Decomposing hierarchical alignment: co-arguments as conditions on alignment and the limits of referential hierarchies as explanations in verb agreement*

Alena Witzlack-Makarevich[a], Taras Zakharko[b], Lennart Bierkandt[c], Fernando Zúñiga[d], & Balthasar Bickel[b]

[a]University of Kiel
[b]University of Zürich
[c]University of Jena
[d]University of Bern

Abstract

Apart from common cases of differential argument marking, referential hierarchies affect argument marking in two ways: (a) through hierarchical marking, where markers compete for a slot and the competition is resolved by a hierarchy, and (b) through co-argument sensitivity, where the marking of one argument depends on the properties of a co-argument. Here we show that while co-argument sensitivity cannot be analyzed in terms of hierarchical marking, hierarchical marking can be analyzed in terms of co-argument sensitivity. Once hierarchical effects are analyzed in terms of co-argument sensitivity, it becomes possible to examine alignment patterns relative to referential categories in exactly the same way as one can examine alignment patterns relative to referential categories in cases of differential argument marking and indeed any other condition on alignment (such as tense or clause type). As a result, instances of hierarchical marking of any kind turn out not to present a special case in the typology of alignment, and there is no need anymore for positing an additional non-basic alignment type like 'hierarchical alignment'. While hierarchies are not needed for descriptive and comparative purposes, we also cast doubt on their relevance in diachrony: examining two families for which hierarchical agreement has been postulated, Algonquian and Kiranti, we find only weak statistical evidence for the distribution of markers to have been shaped by specific rankings of person categories.

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1 Introduction

Alignment is understood here as the way in which the generalized semantic argument roles S, A, and P[1] are treated alike by case assignment, agreement marking, and other morphosyntactic operations. The three roles S, A, and P yield five logically possible alignment types: accusative (subsetting roles as {S, A} vs. {P}), ergative ({S, P} vs. {A}), tripartite ({S} vs. {A} vs. {P}), horizontal ({S} vs. {A, P}), and neutral ({S, A, P}). These five basic types have figured prominently in typological research and haven proven useful for descriptive purposes as well.

At the same time, it has often been noted that not all cases of argument marking can be straightforwardly characterized in terms of these basic alignment types because the way in which case or agreement aligns argument roles is often subject to various conditions. In many cases the complications created by such conditions, however, are more apparent than real: phenomena like differential subject and differential object marking, for example, simply suggest that alignments may hold only for certain referential types, e.g. one might find accusative alignment for first person and ergative alignment for third person referents. The characterization and analysis of such systems is straightforward and is not different in principle from well-established alignment conditions based on clausal properties such as tense, aspect, or polarity, which also frequently result in alignment splits.

By contrast, other ways in which referential properties affect alignments are far less straightforward and have given rise to the postulation of further alignment types such as 'hierarchical alignment' (Mallinson & Blake 1981, Nichols 1992, Siewierska 1998) or 'inverse alignment' and 'inverse voice' (Gildea 1994) or even more specific types, such as 'Philippine-type languages' (Himmelmann 2002) and 'Austronesian alignment' (Aldridge 2012). None of these concepts has received general acceptance because (a) their definitions do not follow the same conceptual logic of forming subsets of roles that underlies other alignment types (cf. Creissels 2009), (b) they tend to be ad-hoc and not universally applicable, and (c) they tend to contain traces of other alignment types (Nichols 1992, Bickel 1995, Zúñiga 2006, Haude 2009). The key challenge of all these phenomena is that the relevant condition is not a simple referential feature but an entire constellation of such features.

Here we propose a new analysis of the effects that such constellations can have on alignment. The basic idea is that all such effects boil down to a sensitivity to co-arguments, and that such a sensitivity is not in principle different from well-established kinds of conditions on alignments. We argue that this analysis challenges the assumption that a notion of referential hierarchy or scale is part of the universal inventory of analytical concepts in grammar. By contrast, there is a series of phenomena that (we argue) cannot be successfully analyzed without the notion of co-argument sensitivity. This notion is therefore a necessary ingredient of the universal inventory of analytical concepts.

[1] We understand the generalized argument roles S, A, and P as exclusively semantic notions, defined by the logical entailments of a predicate and not its syntactic behavior – for details, see Bickel & Nichols (2009), Bickel et al. (2010), Bickel (2011), Witzlack-Makarevich (2011), Bickel et al. (2014). On other uses of S, A, and P (or O) and a comparison of approaches, see Haspelmath (2011). For the sake of simplicity we focus here on one- and two-place predicates – for the application of the suggested method to three-place predicates and challenges thereof see Jansen et al. (this volume).

In the following we first describe in more detail the challenges posed by various types of feature constellations: situations where argument roles seem to compete for expression or marking so that only the 'highest' role is selected (Section 2), and situations where expression or marking of one argument depends on properties of another argument (Section 3). In Section 4 we introduce our response to these two kinds of challenges, showing that hierarchies are not needed for descriptive or comparative purposes. Specifically, we argue that any descriptive generalizations and simplifications that emerge from using hierarchies are more apparent than real and that not much is gained by using them. In Section 5 we examine the extent to which hierarchies may be needed at least for the purpose of explaining the diachronic development of specific paradigms, concluding that the evidence for hierarchies is very thin. Section 6 summarizes the paper and suggests general conclusions.

2 Role competition

In several languages, case or agreement marking can be conditioned by the referential properties of all arguments that are involved and represented in the clause. The phenomenon comes in two flavors: (i) in some systems, discussed in this section, arguments of a clause compete for a particular agreement slot or for a particular case marker. It is normally assumed that in order to provide an account for such a system, it is necessary to posit a referential hierarchy (or scale) of a certain form (language-specific or universal). Then, one can say that only the argument that ranks higher on the hierarchy gets access to the agreement slot or case marker. Such cases underlie the traditional label 'hierarchical agreement' and its much less frequently used counterpart 'hierarchical case marking'. (ii) In the other systems, discussed in detailed in Section 3, argument marking also depends on the whole constellation of arguments of a clause, or what we call 'participant scenario'. However, in contrast to the first type, in such systems it is impossible to account for the distribution of markers in terms of a referential hierarchy because the relevant conditions determining their distribution seem too idiosyncratic (e.g. 'assign accusative to the P argument if the A argument is second person singular and nowhere else').

Hierarchical agreement can be illustrated by the following examples from the Tupian language Emerillon. Emerillon has two sets of agreement prefixes. Whereas one set marks S and A arguments, the other set marks P arguments. In the case of one-place verbs, the prefix slot shows agreement with the S argument, as in (1a) and (1b):

(1) Emerillon (French Guiana, Tupi-Guaraní; Rose 2003)

a. ***ere****-zaug-tanẽ-po?*
2sS/A-bathe-DESID-INTER
'Do you want to bathe?'

b. *Polo* ***o****-manõ.*
Paulo **3S/A**-die
'Paulo died.'

In the case of two-place verbs, there is a competition between the two arguments for the same agreement slot. The following person hierarchy determines the access to this agreement slot:

(2) 1/2 ≻ 3

As (3a) and (3b) show, if there is a first or second person argument in a clause, the verb agrees with this argument, no matter whether it is an A or a P. The verb agrees with the third person A argument only if there is no first or second person argument in the clause, as in (3c):[2]

(3) Emerillon (French Guiana, Tupi-Guaraní; Rose 2003)

a. *nõde-i-a-ne* ***ere****-zika.*
1INCL.POSS-mother-*a*-CONTR **2sS/A**-kill
'You killed our mother.'

b. *zawal* ***de****-su?u.*
dog **2sP**-kill
'A dog killed you.'

c. *kija* ***o****-ba?e* *palilu-pe.*
hammock **3S/A**-make son.in.law-for
'She makes a hammock for her son-in-law.'

Another example of hierarchical agreement comes from Plains Cree. In the case of one-place verbs, the prefix slot shows agreement with the S argument, as in (4a) and (4b). In the case of two-place verbs, the situation is more complex: if there is a second person argument, the verb agrees with it, no matter whether it is an A or a P, as (4c) and (4d) show. Only if there is no second person argument, the verb agrees with the first person argument, as in (4e) and (4f):

(4) Plains Cree (Canada, Algonquian; Dahlstrom 1991)

a. ***ki****-pimipahtā-n.*
2-run-sSAP
'You(sg) run.'

b. ***ni****-pimipahtā-n.*
1-run-sSAP
'I run.'

c. ***ki****-pēhtaw-i-n.*
2-hear-2→1-sSAP
'You (sg) hear me.'

d. ***ki****-pēhtaw-iti-n.*
2-hear-1→2-sSAP
'I hear you (sg).'

e. ***ni****-wāpaht-ē-n.*
1-see-TR-sSAP
'I see it.'

f. ***ni****-pakamahw-ikw-w.*
1-hit-INV-3
'He hits me.'

Usually, the access to prefixal agreement is described as being governed by the well-known Algonquian hierarchy (cf. Dahlstrom 1991, Zúñiga 2006):

(5) 2 ≻ 1 ≻ 3

A similar situation is found in the domain of case marking and is particularly common in some Western Malayo-Polynesian languages. For instance, in Tagalog (Schachter & Otanes

[2] In first and second person ('local') scenarios the verb always shows agreement with the A argument.

1972, Kroeger 1993), only one noun phrase of a clause is marked by *ang*=, glossed here as 'nominative'.[3] The choice of which noun phrase is marked with *ang*= depends on the referential properties of arguments and adjuncts of the clause: the marker is assigned to whichever element in the clause is most 'prominent' in terms of referentiality, definiteness, and further discourse-pragmatic factors (cf. Himmelmann 2005).[4] The following examples illustrate this:

(6) Tagalog (Austronesian; Southeast Asia; Kroeger 1993:26)

a. *bumili* ***ang****=lalake ng=isda sa=tindahan.*
PFV.A.buy **NOM**=man OBL=fish LOC=store
'*The man* bought fish at the/a store.'

b. *binili* *ng=lalake* ***ang****=isda sa=tindahan.*
PFV.P.buy OBL=man **NOM**=fish LOC=store
'The/a man bought *the fish* at the/a store.'

c. *binilhan ng=lalake ng=isda* ***ang****=tindahan.*
PFV.G.buy OBL=man OBL=fish **NOM**=store
'The/a man bought fish *at the store*.'

Similar to Emerillon, one can formulate the rule of the distribution of *ang*= 'NOM' as being governed by a hierarchy like the following:

(7) [more prominent] ≻ [less prominent]

Phenomena like those in Emerillon, Plains Cree, and Tagalog could all be typologized as representing 'hierarchical alignment'. But if we allow for it, hierarchical alignment would have a special position among alignment types. As mentioned in the introduction, the three roles S, A, and P yield only five logically possible alignment types: accusative, ergative, tripartite, horizontal, and neutral. Hierarchical alignment would be an additional, *non-basic* type. Such an extension incurs several problems.

In contrast to the mere comparison of argument roles that underlies the basic types, the non-basic types are based on different principles: they merely refer to the existence of some additional conditioning factors of argument marking, but they do not specify what the grouping of argument roles is. This makes the basic notion of alignment inconsistent, as already noted by Zúñiga (2007) and Creissels (2009). Along the same lines, if hierarchical alignment indeed exists as a type of its own, we would expect it to be on a logical par with the other types and, in particular, we would expect that the existence of hierarchical alignment in one construction or form would exclude any other kind of alignment in the same construction or form. Yet this

[3] The exact status of *ang*-marked noun phrases is still under debate in Austronesian linguistics where it is referred to as 'topic', 'focus', 'pivot', 'nominative', 'subject' or 'specific article'. See Himmelmann (2002) for discussion and references.

[4] Competitive access to a single category is what makes Tagalog similar to Algonquian, but there are of course many differences. Most importantly, unlike in Tagalog, Algonquian languages usually limit the principle of competitive access to scenarios with a mix of first or second and third person arguments. When there are only third person arguments in a clause, any of these arguments can be proximative or obviative, depending on their role in the wider discourse (e.g. Cowell & Moss 2008:350 on Arapaho).

prediction is not warranted: Within the same agreement system, one often – perhaps indeed mostly (cf. Nichols 1992:68) – finds 'hierarchical' principles along with other alignment types. To illustrate this point, consider again the Emerillon prefixes illustrated in (1) and (3). In these examples, the prefixes shows accusative alignment, for instance, *eɾe-* '2sS/A' in (1a) and (3a) is used to mark the S and A arguments of the first person inclusive, whereas the prefix *de-* 2sP' is used to mark the P argument, as in (3b). Similar observations have been made for Algonquian languages (Bickel 1995, Zúñiga 2006:126).

How can we then capture agreement systems like that of Emerillon? As 'hierarchical with a trace of accusative alignment'? As a combination of 'hierarchical', 'neutral' and 'accusative'? These choices seem all unattractive. What we want to capture is both the accusative alignment of prefixes and the effects of arguments' referential values on the distribution of all agreement markers. A notion of 'hierarchical alignment' does not seem to generate insights here.

3 Co-argument sensitivity

Not every system with effects of arguments' referential values on the distribution on marking can be analyzed as governed by a hierarchy. An example is given by dual number agreement in the Sino-Tibetan language Belhare. The suffix *-chi* indexes dual S, A, and P arguments in most contexts, as in (8a)–(8d). However, in certain cases, the suffix is absent, as in (8e)–(8h). For illustration we show optional NPs with dual number in brackets; unlike first and second person pronouns, third person NPs allow no dual marking and we use numerals instead.[5]

(8) Belhare (Sino-Tibetan, Nepal; Bickel 2003)

a. *(ŋkeŋchiŋ) khai-**chi**-ŋa* (1S)
(1de[NOM]) go[NPST]-**d**-e
'we (excl.) two go'

b. *(hanchik) khai-**chi**-ga* (2S)
(2d[NOM]) go[NPST]-**d**-2
'you two go'

c. *(sip-paŋ-ŋa) n-lui-**ch**-u* (3A)
(two-HUM-ERG) 3A-tell[NPST]-**d**-3[s]P
'they two tell him/her'

d. *(hanchik) n-lui-**chi**-ga* (2P)
(2dNOM) 3A-tell[NPST]-**d**-2
's/he/they tell you two'

e. *(ŋkeŋchiŋ) lui-ʔ-na-chi-ŋa*
(1de[NOM]) tell-NPST-1→2-nsA-e
'we two (excl.) tell you (s/d/p)'

f. *(sip-paŋ-ŋa) n-lui-ka*
(two-HUM-ERG) 3A-tell-NPST.2
'they two tell you (s)'

g. *(ŋkeŋchiŋ) lui-t-u-m-chi-m-ma*
(1d[NOM]) tell-NPST-3P-nsA-nsP-nsA-e
'we two (excl.) two tell them (d/p)'

h. *(hanchik) lui-t-u-m-chi-m-ga*
(2d[NOM]) tell-NPST-3P-nsA-nsP-nsA-2
'you two tell them (d/p)'

Unlike with hierarchical agreement, there is no competition for a particular slot: *-chi* 'dual' is not limited to a specific part of the referential hierarchy and, as illustrated by (8a–8e) indeed

[5] Note that there is a homophonous suffix *-chi*, which marks nonsingular A, as in (8e), so that the verb form *lui?-nachiŋa* could also combine with a plural agent pronoun *ŋkeŋ* 'we (excl)' and mean 'we (p, excl) tell you (s/d/p)', or nonsingular P arguments, as in (8g) and (8h). The nonsingular *-chi* suffix appears in a different inflectional position than the dual marker (e.g. after rather than before the third person P marker *-u*, cf. 8h vs. 8c) and behaves differently morphophonologically (Bickel 2003).

co-occurs with all persons and in all roles. What occasionally blocks *-chi* is two specific person feature constellations: (i) if a first or third person acts on a second person, as in (8e) and (8f), dual number is not marked for the A argument, though it is marked for P arguments in the same constellation, e.g. (8d); (ii) if an A argument acts on a third person i.e. if the third person is a P and not an S argument, as in (8g) and (8h), dual is not marked for P arguments, though it is marked for A arguments, cf. (8c).

The presence of dual marking in Belhare can only be captured by appeal to the referential features of two arguments at once; the pattern cannot be analyzed in terms of a referential hierarchy: condition (i) cannot be re-cast as a statement like 'all A arguments lower than the second person on a $1/2 \succ 3$ hierarchy' because in other scenarios low-ranking persons do allow dual marking in A role, e.g. the third person in (8c). Condition (ii) does amount to a constraint on what can be thought of as the lowest segment of the hierarchy, i.e. all third persons. But it only holds of P arguments, and does not generalize across all third persons. This is different from hierarchical agreement of the kind that is known from the Emerillon or Plains Cree prefix marking patterns discussed above.

Co-argument sensitivity that is not based on a hierarchy is also found with case marking. This can be illustrated by the following examples from Ik. In Ik, the P argument can be either in the nominative, as in (9a) and (9b), or in the accusative case, as in (9c) and (9d):

(9) Ik (Kuliak, Uganda; König 2009)

a. *en-í-a nk-a wík-**a**.*
see-1s-A I-NOM children-**NOM**
'I see the children.'

b. *en-es-íd-a bi-a wík-**a**.*
see-IRR-2s-A you-NOM children-**NOM**
'You (sg) will see the children.'

c. *en-es-uɠot-a wík-á njíní-**ka**.*
see-IRR-AND-A children-NOM 1pINCL-**ACC**
'The children will see us (incl.).'

d. *en-es-át-a ńt-a ceki-**ka**.*
see-IRR-3p-A they-NOM woman-**ACC**
'They will see the woman.'

What determines the distribution of the case markers on the P argument is the nature of the A arguments: the P argument is in the accusative case only if the A argument is third person, otherwise the P argument is in the nominative case. This is made explicit in Table 1, where subscripted numbers indicate person (e.g. S_1 refers to the first person S argument).

Similar to Belhare and in contrast to the Emerillon or Tagalog examples, it is impossible to account for differential P marking here by formulating a referential hierarchy of any kind, whereas the reference to the nature of co-arguments is unavoidable. For example, one could consider an analysis of Ik based on a hierarchy that ranks first and second person above third person ($1/2 \succ 3$). Then, if the P argument is higher or equal to the A argument on this hierarchy, it is in the accusative case. This hierarchy would correctly predict the distribution of the accusative and nominative cases in the scenarios involving third persons, but it would overgenerate in that the analysis would also predict the accusative P argument in scenarios involving only first and second person ('local' scenarios).

The examples from Belhare and Ik show that for some systems of case and agreement marking it is unavoidable to make reference to specific constellations of person features. In principle, however, it seems that reference to such constellations is not fundamentally different from reference to single referential properties. Reference to single referential properties is something

marker	marked argument	co-argument
NOM	S_1	n.a.
NOM	S_2	n.a.
NOM	S_3	n.a.
NOM	A_1	any
NOM	A_2	any
NOM	A_3	any
NOM	P_1	A_2
NOM	P_2	A_1
NOM	P_3	A_1
NOM	P_3	A_2
ACC	P_1	A_3
ACC	P_2	A_3
ACC	P_3	A_3

Table 1: Distribution of case markers in Ik. Subscripts indicate person, e.g. S_1 is a first person S argument.

that we need anyway for any type of differential object or differential subject marking, i.e. alignment types need to be stated relative to referential contexts anyway (Bickel 2011). This paves the way towards a unified analysis, to which we turn in the following.

4 Analysis of co-argument sensitive argument marking

Whereas hierarchical marking systems are typically squeezed into alignment typology by introducing one or more non-basic alignment types, non-hierarchical cases of co-argument sensitivity are often either ignored in the discussion of alignment, or they are classified as instances of hierarchical alignment (e.g. in the case of Limbu in Siewierska 2005). To include these systems, one could in principle consider expanding the typology of alignment systems with yet another type, 'co-argument sensitive alignment'. But as discussed above, this would obscure the notion of alignment even more. The alternative that we propose is to analyze both co-argument sensitivity and hierarchical agreement in terms of basic alignments that are subject to or conditioned by specific referential effects (Zúñiga 2007, Bickel 2008, 2011).

But there is a fundamental challenge when one tries to spell out the basic idea: alignments can only be formulated for sets of roles under a single general condition, e.g. {S, A} vs. {P} for all third person arguments. Now, co-argument sensitivity means that the relevant conditions are by definition *not* general across all arguments, e.g. the condition may be split between a third person P co-occuring with a first A as opposed to a third person P co-occuring with a third person A (as is indeed the case for instance in Ik, cf. the 'P_3' rows in Table 1). As a result, there is no immediate sense in which one could compare third person P arguments to third person S and A arguments.

In response to this challenge we suggest to compute what we call 'exhaustive alignments', i.e. we retrieve all possible alignment patterns for each referential type under the condition of every possible co-argument (Witzlack-Makarevich 2011). For this we first build all possible

triads of the three argument roles, whereby for the A and P arguments we list all co-arguments that these arguments can occur with. In Ik, for example, a first person A argument (A_1) can co-occur with a second person and a third person P argument (P_2 and P_3); a first person P argument (P_1) can co-occur with a second person A and a third person A argument (A_1 and A_3). Combined with first person S arguments (S_1), this results in four triads of the three argument roles: (i) $\langle S_1, A_{1\text{ with }P_2}, P_{1\text{ with }A_2}\rangle$ (ii) $\langle S_1, A_{1\text{ with }P_2}, P_{1\text{ with }A_3}\rangle$ (ii) $\langle S_1, A_{1\text{ with }P_3}, P_{1\text{ with }A_2}\rangle$ (iv) $\langle S_1, A_{1\text{ with }P_3}, P_{1\text{ with }A_3}\rangle$.[6] For the Ik case marking system exemplified in (9), the resulting comparative triads are given in the left three columns of Table 2.

In a second step, we determine whether argument marking is the same or different for the three arguments in each triad, e.g. whether first person arguments receive the same marking when comparing S_1, $A_{1\text{ with }P_2}$ and $P_{1\text{ with }A_2}$. This results in alignment statements for each triad (last column of Table 2). Aggregating by referential category, we can then deduce proportions of individual basic alignment types for each such category. In the Ik example, this means that for the first and second person, i.e. all four triads $\langle S_1, A_{1\ldots}, P_{1\ldots}\rangle$ and all four triads $\langle S_2, A_{2\ldots}, P_{2\ldots}\rangle$, we get 50% neutral and 50% accusative alignment. For the third persons, i.e. all nine triads with $\langle S_3, A_{3\ldots}, P_{3\ldots}\rangle$, we obtain 66% neutral and 33% accusative alignment.

The same analysis can be generalized to hierarchical marking. In order to show this, we first demonstrate in the following that all cases of hierarchical marking can be analyzed as cases of co-argument sensitivity without any appeal to a hierarchy. Note that the reverse is not true: as we found in Section 3, not all cases of co-argument sensitivity can be analyzed in terms of hierarchical marking. Once hierarchical argument marking is analyzed in terms of co-argument sensitivity, its alignments can be computed in exactly the same way as we did for co-argument sensitivity in Ik.

Cases of hierarchical marking can be analyzed in terms of co-argument sensitivity as follows. Take as an example prefixal agreement in Plains Cree, as illustrated in (4) above. Table 3 lists all logically possible scenarios (the first column, the argument marked with a prefix is in bold). It also indicate which prefix is used with the respective scenario (the second column) and explicitly states the marked argument and its unmarked coargument (the third and fourth column respectively). The table clearly illustrates that the marking is not restricted to a particular role (S, A, and P can all be marked). It also makes clear that whether the arguments of one and the same referential type is marked or unmarked depends on its coargument, which is the case for the first person argument in the two-argument scenarios: it is marked in rows (f) and (i), but marked in rows (d) and (g).

In Table 4 exactly the same procedure as in the case of Ik in Table 2 is applied to the Plains Cree prefixal marking to establish triads and determine alignments. For the second person we obtain neutral alignment for all triads; for the first person in half of the cases the alignment is neutral and it is accusative and ergative in a quarter of cases each. The third person is not marked in the prefix position and thus is excluded from this partial representation, but it is evaluated when all argument markers (i.e. both prefixes and suffixes) are considered.

The representation of Plains Cree prefixal agreement as dependent on the whole scenario in Table 3 raises the question whether we do not lose a possibly important generalization, viz. the

[6] We ignore reflexive scenarios like $A_1 \rightarrow P_1$ which are treated as intransitive in Ik (König 2009:178).

Comparative triads			*Alignment*
S argument	*A argument with its co-argument*	*P argument with its co-argument*	
S_1	A_1 [with P_2]	P_1 [with A_2]	neutral
S_1	A_1 [with P_2]	P_1 [with A_3]	accusative
S_1	A_1 [with P_3]	P_1 [with A_2]	neutral
S_1	A_1 [with P_3]	P_1 [with A_3]	accusative
S_2	A_2 [with P_1]	P_2 [with A_1]	neutral
S_2	A_2 [with P_1]	P_2 [with A_3]	accusative
S_2	A_2 [with P_3]	P_2 [with A_1]	neutral
S_2	A_2 [with P_3]	P_2 [with A_3]	accusative
S_3	A_3 [with P_1]	P_3 [with A_1]	neutral
S_3	A_3 [with P_1]	P_3 [with A_2]	neutral
S_3	A_3 [with P_1]	P_3 [with A_3]	accusative
S_3	A_3 [with P_2]	P_3 [with A_1]	neutral
S_3	A_3 [with P_2]	P_3 [with A_2]	neutral
S_3	A_3 [with P_2]	P_3 [with A_3]	accusative
S_3	A_3 [with P_3]	P_3 [with A_1]	neutral
S_3	A_3 [with P_3]	P_3 [with A_2]	neutral
S_3	A_3 [with P_3]	P_3 [with A_3]	accusative

Table 2: Comparison triads for determining alignment of Ik case marking

	Scenario	*Prefix*	*Marked argument*	*Unmarked co-argument*
(a)	$\mathbf{S}_1$	*ni-* '1'	S_1	n.a.
(b)	$\mathbf{S}_2$	*ki-* '2'	S_2	n.a.
(c)	S_3	no prefix	none	n.a.
(d)	$A_1 \rightarrow \mathbf{P}_2$	*ki-* '2'	P_2	A_1
(f)	$\mathbf{A}_1 \rightarrow P_3$	*ni-* '1'	A_1	P_3
(g)	$\mathbf{A}_2 \rightarrow P_1$	*ki-* '2'	A_2	P_1
(h)	$\mathbf{A}_2 \rightarrow P_3$	*ki-* '2'	A_2	P_3
(i)	$A_3 \rightarrow \mathbf{P}_1$	*ni-* '1'	P_1	A_3
(j)	$A_3 \rightarrow \mathbf{P}_2$	*ki-* '2'	P_2	A_3
(k)	$A_3 \rightarrow P_3$	no prefix	none	A_3 & P_3

Table 3: Co-argument sensitive distribution of Plains Cree verbal agreement prefixes

S argument	*A argument with its co-argument*	*P argument with its co-argument*	*Alignment*
S_1	A_1 [with P_2]	P_1 [with A_2]	ergative
S_1	A_1 [with P_2]	P_1 [with A_3]	neutral
S_1	A_1 [with P_3]	P_1 [with A_2]	accusative
S_1	A_1 [with P_3]	P_1 [with A_3]	neutral
S_2	A_2 [with P_1]	P_2 [with A_1]	neutral
S_2	A_2 [with P_1]	P_2 [with A_1]	neutral
S_2	A_2 [with P_3]	P_2 [with A_3]	neutral
S_2	A_2 [with P_3]	P_2 [with A_3]	neutral

Table 4: Comparative triads of the Plains Cree verbal agreement prefixes

relevance of the $2 \succ 1 \succ 3$ hierarchy for the marking in the prefix slot, and whether we do not make a seemingly simple picture unnecessarily complex. Under closer inspection however, it is unclear to what extent hierarchies are genuine generalizations and whether analyses in terms of hierarchies are indeed less complex than analyses in terms of co-argument sensitivity: The generalization of a $2 \succ 1 \succ 3$ hierarchy in Plains Cree quickly loses its descriptive appeal once one moves away from prefixes and considers the entire agreement system. In order to account for the full distribution of agreement markers one needs to postulate at least three hierarchies (cf. Zúñiga 2006:85f., see also Macaulay 2005, 2009 for similar conclusion with respect to a range of further Algonquian languages). They are given in (10). Note that the first two hierarchies

show conflicting evidence for the ordering of the first and second person:

(10) Plains Cree hierarchies (Zúñiga 2006:85f.)

a. Plains Cree hierarchy I:
2/1p.incl. ≻ 1 ≻ 3

b. Plains Cree hierarchy II:
1p ≻ 1p.incl./2p ≻ 3 animate ≻ sSAP ≻ 3 inanimate

c. Plains Cree Hierarchy III:
SAP ≻ 3 proximate ≻ 3 obviative (≻3f.obv)

These hierarchies are not only language-specific but specific to parts of the paradigm. Such idiosyncrasies are fairly common in the languages categorized as possessing hierarchical systems. Another example is provided by Aguaruna (Jivaroan, Peru): in order to analyze the distribution of case markers in this language Overall (2007, 2009) needs to posit the following Aguaruna-specific hierarchy:

(11) 1s ≻ 2s ≻ 1p/2p ≻ 3

Hierarchies like the ones in Plains Cree and Aguaruna – in (10) and (4) respectively – capture the facts, but they do not explain anything more than an analysis in terms of co-argument sensitivity. As a result, the seeming generalization does not lead to more insight into the workings of these languages.

Further, once hierarchies are language-specific, it is difficult, often impossible, to compare them for reconstruction purposes or when exploring areal or universal distributions. Alignment statements, by contrast, are well-established notions for comparative purposes, they make it possible to compare proportions (or degrees) of, say, 'ergativity' along with the effects of specific referential categories (for applications, see Bornkessel-Schlesewsky et al. 2008, Bickel et al. 2013, 2015a,b).

5 Case study: Hierarchies as determinants in Algonquian and Kiranti diachrony?

The previous discussion has shown that (a) systems of hierarchical marking can be represented in terms of co-argument sensitivity and that (b) this representation allows for consistent notions of alignment and for systematic comparison of alignments across referential categories and across languages. An immediate consequence of this is that we in fact do not need hierarchies for either descriptive or comparative purposes. Any generalizations that hierarchies seem to capture turn out to be more apparent than real because they are fraught with idiosyncrasies and peculiarities that leave little or no room for explanatory insights.

However, while hierarchies are not needed for descriptive or comparative purposes, it may still be possible that hierarchies play a systematic role in shaping agreement paradigms over time. Evidence for this would come from the observation that individual markers compete for the same slot and that there is a trend across an entire genealogical unit (e.g. a family like Algonquian) that such competitions are resolved by a uniform hierarchy (e.g. the 2 ≻ 1 ≻ 3 hierarchy). If there is such a trend, it would be plausible to assume that this hierarchy played a

shaping role in the history of the family and that it therefore reflects a deeper, perhaps cognitive, reality. If there is no detectable trend, this would suggest that hierarchies are obsolete artifacts not only for the purpose of describing and comparing languages but also for explaining their diachronies (for a detailed discussion of various diachronic paths of hierarchical marking see Gildea & Zúñiga 2015+).

We address this issue by way of a case study of Algonquian and Kiranti languages because the verbal paradigms of these families are rich in co-argument sensitive markers that could be analyzed in terms of hierarchies (Hockett 1966, DeLancey 1981, Dahlstrom 1991, Ebert 1991, Nichols 1992, Bickel 1995, LaPolla 2003, Zúñiga 2006). We focus on person categories, ignoring number and the inclusive/exclusive distinction because only person categories are relevant for both families and indeed recur in virtually all work on the referential hierarchies.

5.1 Data

Our sample includes 8 Algonquian languages and 16 Kiranti languages. For lack of sufficient data we limited the Algonquian survey to the paradigms of what is called the independent order, i.e. main clause forms. For Kiranti we limited the survey to the indicative mood paradigms and included both past and non-past tenses for those languages which have different person and/or number marking in the two paradigms (though this does not necessarily result in different rankings of person values, as we will see).

We considered only overt markers. Also, we excluded all portmanteau markers from the further analysis, as they mark two arguments at the same time and therefore do not provide any evidence for a particular ranking between these arguments. The agreement paradigms of these languages were coded in the AUTOTYP database of grammatical relations (Witzlack-Makarevich et al. 2011). Our analyses largely follow the language specialists' morpheme analyses in the literature, although we took the liberty of occasionally unifying and harmonizing different analyses.[7]

For hypothesis testing we make assumptions about the topology of the Algonquian and Kiranti trees. These assumptions are made explicit in Figures 1 and 2. The Kiranti tree is based on the summary in Bickel & Gaenszle (2015). For Algonquian we test our hypothesis both on a flat tree that is traditionally posited (e.g. Mithun 1999) and a more structured tree that we construct on the basis of shared innovations that have developed in a west-to-east cline (Goddard 1994, Oxford 2015). In each tree, all branches have length 1 between the nodes that are posited in the literature even when the nodes are not relevant for our sample. For example, there is evidence for Kulung being a descendant of a 'Khambu' node covering several closely related languages that are not included in our sample. Therefore, there is one additional node between 'Central Kiranti' and the Kulung paradigms we selected here. This results in a total length of 2 between Central Kiranti and Kulung, the same length as between Central Kiranti and Bantawa, which develops via the node 'Southern Kiranti'.

[7] The database with all analyses and the algorithm used obtain the calculations reported below are available as Supporting Online Material at [URL TO BE ADDED BY PUBLISHER].

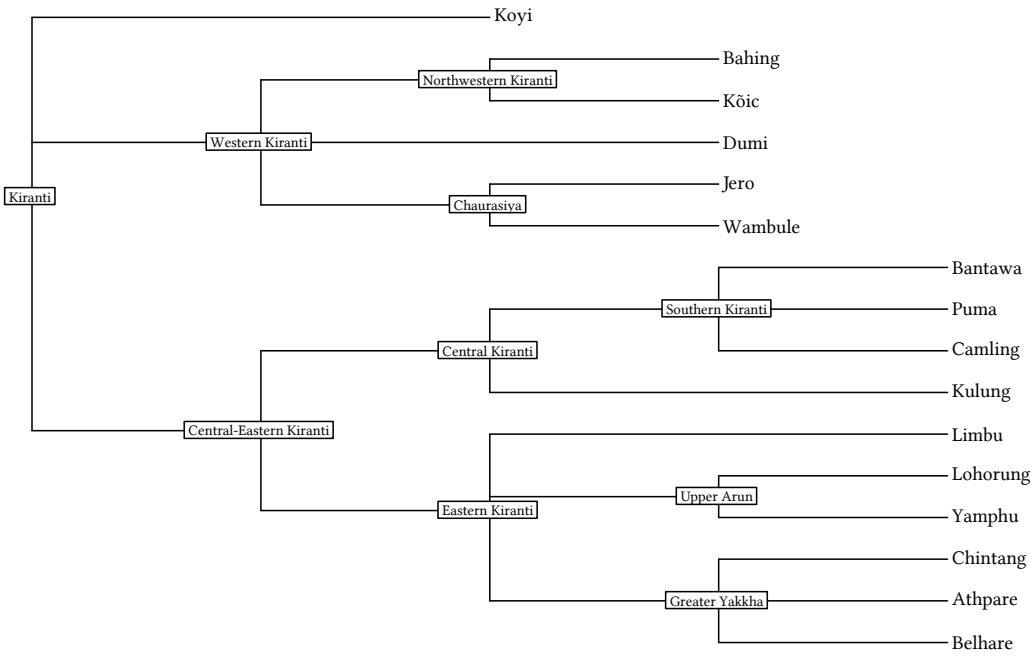


Figure 1: Genealogy of the Kiranti languages in the sample (Bickel & Gaenszle 2015)

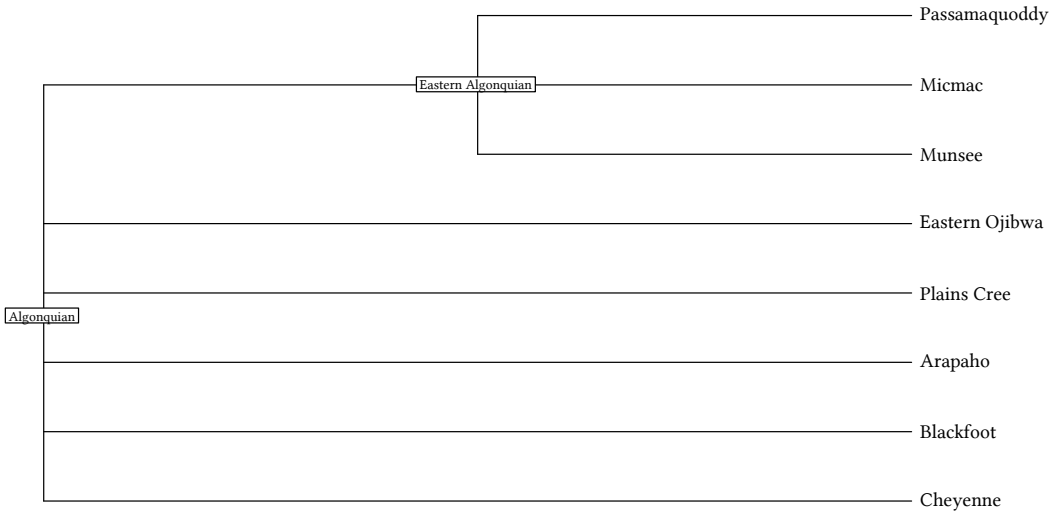
5.2 Methods

For detecting hierarchical rankings of persons (first, second, and third) within each slot we apply the following algorithm:[8]

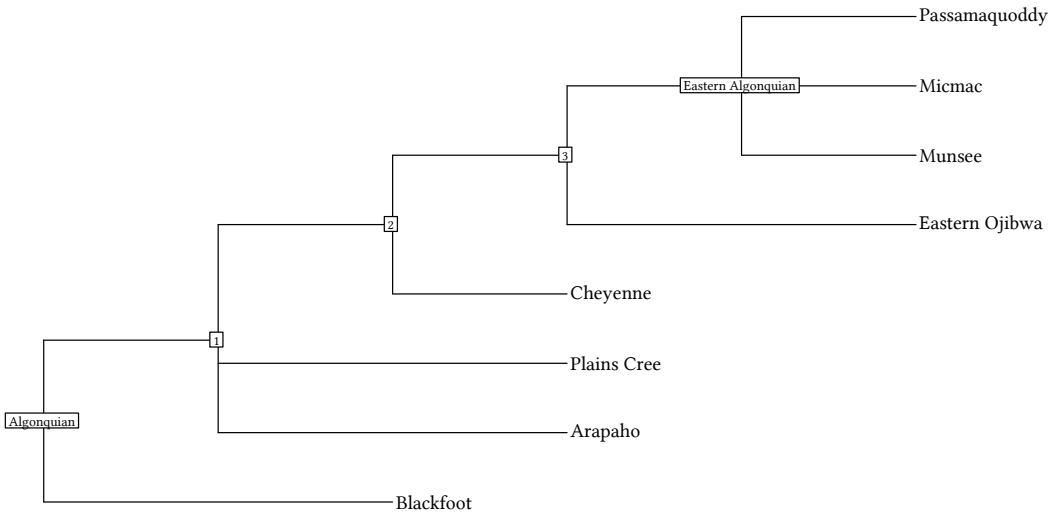
1. The input to the algorithm is a set of occurrences of agreement affixes with the indication of their respective slots and their co-arguments in the way illustrated for the Plains Cree prefixes markers *ki-* and *ni-* in Table 3 above. (For expository purposes, Table 3 only represents the person feature, but the complete data set also includes the number, clusivity, and – for Algonquian languages – animacy features and obviation status, as these features also condition the presence or absence of an agreement affix.)

2. Because evidence for hierarchical order means that person markers compete for the same slot, the algorithm first compiles sets of markers which could potentially occur in a given slot in accordance with their person feature. This is done by putting together lists of markers occurring in the same slot and then extracting from them the information about the person feature that they express. In the case of the Plains Cree prefix slot in Table 3 only two prefixes occur in this slot and thus only these two compete with each other. As the two markers express first and second person, only the ranking of these two person

[8] The algorithm is implemented as Python script, available in the Supporting Online Material.



(a) Traditional genealogy of the Algonquian languages in the sample (Mithun 1999).



(b) Alternative genealogy of the Algonquian languages in the sample, derived from the west-to-east cline of shared innovations observed by Goddard (1994) and Oxford (2015). Subgroups are labeled by the numbers specifying innovations in Oxford (2015).

Figure 2: Two possible genealogies of Algonquian

categories can be established in the prefix slot unlike in, say, Eastern Ojibwa, where third person prefixes also compete for the prefix slot. The remaining person markers (in our example, those expressing third person) cannot enter the slot and are hence irrelevant for the competition. Therefore, the algorithm ignores all contexts of occurrence which refer to these features, e.g. in Plains Cree, we do not need to consider the contexts where the co-argument is third person (gray rows (a), (c), (d), and (f) in Table 5).

	Marker	*Argument*	*Co-argument*	*Filter output*
(a)	*ni-* '1'	A_1	P_3	ignore
(b)	*ki-* '2'	A_2	P_1	consider for ranking
(c)	*ki-* '2'	A_2	P_3	ignore
(d)	*ni-* '1'	P_1	A_3	ignore
(e)	*ki-* '2'	P_2	A_1	consider for ranking
(f)	*ki-* '2'	P_2	A_3	ignore

Table 5: Filtering the Plains Cree verbal agreement prefixes

3. The remaining contexts can be directly interpreted in terms of ranking. For instance, in our simplified Plains Cree example there are two remaining contexts (the contexts (b) and (e) in Table 5). In the first context (b), a second person A acts on a first person P, and it is A which is marked (by the prefix *ki-* '2'). Thus, for this context, the prefix marking the second person wins over the prefix marking the first person and consequently this context provides a point in support of the $2 \succ 1$ ranking. In the second relevant context (e), a first person A acts on a second person P, and it is P which is marked (again by the prefix *ki-* '2'). This context provides another point in support of the $2 \succ 1$ ranking. Now, because in some languages number and obviation status interact with the person ranking (cf. the hierarchies in 10), the actual amount of the environments considered for ranking is higher and corresponds to all allowed person/number/obviation/animacy combinations, which in case of Plains Cree prefixes results in eight different contexts supporting the ordering $2 \succ 1$.

Once all verb agreement slots of a language are evaluated in the way described above, we tabulate the counts of contexts per paradigm that support specific pairwise rankings (first and second, first and third, second and third). We then perform statistical analyses to determine whether or not a specific ranking (say, $1 \succ 3$) plays a significant role in shaping the paradigms of each family in diachrony. For this, we use two approaches.

The first approach, called here a *set-based approach*, takes each paradigm in a family to be the result of an independent diachronic trial (a particular instance of morphological evolution), so that a paradigm has a certain number of contexts that support a given ranking hypothesis, e.g. there may be 6 out of 8 relevant contexts that support a $1 \succ 3$ ranking. We then test for each ranking whether the number of its supporting contexts significantly exceeds what can be expected under the null hypothesis of a plain chance process, i.e. that there are about

as many contexts that support the ranking as there are contexts that contradict the ranking.[9] This results in *p*-values for each ranking hypothesis, i.e. probabilities that the observed counts result from the chance process assumed by the null hypothesis. These values are then collected from all paradigms in the family. Such a collection amounts to multiple testing of the same hypothesis, inflating the risk of false positives. In response to this, we correct the *p*-values using the Holm-Bonferroni correction. Finally, we compute the proportion of paradigms that significantly support a given ranking hypothesis and take this proportion as an index of the extent to which the paradigms were shaped in their development by the given person ranking.

The second approach, called here a *tree-based approach*, adapts methods from computational phylogenetics for estimating the extent to which the evolution of a trait (here rankings) is biased towards a certain optimum value, i.e. adapts to this value as the result of selection pressure (following Hansen 1997, Butler & King 2004 and using the algorithms implemented in Harmon et al. 2008 and Paradis et al. 2004). We take the proportion of counts that support a given ranking as a continuous trait that a paradigm can have, e.g. a value of $\frac{6}{8} = .75$ in the example above. We then fit two evolutionary models per family tree and per pairwise ranking hypothesis: first, a simple model of Brownian motion, where at each node in the tree, the proportion randomly changes in no specific direction, i.e. without a preference for or against a hypothesized ranking; the only parameter of this model is σ^2, the amount of random (normally distributed) variation. The second model is what is known as an Ornstein-Uhlenbeck model and assumes that there is a preferred optimum proportion towards which paradigms evolve with a certain strength in a family. In addition to σ^2, this model has parameters θ for the optimum value and α for the strength of attraction to this value. The parameters of both models are estimated via maximum likelihood. The models are then compared using likelihood ratio tests assuming a χ^2 distribution with degrees of freedom equal to the difference in the number of parameters. Since the parameter estimating procedures are not bounded to the [0,1] interval that is inherent to the proportions we examine, we apply an arcsine square root transformation to the proportions before model fitting.

For model fitting, we set all lengths of branches between nodes in the trees to 1, assuming that each change in a paradigm requires the birth of a new language, i.e. a new node, and that rates of non-cladogenetic change elsewhere in the language (e.g. lexical change in cognate replacement) have no impact on the number of opportunities for restructuring of a paradigm. These assumptions are consistent with the research tradition in historical linguistics and also with more recent observations that structural change tends to be characterized by punctuated evolution (Dediu & Levinson 2012).

The two approaches have the same goal but differ in a number of ways. The set-based method has a relatively weak power of detecting relevant signals because the overall counts of relevant contexts are low and the method does not directly model diachronic trajectories. The advantage however is that the method does not assume that each diachronic process must have followed a tree but also allows for areal diffusion effects or wave models of a family (François 2014). The tree-based method has the advantage that it is more powerful (because it depends less

[9] Technically, our null hypothesis assumes a Bernoulli process with a .5 probability of success. Note that if there are no contexts in a paradigm that are relevant for a specific ranking, we simply assume the null hypothesis.

on the total counts) and that it directly targets diachrony. The disadvantage is that the method only allows changes along a tree and not for example along the waves in a dialect landscape.

Given this mix of advantages and disadvantages we apply both methods and expect that if a given ranking has an effect it is detectable by at least one of the methods, and if the effect is strong, by both methods.

We apply the two methods to the entire families but in the case of Kiranti, we also examined possible signals within each of the major sub-branches, Western and Central-Eastern Kiranti (Figure 1).[10] We do this because there is no reason to assume that a shaping force of rankings can only be detected in the deeper time span that the entire family represents. It could also be a more shallow effect. For Algonquian our sample is too small for testing the hypothesis within shallower branches.

5.3 Results

The aggregated output of the algorithm is shown in Table 6 for the Kiranti languages and in Table 7 for the Algonquian languages. The numbers in the tables are the counts of contexts where a particular ranking of person values can be observed as evidenced by an agreement marker winning a competition against another marker (or markers) in a particular cell of a paradigm.

As the shape and size of paradigms vary across languages, the bare numbers in the tables cannot be directly compared. What can be directly compared, however, is the preference for a particular ranking of two person features within a language. For example, in Plains Cree in ten contexts there is evidence for $2 \succ 1$ ranking, whereas in four contexts there is evidence for $1 \succ 2$ ranking. Eight of these ten contexts correspond to the eight cells of the paradigm where in the prefix slot the prefix *ki-* '2' wins over the prefix *ni-* '1', as illustrated by the data in (4) above. These are the four cells with a second person (singular and plural) acting on a first person singular and first person plural exclusive and four cells with the second person (again, singular and plural) being acted upon by the first person singular and first person plural exclusive. Two more points for the $2 \succ 1$ ranking come from the distribution of the suffix *-nāwāw* '2p', which in the two paradigm cells where the second person plural interacting with the first person singular wins over the competing suffix *-n* '1s/2s' (cf. Zúñiga 2006:78). The four points in support of $1 \succ 2$ ranking stem from the distribution of the suffix *-nān* '1pEXCL', which blocks the suffixes *-nāwāw* '2p' (in two paradigm cells) and *-n* '1s/2s' (also in two paradigm cells).

Table 8 summarizes the results from the set-based method. Applying this method to the counts in Kiranti (from Table 6) shows that the proportion of paradigms that show a significant preference for a given ranking never exceeds .13 in the family as a whole (for $2 \succ 3$). Western Kiranti reaches a proportion of .29 for $1 \succ 3$ and Central-Eastern Kiranti a proportion of .21 for $2 \succ 3$.

These results are confirmed by the tree-based method, where none of the rankings in Kiranti (as a whole or limited to a sub-branch) was found to be statistically better supported by a model with a preferred optimum proportion (Ornstein-Uhlenbeck model) than by a model with no

[10] An R script performing all statistical analysis is available in the Supporting Online Material.

Language	TAM	1≻2	2≻1	1≻3	3≻1	2≻3	3≻2
Athpare	IND	0	4	2	1	4	0
Bahing	NPST.IND	4	0	8	0	2	0
	PST.IND	4	0	8	0	2	0
Bantawa	IND	0	0	1	0	1	0
Belhare	IND	8	2	0	0	1	0
Camling	IND	2	1	8	0	13	0
Chintang	NPST.IND	9	6	14	0	3	0
Dumi	NPST.IND	5	0	0	0	2	0
Jero	IND	3	0	1	0	4	0
Kõic	NPST.IND	4	4	5	4	4	3
	PST.IND	7	4	5	4	3	4
Koyi	NPST.IND	8	0	17	0	4	0
	PST.IND	8	0	14	3	4	0
Kulung	NPST.IND	3	1	4	0	4	0
	PST.IND	3	3	4	0	4	0
Limbu	NPST.IND	0	0	0	0	6	6
	PST.IND	0	0	0	0	6	6
Lohorung	NPST.IND	0	0	4	6	0	1
	PST.IND	0	0	4	6	0	1
Puma	NPST.IND	2	6	7	2	12	1
	PST.IND	2	6	7	2	12	1
Wambule	IND	1	3	5	0	3	0
Yamphu	IND	3	3	1	3	2	1

Table 6: Pairwise ranking of person values in the Kiranti languages

Language	1>2	2>1	1>3	3>1	2>3	3>2
Arapaho	0	6	21	9	20	0
Blackfoot	2	8	4	0	0	0
Cheyenne	2	12	28	2	16	2
Eastern Ojibwa	2	8	28	0	16	0
Micmac	10	2	56	30	48	6
Munsee	2	8	28	6	16	6
Passamaquoddy	0	8	24	12	16	12
Plains Cree	4	10	48	12	27	10

Table 7: Pairwise ranking of person values in the Algonquian languages

such optimum (Brownian motion model) (all $p_{LR} > .1$). The only case where a model with an optimum proportion approached statistical significance was Central-Eastern Kiranti ($LR = 3.43$, $p = .064$), but here the optimum turns out to be for a mix of rankings, with similar optima for $1 \succ 2$ ($\theta = .47$) and $2 \succ 1$ ($\theta = .53$), both with weak strengths ($\alpha = 1.22$).

For Algonquian, the set-based method suggests that a proportion of .63 paradigms shows a significant preference for $1 \succ 3$ and $2 \succ 3$ rankings (Table 8). While this may point towards a weak diachronic bias, tree-based methods do not support it, regardless of whether one assumes a flat or a structured tree topology (all $p_{LR} > .1$). What the tree-based method does detect, however, is a bias towards a $2 \succ 1$ ranking. Models with a preferred optimum fit the data significantly better in the structured tree ($LR = 5.48$, $p = .019$, with an optimum of $\theta = .82$ in favor of the ranking that is selected with strength $\alpha = 2.72$) and almost significantly better in the flat tree ($LR = 3.59$, $p = .057$, with $\theta = .83$ and $\alpha = 2.72$). (Standard errors of θ were both $< .01$). The preference for $2 \succ 1$ in Algonquian is weakly confirmed by the set-based method, which shows that one quarter of all paradigms show a significant preference for the ranking (Table 8).

Family	$1 \succ 2$	$2 \succ 1$	$1 \succ 3$	$2 \succ 3$
Kiranti	0	0	.09	.13
Western Kiranti	0	0	.29	0
Central-Eastern Kiranti	0	0	.07	.21
Algonquian	0	.25	.63	.63

Table 8: Evidence for family-wise preferences for a given ranking against its opposite. The figures are the proportion of paradigms in a family that show a significant preference for the respective ranking in the header, with significance defined as Holm-corrected $p < .05$.

5.4 Discussion

Overall, our results suggest that hierarchical rankings of person are unlikely to have systematically shaped the evolution of agreement paradigms in Kiranti or Algonquian. The only evidence we found for a ranking to have played a role is the $2 \succ 1$ ranking in Algonquian and there is a slight bias towards ranking both first and second person over third persons in this family. The $2 \succ 1$ ranking has relatively good support from the results of tree-based modeling when assuming a highly structure tree topology. The support for $1/2 \succ 3$ is limited to the fact that slightly more than half of the paradigms show significant evidence for the ranking.

The particular relevance of the $2 \succ 1$ ranking has often been emphasized for Algonquian, going back to Wilhelm von Humboldt's (1836) first foray into the Massachusett language. The ranking is a trademark feature of this family, and clearly not a reflex of any universal pressure. This is perhaps different for the case of the $1/2 \succ 3$ ranking, which could be seen as the effect of universal pressure. But the evidence is weak and depends on the method chosen.

6 Conclusion

In this paper we showed that apart from differential argument marking, hierarchies affect argument marking in two ways: (a) through hierarchical marking, where markers compete for a slot and the competition is resolved by a hierarchy, and (b) through co-argument sensitivity, where the marking of one argument depends on the properties of a co-argument. While co-argument sensitivity cannot be analyzed in terms of hierarchical marking, hierarchical marking can be analyzed in terms of co-argument sensitivity. Hence, co-argument sensitivity is a notion that is needed for descriptive purposes while hierarchies are not needed. We further showed that once hierarchical effects are analyzed in terms of co-argument sensitivity, they allow examining alignment patterns relative to referential categories in exactly the same way as one can examine alignment patterns relative to referential categories in cases of other known hierarchy effects, such as differential argument marking. Hence, analyses in terms of co-argument sensitivity are suitable for comparative purposes as well. As a result, cases of hierarchical marking of any kind turn out not to present a special case in typologies of alignment and there is no need for positing an additional non-basic alignment type like 'hierarchical alignment'.

While hierarchies are not needed for descriptive and comparative purposes we also cast doubt on their relevance in diachrony: for at least two families whose agreement systems are often cited as being based on hierarchies, Algonquian and Kiranti, we find only weak evidence for the evolution of paradigms to be shaped by the way person categories are ranked. The only relatively robust evidence we find is for the ranking of second over first person in Algonquian, a ranking that is a well-known trademark of the family. Beyond this, there is a weak, and method-dependent signal in Algonquian paradigms to have been shaped by a preference for first and second person to be ranked above third person.

None of these rankings is replicated in Kiranti. This confirms the results from a large-scope typological survey study that shows that person hierarchies play no significant role in the evolution of agreement paradigms (Bickel et al. 2015b). On a more general level, our results are consistent with recent findings that referential hierarchies are much less important for argument coding (through agreement or case) than previously assumed (see also Filimonova 2005, Iemmolo & Schikowski 2015, Phillipps 2013, Fauconnier & Verstraete 2014, Bickel 2008, Bickel et al. 2015a).

Abbreviations

Abbreviations used in the glosses follow Leipzig Glossing Rules with the following additions: CONTR contrastive, d dual, DESID desiderative, G goal, INTER interrogative, INV inverse, ns nonsingular, p plural, s singular, SAP speech act participant.

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