from function, this account has a number of empirical advantages over other possible morpheme-based or syntactic approaches.

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