Person, Number and Location : A Feature Geometric Approach to Sign Language Pronouns

4. Person, Number and Location: A Feature Geometric Approach to Sign Language Pronouns

Donovan Grose
The Hang Seng University of Hong Kong, Hong Kong SAR, PRC

Abstract

This proposal analyzes personal pronouns and locative adverbials, two types of referring expression (RE) in sign languages using a morphological feature geometry that includes conceptually-grounded contrasts in grammatical person, number, class as well as location. The grammatical properties of RE in sign languages are analyzed using sub-trees of this geometry which define their functional roles within the system. These modality-specific sub-trees result from the grammaticalization of both locative and personal RE from pointer gestures. RE systems in sign and spoken languages are functionally equivalent but represent different solutions to the same linguistic problem of identifying the referents of RE that are adapted to their respective modalities.

4.1. Introduction

This proposal argues for a theoretical 'patch' to the morphological feature geometric analysis of personal pronouns proposed by Harley and Ritter (2002) to address three related issues specific to personal pronominal signs in sign languages. Sign languages (SL) appear to violate the otherwise robust generalization that all languages make a three-way distinction between the 1st, 2nd and 3rd persons within their pronoun systems. It has been argued that SL grammaticalize only a 1st/non-1st contrast (Cormier, Schembri, and Woll 2013; Lillo-Martin and Meier 2011; McBurney 2002; Meier 1990; and others). Second, the referents of non-1st person pronominal signs are identified based on their real or conceptualized locations (Aronoff, Meir, and Sandler 2005; Koulidobrova and Lillo-Martin 2016; Liddell 1995, 2003, 2011; McBurney 2002; Lillo-Martin and Klima1990; Sandler and Lillo-Martin 2006; Wilcox 2004a, 2004b). Co-speech pointer gestures are similar in this regard, but personal pronouns in spoken languages do not encode locative contrasts. Finally, the pronominal systems of SL include forms that are categorical or fixed, but also forms that are flexible, analogue and context-dependent.

 The patch proposed here is an elaboration the feature geometry proposed by Harley and Ritter (2002) (hereafter H&R) to include the grammatical contrasts that are relevant for locative adverbials as well as those that are relevant for personal pronouns. These two

types of *referring expressions* (RE) are represented as nodes within a hierarchical dependency structure that defines the basic contrasts made by all languages and the particular ways in which individual languages may elaborate their RE systems. The grammatical properties of individual RE are represented with sub-trees of this larger structure which define the functional role or niche that the RE serves within the larger system. H&R's analysis includes contrasts in person, number and gender. Their feature geometry is expanded here to a set of locative contrasts relevant for both locative and personal RE in SL and to represent RE with default and shifted person and spatial deixis. This analysis argues that these same contrasts are relevant in spoken languages, but within separate grammatical systems. They have been incorporated into a single feature geometry in SL as a consequence of grammaticalizing both locative adverbials and personal pronouns from non-linguistic pointer gestures. The feature geometry includes only those contrasts that are grammatically relevant or visible to syntax. The analogue forms of some RE are attributed to interfaces between the semantic and phonological systems, but this analysis allows all RE to be analyzed syntactically in the same terms.

The next section discusses RE systems in spoken languages and then in SL. The current framework is presented in Section 4.3. Section 4.4 applies this expanded analysis to a representative sub-set of RE from American Sign Language (ASL). Conclusions and areas for further research are presented in Section 4.5.

4.2. RE Systems in Spoken Languages

RE systems in spoken languages are diverse, but they vary in particular ways and there appear to be limits on how simple or how elaborate these systems can be. It is not possible here to discuss the rich literature and various analyses proposed for these systems in any detail. Since this proposal is developed from H&R's analysis, this section focuses on the grammatical contrasts of person, number and to a lesser extent class/gender in free-standing personal pronouns. In all languages, RE are deictic referential morphemes that substitute for full noun phrases and which are assigned argument roles by the verb or predicate. In spoken languages, RE are categorical morphemes with lexicalized fixed forms (Harley and Ritter 2002; Meier 1990; and others). By definition, personal RE must minimally mark contrasts in grammatical person, which must be a distinction between RE referring to the source (1st person), RE referring to an addressee (2nd person) and RE that refer to other individuals or entities that are non-participants in the discourse (3rd person). In more elaborated systems, personal RE may also mark contrasts in grammatical number and class/gender. In some languages, RE are also case-marked, but case is set aside here. RE are deictic and so can refer to any number of potential referents, within its particular grammatical constraints (Wilbur 2013; Quer 2011). The intended referent of an RE is identified based on the grammatical and discourse context in which it appears. Because they are cateogorical morphemes, spoken language personal RE fit neatly into grammatical paradigms like those presented below for Cantonese (1) and English (2).

(1) Cantonese pronoun paradigm

	Singular	Plural
1st	ngo5*	ngo5-dei6
2nd	lei5/nei5	lei5-dei6
3rd	keoi5	keoi5-dei6

*5 indicates a low rising tone and 6 a level
low tone.

(2) English pronoun paradigm

	Singular	Plural
1st	I/me	we/us
2nd	you	you
3rd masc.	he/him	
3rd fem.	she/her	they/them
3rd neut.	it	

The Cantonese system in (1) illustrates a minimally elaborated system that marks only a three-way person contrast within RE. It does not have a grammatical gender system and all pronouns are singular by default. Multiple referents are indicated with morpheme *dei6* (Matthews and Yip 1994). The English pronoun paradigm in (2) is relatively more elaborated but it is also irregular. English marks number and case in the 1st and 3rd persons, but not in the 2nd. A three-way gender contrast is marked in the 3rd singular, but not 3rd plural. These irregularities are the results of historical changes in which gender contrasts were lost in 3rd person plurals, followed later by the loss of all 2nd person forms other than *you* (Mugglestone 2012). Irregularties like these are another source of diversity within RE systems that must be taken into account.

The English gender system makes a distinction between masculine, feminine and neuter, but two-way masculine/feminine distinctions are made in other languages like Spanish and French. Many languages do not have grammatical gender, but like Cantonese some of these languages have more elaborate class systems involving perhaps dozens of grammatical classes marked with dedicated classifier morphemes (Matthews and Yip 1994). Likely due to the sheer number of contrasts, these class contrasts are not marked in personal RE.

Grammatical number systems also vary across langauges. Cantonese illustrates one strategy in which person and number are marked with separate morphemes. In English, the 1st and 3rd persons illustrates an alternative strategy in which person and number are marked within the pronoun. Cantonese and English both grammaticalize the minimal contrast between RE that refer to a single referent and those that refer to multiple referents. Other languages make grammatical contrasts between singular, dual (specifically two referents) and plural (more than two referents) numbers. Of those languages with dual numbers, some make additional contrasts of either trial (specifically three referents) or paucal (several referents) numbers (Harley and Ritter 2002). The contrast between RE that refer to single referents and those that refer to multiple referents is traditionally labled a singular/plural contrast, but in fact only 3rd person RE which refer to multiple individuals and 2nd person RE that refer to multiple addressees represent true plurals, or multiple individuals of the same kind. RE with multiple referents that include the source (1st person) and/or a particular addressee (2nd person) together with other individuals are better understood as conjunctions of a particular referent, grouped together with other indivdiuals ('me and you' or 'me and them') (Cormier, Schembri, and Woll 2013; Harley and Ritter 2002). Directly related to this is the contrast in some languages between inclusive and exclusive 1st person non-singular RE. This contrast is not present in Cantonese or English, but many languages make a distinction between 1st person non-singular RE that include the addressee and those that specifically exclude the addressee. These contrasts and the distinction between plurality and conjunction

are represented directly in H&R's feature geometry.

If issues of case-marking and formal/informal contrasts in the 2nd person are set aside, a minimally elaborated RE system in a spoken language marks only a three-way person contrast. The most elaborated systems personal pronouns include a three-way person contrast, inclusive/exclusive contrasts, four grammatical numbers (singular, dual, trial or paucal and plural) and a three-way contrast in grammatical gender (Harley and Ritter 2002). Spoken language RE do not identify referents based on their locations.

4.2.1. RE in Sign Languages

The RE systems in SL are in many ways similar to those in spoken languages, but in other ways they seem to be both simpler and more complex at the same time. SL do not form a single language family and many are complete isolates. SL also vary in terms of their relative language age from centuries to only decades. Only a minority of SL are reasonably well-documented and very little is known about many others. Recognizing these issues, in this section reported claims about RE in SL are qualified with 'some' or 'many' to avoid possible over-generalizations.

While they are diverse in many ways, the RE systems of at least documented SL tend to be broadly similar in certain ways. Beginning with class/gender and number contrasts, as a group, SL do not seem have grammatical gender systems (Cormier et al. 2013). In this regard, they are like many spoken languages. The grammatical number systems vary across SL, as they do in spoken languages. Some SL have minimal systems with only singular and plural contrasts while others grammaticalize as many as four numbers. Composite forms have also been reported that indicate multiple referents with multiple points (Cormier 2005; 2007; 2012), but these forms will not treated as individual RE here. Across SL, grammaticalized plural non-1st person forms are generally marked with a horizontal arc movement directed towards the referents' physical positions or a referential location (R-loci) in the signing space associated with the referents (Cormier 2014; Cormier et al. 2013; Rathmann and Mathur 2011; and others). Many SL have a grammaticalized dual forms with a repeated movement of the ᴋ-handshape (✍) between the locations of the two referents. Cormier (2005) identifies a possible trial form composed of the 3-handshape (✍) with a circular movement in the signing space. It is possible that this form is a product of numeral incorporation rather than a true trial RE (Cormier et al. 2013), but presumably if an SL were to grammaticalize the trial number it would do so from productive forms with numeral incorporation. Some SL also distinguish between inclusive and exclusive 1st person plurals. In ASL, the inclusive ᴡᴇ.incl, with two points of contact on either side of the signer's chest includes the addressee in its referents. The exclusive ᴡᴇ.excl which does not include the addressee, is displaced so that both contract points occur on the signer's dominant side (Cormier 2005).

In general, it seems that relatively older SL tend to have more elaborated RE systems while those of younger SL tend to be less elaborated. Since grammaticalization takes time, these differences may be a function of language age but it is not necessarily the case that RE systems become more elaborate over time. Cantonese has a very long history but a minimal RE system, and the English system has actually been simplified over time. The

fact that the RE systems in unrelated SL are similar is interesting, bcause if two or more unrelated and geographically distant SL evolve similarities in their RE systems, they must have done so independently. Especially in terms of person marking, RE across SL tend to be similar in ways that set them apart from RE in spoken languages.

Here ASL is used to illustrate person marking in RE, with the understanding that SL differ in other ways. In ASL and other documented SL, non-1st person RE glossed collectively as INDEX have a fixed handshape (👆 or ✍) and movement but flexible context-dependent places of articulation (POA) and orientations so that they are directed towards a referent's position in space or towards a R-loci. In ASL, 1st person RE are categorical morphemes with fixed forms composed of a point to the source's (S) chest (3a). Non-1st RE are illustrated with INDEX directed towards the addressee (A) in (3b) or towards a R-locus standing-in for a non-present individual (N) in (3c).

(3) Personal pronominal signs in ASL

a. ME
   (S to self)

b. INDEX_A
   (S to A)

c. INDEX_N
   (S to non-participant)
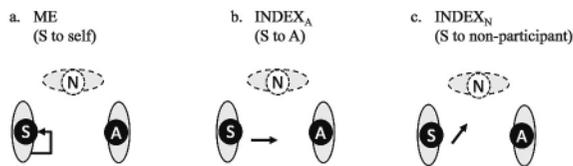
Wherever the source and addressee happen to be positioned relative to each other, an INDEX referring to the addressee is directed towards that person's position, generally towards the torso. This is also true for INDEX signs directed towards the R-locus of non-present individuals, as though the referent were actually present at the R-locus (Liddell 2003). In at least one village SL, Kata Kolok from Bali in Indonesia, R-loci like that in (3c) are not used to refer to non-present referents. Instead, the INDEX is directed towards the real-world position of the referent, or towards a house or another place associated with the referent (Perniss and Zeshan 2008; de Vos 2012). Whether or not Kata Kolok is unique in this regard, it shows that even in terms of person marking, SL may vary.

Inanimate objects cannot participate in a discourse, but INDEX signs referring to objects are otherwise similar to those in (3) referring to animate persons. At least in some SL, the palm is oriented downwards towards the x-plane when INDEX refers to objects and sideways towards the midsagittal z-plane when the referent is a person (Cormier et al. 2013; Pfau and Steinbach 2006).

(4) INDEX referring to inanimate entities in ASL

a. INDEX_E
   (S to present entity E)

b. INDEX_F
   (S to R-locus)

c. INDEX_K
   (S to distant entity K)
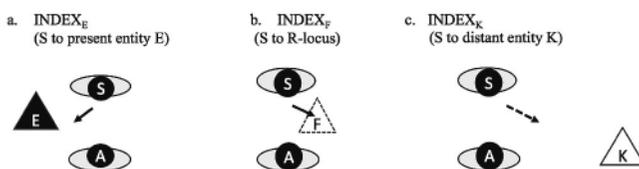
To refer to an object that is present in the discourse context, the INDEX is directed towards the object's position in space (4a), wherever that happens to be. Non-present objects are referred to by INDEX signs directed towards an R-locus established in x-plane of the signing space (4b), much like in (3c) above. When directed at a R-loci in the x-plane of the signing space, INDEX signs tend to be oriented downwards or at an angle below horizontal. This helps to distinguish these RE from those like that in (4c) that refer to a distant entity located outside the discourse context and beyond perceptual range. These forms tend to be elevated at an angle above the horizontal, with relative distance reflected in the elevation of the sign (Pfau and Steinbach 2006).

Non-1st person RE in SL use location to identify individual referents but refer to addressees and other individuals with the same handshapes and movements. It has been reported that at least in some SL, nonmanual markers are used to distinguish 2nd and 3rd persons (Alibasic Ciciliani and Wilbur 2006; Berenz 2002), but for other SL and it has been argued that RE systems include only a contrast between 1st and non-1st person RE. If this be the case, then these SL would violate two otherwise robust generalizations that apply across spoken languages: SL make a two rather than a three-way person contrast and SL use the location to identify the referents of personal RE. SL also use similar forms similar to non-1st RE within locative adverbials to refer to 'bare' locations.

(5) INDEX referring to locations in ASL

a. HERE discourse location   b. INDEX$_{Loc2}$ proximal location 'here'   c. INDEX$_{Loc3}$ distal location 'there'   d. INDEX$_{Loc4}$ exterior location 'there'
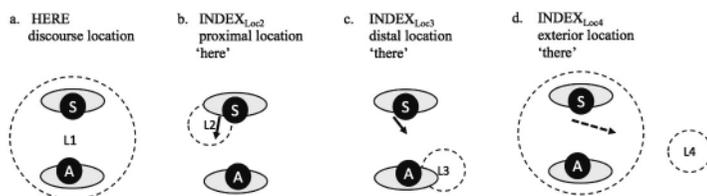
In (5a), the sign HERE is a lexical non-pointing sign that refers to the shared discourse space containing the source and the addressee, and like the 1st person RE ME in (3a) it has a fixed form. The variants of INDEX in (5b-5d) like those in (3b) and (4a and 4d) are flexible and refer to locations within the real-world ground. In the situation represented in (5b), the INDEX is oriented downwards at a steep angle referring to the source's location or a location proximal to the source. In (5c), the INDEX refers to the addressee's location or somewhere nearby and because the referent is further away from the source, the form has a shallower downward orientation below the horizontal. When an INDEX refers to a location outside of the discourse as in (5d), it tends to be oriented at an angle above the horizontal, similar to (4c) above. Bare locations are not individuated like the persons and entities in (3-4), so they cannot be associated with individual R-loci like (3c) and (4b). Instead, the spatial deixis is shifted from the real-world ground to the indexical ground of signing space.

4.2.2. RE and the Lexicon
RE in SL with fixed categorical forms can be 'listed' or represented within the lexicon as individual units, but the RE with flexible forms have raised questions about how these traits

are represented in the lexicon, if at all. Given their apparent similarities with pointer gestures and assuming that language and gesture are two parts of a single system, which in SL are both channeled through the same modality, it has been argued that RE in SL represent fusions of lexical and gestural components (Liddell 2003, 2011; and others). In this view, the flexible components, the POA and orientation, are not represented in the lexicon and are not grammatically relevant.

Assuming that language and gesture are distinct but interconnected systems, an alternative approach argues that RE in SL are underspecified syntactically for person features and phonologically for POA and orientation, and are represented within the grammar as abstract referential indices (R-index) that are provided with person values, and POA and orientation by the context in which they are used through an interface with gesture (Lillo-Martin and Meier 2011; Meier 1990; and others). In a sense, the context provides many values to the syntactic and phonological representations of RE just as it does for their deictic semantic representations. By relying so heavily on context, RE systems in SL are more powerful than the more heavily grammaticalized systems in spoken languages, because their forms are able to identify referents individually.

As an alternative to an analysis based on abstract R-indices, the grammatical contrasts encoded in personal RE may be represented with a small set of binary features. If the same person contrasts are relevant for both agreement markers and personal RE, then this might be done with as few as two: [+/-1] distinguishing 1st and non-1st person RE; and [+/-plural] to distinguish singular and plural. The unspecified or un-lexicalized components of the RE and in particular the analogue components of the form would then be provided by an interface with the gestural systems (Rathmann and Mathur 2002, 2011; Mathur 2012).

Many of the proposed solutions to the issue of analogue forms involve gesture one way or another. However, there are analyses for which both the fixed and flexible components of SL RE are analyzed entirely linguistically (Wilbur 2013; Quer 2011). Wilbur (2013) argues that the linguistic uses of space in SL to encode semantic notions of location, motion and time involves interfaces among semantics, phonology and syntax, but not gesture. Gestural expressions and signed linguistic expressions may use space and movement in similar ways, but only the latter conform to linguistic constraints.

The model of the faculties of language and gesture and their relationships with each other and of the lexicon (Koulidobrova and Lillo-Martin 2016) are required in order to determine which of these various approaches best addresses the issues related to the context-dependent forms analogue RE. For this purpose, the next section presents a modified version of Parallel Architecture that also suggests a pathway by which SL RE evolved from pointer gestures.

4.3. Framework: Language and Gesture

The model of the faculties of language and gesture adopted here is a modified version of Parallel Architecture developed by Jackendoff (1997; 2002; 2007). In this model, the faculty of language (FL) and of gesture (FG) are analyzed as two networks linking Perceptual/ Articulatory Systems (PAS) and Conceptual/Intentional Systems (CIS). These networks are

composed of systems that operate in parallel, linked to each other through interfaces that are elaborated and modified through learning. Each system operates in its own format following its own principles of combination and is only selectively sensitive to the input it receives from other systems:
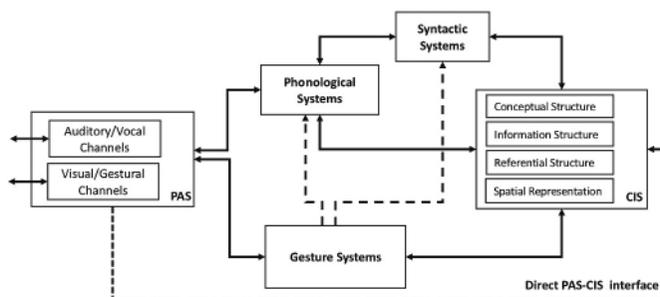

Figure 4-1 The architecture of the faculties of language and gesture

The FL is comprised of those parts of PAS associated with linguistic form, Phonological Systems (PS), Syntactic Systems (SS), those parts of the CIS associated with linguistic meaning and the interfaces linking these systems together. SS generates and parses syntactic structures and PS does the same with phonological and prosodic structures. With CIS, there is no distinction of level between semantics and pragmatics, but there are four tiers of meaning relevant for linguistic meaning: symbolic and propositional conceptual structure, information structure, referential structure and analogue spatial representation.

The FG is comprised of those parts of PAS associated with gestural form. Gestural Systems (GS) is comprised of those parts of the CIS associated with gestural meaning and the interfaces linking these systems together. GS produces and parses voluntary gestures (McNeill 2005, 2012, 2016; Kendon 2000, 2004; and others), including iconic or representational gestures, symbolic gestures or emblems, beat gestures and most importantly here, pointer gestures. There are interfaces linking GS with PS and with SS allow gestural and linguistic expressions to be coordinated within composite utterances.

The conceptual content from CIS is expressed both gesturally and linguistically. Because they are processed by PS and SS, linguistic expressions are phonologically and syntactically structured; gestural expressions are not. For both signers and non-signers, gestural expressions are routed through the visual/gestural channels of PAS. In SL they share these channels with linguistic expressions, which in spoken languages are routed through the auditory/ vocal channels. Basic FL and FG are universal, but they are elaborated in different ways with inventories of learned linguistic and gestural traits that make up individual linguistic and gestural systems. These traits represent small-scale interface rules (Jackendoff 2002; 2007) or sub-networks within these systems. The inventory of these traits within FL, the lexicon, includes sub-networks representing morphemes and lexemes as well as any other part of a language that must be learned and stored in long-term memory (Jackendoff 2002;

2007). Categorical RE morphemes are traits composed of semantic components visible to CIS, syntactic components visible at SS that determine their behavior and interactions within the grammar, and phonological components visible at PS that determine their possible forms. Limited as they are by the auditory/vocal modality, the forms of RE in spoken languages are constrained within a very narrow range. SL are not limited in the same ways, allowing for analogue RE with forms that vary within much broader ranges. Semantically and syntactically categorical and analogue RE are represented in the same terms. There is no issue of listablity for the deictic meanings of RE that can refer to any number of potential referents (Wilbur 2013; Quer 2011), nor in this model is there an issue with the listability of RE with analogue forms.

Pointer gestures help to establish shared attention and appear very early in development (Kita 2003; Goldin-Meadow 2003, 2005). If RE evolved in SL from pointer gestures through gradual conventionalization and grammaticalization they would have displaced them. Since signers use both pointer gestures and RE, they must have evolved through a different pathway. The model in Figure 4-1 suggests a pathway involving at least four changes, which with this model may have occurred sequentially or in parallel. First, at the very beginnings of each SL, signers must have rerouted the pointer gestures used by others through FL rather than FG. Second, these elements would phonologically and syntactically reanalyzed at FL. At PS this would involve reanalyzing holistic gestural forms in terms of the available contrasting handshape, movement and POA features. Based on their meanings and functions in context, at SS pointer gestures would be reanalyzed in terms of the available person, number, class and importantly locative grammatically relevant contrasts. Third, the resulting phonological and syntactic representations would have to be learned and added to these signer's linguistic competence states. Finally, these signers must have used these new linguistic traits to produce linguistic expressions from which they could be learned as indivdual RE and as a system by others and spread within the population. Note that at least initially, this evolutionary pathway does not require obvious changes in surface forms or to the deictic meanings of these elements, but the resulting linguistic traits would be phonologically and syntactically structured.

4.3.1. Framework: A Feature Geometric Analysis of Person and Number

The current proposal is an expansion and modification of the H&R's analysis of person and number contrasts, designed to explain both cross-linguistic universals and variation in RE systems. Pronouns have often been analyzed in terms of bundles of binary syntactic features, in which person is analyzed with the features [+/-source] and [+/-addressee], gender is analyzed with [+/-masculine] and [+/-feminine], and number with [+/-plural]. For languages like Cantonese (1), this works well enough, but for languages like English (2) this approach is far less elegant. To account for RE in English with binary features, it must be stipulated that [+/-source] and [+/-addressee] are always active, but [+/-plural] is active only in 1st and 3rd persons and gender features are only active in the 3rd singular. Accounting for dual, trial and paucal numbers in those languages that have them also requires a cumbersome set of rather arbitrary features (i.e. [+/-dual], [+/-trial], [+/-paucal]).

H&R argue that analyses of RE using unstructured bundles of features offer no principled

way of explaining why certain features are relevant, why certain features are only active in some languages, or why some features are active only if other features are also active. For example, it is possible to describe the relevant contrasts for agreement markers in SL using binary features, as Rathmann and Mathur (2011) show with [+/-1] (equivalent to [+/-source]) and [+/-plural]. However, it is difficult to account for why SL do not use [+/-addressee], or why no spoken language uses this bundle of features without also including [+/-addressee]. Language modality certainly plays a role, but it is difficult to explain how using unstructured bundles of syntactic features.

The solution H&R propose based on a dataset of 110 languages, including ASL (based on Pettito 1987), analyzes individual RE as sub-trees of a single morphological feature geometry in which the grammatically relevant contrasts that produce the observed person, number and class contrasts are represented as nodes within a hierarchical dependency structure. This feature geometry does not represent contrasts in case, or informal/formal contrasts:
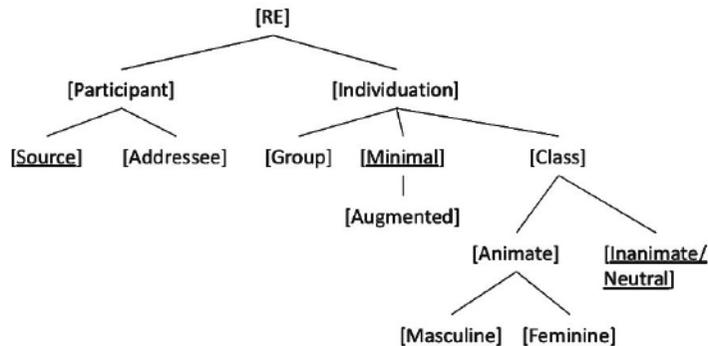
**Figure 4-2** Feature geometry of person, number, and class features adapted from Harley and Ritter (2002)

In this system, each personal RE is represented as a sub-tree of this full structure. To see how this system works it will be helpful to use examples of these sub-trees for English RE. The full node labels have been abbreviated in the interests of space:

(6) Sub-trees of English pronouns

```
 e.  he/him          f.  she/her         g.  it              h.  They/them

     [RE]                [RE]                [RE]                [RE]
      |                   |                   |                   |
    [Indiv]             [Indiv]             [Indiv]             [Indiv]
     ⌒                   ⌒                   ⌒                   |
 [Min] [Class]       [Min] [Class]       [Min] [Class]        [Group]
         |                   |                   |
        [M]                 [F]                 [N]
```
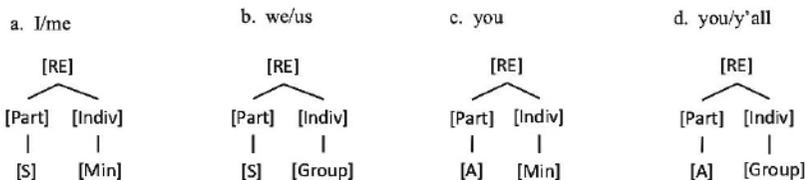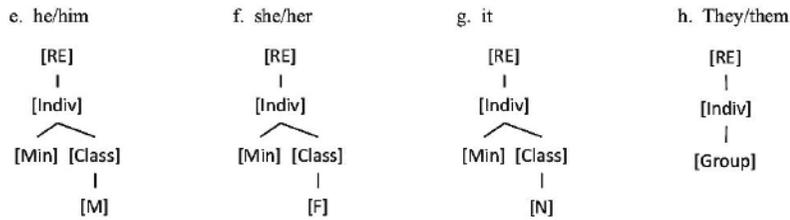
The sub-tree for each RE is dominated by the RE node. All personal RE sub-trees include the Individuation node under which contrasts in number and gender are represented; 3rd person RE contain only this node. The Participant node is present when a RE refers to the source represented with the Source node (relabeled here from H&R's original Speaker node), to the addressee with the Addressee node or to both. As the default value under the Participant node, Source is underlined in Figure 4-2. The sub-trees for English 1st person RE with the Source node are presented in (6a-b), those for 2nd person RE with the Addressee node are presented in (6c-d) and 3rd person RE lacking the Participant node are presented in (6e-g). Number contrasts are represented under the Individuation node with the nodes labeled Minimal (the default value) and Group. The contrasts between singular and plural 1st person RE in English is represented in (6a-b) and in the 2nd person in (6c-d). The sub-tree for plural 3rd person RE in English which lack class/gender features is presented in (6h). This analysis structurally represents the distinction between true plurality in 3rd person plurals (6h), and the conjunction of the source or addressee together with others in (6b) and (6d).

Gender contrasts are represented under the Class node. The default value for this node is Inanimate/Neutral (6g). In languages with gender systems, an Animate node dominates two nodes representing the grammatical Masculine (6e) and the Feminine (6f). With a default neutral value, this node allows languages without gender contrasts, but in languages with gender, it allows for 1st and 2nd person RE to be unmarked for gender. It is omitted here when not relevant.

Although they are not relevant for English and are discussed in relation to ASL below, dual numbers are represented with sub-trees containing both the Minimal and Group nodes, or a minimal group of two. The node labeled Augmented, together with Minimal and Group are used to represent either the trial or the paucal, which H&R argue do not co-occur within the same language. Additionally, in languages like ASL that make a distinction in the surface form, exclusive 1st person non-singular RE are represented in sub-trees with both the Source and Group nodes (6d). Inclusive 1st person non-singular RE include the Source, Addressee and Group nodes.

H&R's analysis accounts for all of the contrasts within the pronominal systems of the 109 spoken languages included in their data set. In the simplest systems, default Minimal and Inanimate/Neutral values under the Individuation node produce RE marking only 1st, 2nd and 3rd persons. In the most elaborated systems, sub-trees of the same basic structure allow for as many as four grammatical numbers, inclusive/exclusive contrasts across all non-singular numbers and three-way class/gender contrast across 3rd person RE. It is less

clear however how well H&R's analysis applies to all of the RE in ASL (the single SL included in their data set) or other SL. The feature geometry in Figure 4-2 does not include locative contrasts, which examples (3) and (4) show are relevant for SL RE systems, and this system seems to require all languages to distinguish between 2nd and 3rd persons. The next section proposes modifications and expansions to this analysis which address these issues.

4.3.2. The Expanded RE Feature Geometry

A feature geometric analysis of RE that applies to SL must do three things: it must apply to both categorical and analogue RE; it must include those locative contrasts that are relevant for analogue RE; and it must explain the apparent lack of a contrast between 2nd and 3rd persons. The first issue can be addressed rather easily. It is not actually necessary to assume that RE must be categorical morphemes, even if they must be in spoken languages. The SS representations of RE can be analyzed in feature geometric terms without assuming that the forms of RE are fixed at PS. In this view, the possible sub-trees of a feature geometry define roles or niches with a RE system rather than syntactic features of individual RE themselves. Some of these niches must be filled for the system to be stable, but other niches are optional. Spoken languages must fill these niches using RE with fixed forms, despite the fact that their referents vary with context. SL are able to fill some of these niches using RE for which both the form and the referents vary with context.

The issues of locative contrasts within SL RE and contrasts among non-1st person RE are addressed here with expansions of H&R's feature geometry. Locative contrasts can be represented in feature geometric terms, but in spoken languages, locative adverbials and personal RE represent distinct grammatical sub-systems associated with distinct feature geometries so these contrasts are not relevant for personal RE in spoken languages. This analysis argues that as a consequence of grammaticalizing both locative adverbials and personal RE from pointer gestures, SL have evolved modality-specific RE systems that incorporate locative contrasts together with person and number contrasts within a single system represented as a single feature geometry. However, if locative contrasts are to be incorporated within an expanded RE feature geometry, it must be done so in a way that allows these contrasts to be relevant for some personal RE in SL, but not others. This expanded RE (xRE) feature geometry is presented below:
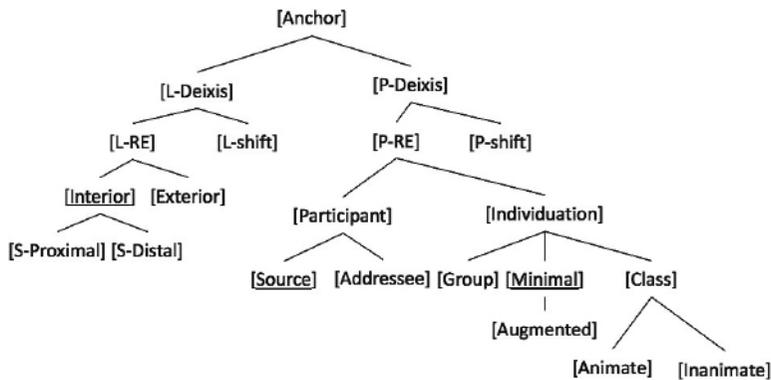
Figure 4-3   The expanded RE feature geometry

In the xRE geometry (Figure 4-3), H&R's RE geometry representing person and number contrasts is incorporated directly here under the node labeled R-RE, but the structure is elaborated in two directions. There is an additional branch of the structure under a node labeled L-RE which dominates sub-structures representing locative contrasts. The substructures under L-RE and P-RE (or the L and P branches) are united together with elaborations to the top of the tree to represent the contrast between those RE with default deictic values and those with shifted deictic values. At the very top of the tree is the Anchor node, representing the deictic anchor from which values all RE are calculated. Adapting an element from Cowper (2005), Anchor immediately dominates two nodes termed L-Deixis and P-Deixis representing the separate spatial and person deictic centers that are relevant for the respective L and P branches of the tree.

The default value of P-Deixis identifies the signer as the source participant. The node labeled P-shift, identifies the source as someone other than the signer. Since sub-trees of this geometry represent individual RE, this is distinct from the phenomenon of role-shift, marked with a shift in the signer's body orientation (Lillo-Martin 1995; Engberg-Pederson 1995). The default value of L-Deixis centers the locative values of RE relative to the position of the signer, as the anchor and source, within the discourse space shared with the addressee. With the node L-shift, locative values of individual RE are shifted from the real-world ground of the discourse location to the indexical ground of the signing space, allowing referents that are outside the discourse location to be treated as though they are within it.

The sub-structures proposed here under the L-RE node are provisional and are elaborated only enough to account for the locative contrasts relevant for distinguishing non-1st person RE in SL. This includes two contrasing nodes termed Interior and Exterior, representing the grammatical contrast between referents within the discourse space (the source and addressee), and referents that are external to it. The Interior node is the default locative value. Although this contrast is not relevant for spoken language personal RE, it is relevant for locative adverbials, as illstrated below:

(7) Sub-trees for English locatives *here* and *there*

a. *here*   b. *there*

   [Anchor]   [Anchor]
      ⋮   ⋮
   [L-RE]   [L-RE]
      | |
   [Int]   [Ext]
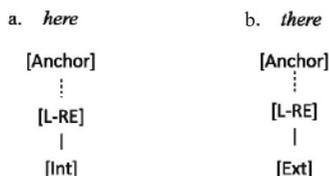
Relative to some other spoken languages, the English locative system is rather minimal and *here* and *there* (7) are also used to make proximal and distal distinctions relative to the source within the discourse space. The sub-structure under the Interior node is provisionally elaborated with two nodes termed S-Proximal and S-Distal representing the contrasts within the discourse space between the location of the source and the location of the addressee, illustrated in (5b-c) above. These values are always calculated relative to the source and shift with changes in discourse roles in the same way that the referents of 1st and 2nd person RE do. The next section analyzes locative and personal RE in ASL as sub-trees of this expanded feature geometry.

4.4. RE Sub-trees in SL

This section presents sub-trees for RE in SL in four groups: locative RE referring to bare locations; RE referring to the source (1st person referents); RE referring to addressees (2nd person referents); and RE referring to non-participants (3rd person referents). Again, these sub-trees represent only those contrasts that are grammatically relevant and visible at SS. The forms of these RE, whether fixed or flexible is handled at the interface between CIS and PS.

Locative RE, corresponding to variants of INDEX illustrated in (5) above, refer to bare locations. The sub-trees for these RE contain only nodes from the L branch of the tree:

(8) Locative RE in ASL

a. HERE   b. INDEX$_{Ext.Loc}$ c. INDEX$_{Prox.Loc}$ d. INDEX$_{Dist.Loc}$
                        'over there'   'right here'   'there'

   [Anchor]   [Anchor]   [Anchor]   [Anchor]
      ⋮   ⋮   ⋮   ⋮
   [L-RE]   [L-RE]   [L-RE]   [L-RE]
      | | | |
   [Int]   [Ext]   [Int]   [Int]
                                                     | |
                                                  [S-Prox]   [S-Dist]
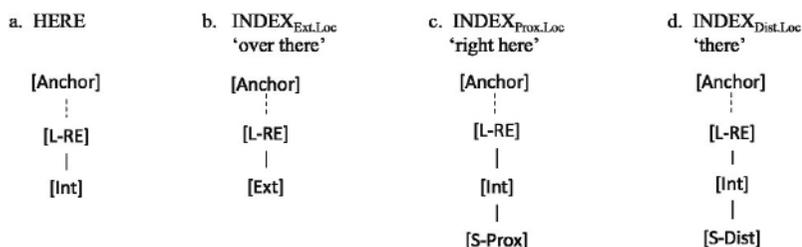

In (8a), HERE refers to the discourse location containing the source and addressee and its sub-tree includes only the default Interior node. This sub-tree helps account for why this RE has a fixed form, while the locative RE corresponding to (8b-d) are flexible. Because HERE always refers to the source's location, grammatically its locative value does not change.

In contrast, the locative values for the RE in (8b-d) vary with context and so do their forms. The lables provided for these forms (i.e. INDEX$_{Ext.Loc}$) and for other analogue RE below represent a range of forms associated with a sub-tree not a specific sign. The sub-tree in (8b) represents RE referring to locations outside or exterior to the discourse location. This sub-tree corresponds to forms like that in (5d) with the INDEX oriented parallel to or at some angle above the horizontal x-plane. RE referring to locations within the discourse, limited here to the location of the source and the location of the addressee, are represented with sub-trees containing either the S-Proximal (8c) or the S-Distal (8d) nodes. These RE refer to locations within the real-world ground, rather than to the source or addressee as persons. In order to refer to the source's location rather than the source as a person, the form is oriented directly downwards. To refer to the location of the addressee the form is oriented at an angle below the horizontal. The actual POA of these forms are determined by the positions of the participants.

   The sub-trees for the RE in (8) containing only the L branch and so can be contrasted with fixed 1st person RE in ASL which contain only the P branch in (9):

(9) Fixed RE referring to the source in ASL
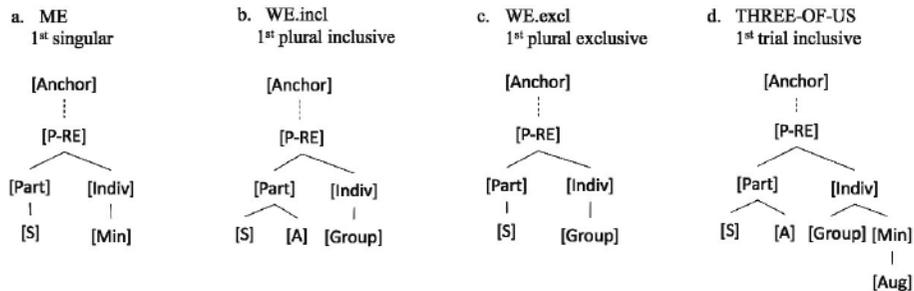
The sub-trees for ME in (9a) and WE.excl in (9c) are otherwise similar to the sub-trees for the English *I/me* and *we* presented in (3) above. Like HERE, the sub-tree for ME contains only default values. Although its referent changes depending on who is using it, it always refers to the source. In (9b), the inclusive WE.incl involves two points to the signer's chest, one on each side of the mid-line, and includes both the source and addressee within its referents. The form of WE.excl in (9c) which, displaced towards signer's dominant side excludes the addressee (Cormier 2005; 2012). Dual RE that include the source are represented in (10c) below, but the sub-tree for THREE-OF-US is represented in (9d) provisionally as a trial RE with the Group, Minimal and Augmented nodes.

   It is possible using only H&R's original RE feature geometry to analyze all of the ASL RE represented in (9), but of course none of the locative RE in (8). With the xRE geometry including locative, person and number contrasts, it is possible to analyze these RE and non-1st person RE as sub-structures of the same geometry. This is shown first with RE referring to the addressee in (10):

(10) RE referring to the addressee in ASL

```
a.  INDEX_A                      b.  INDEX-arc_A               c.  US-TWO
    2nd singular/'you'               2nd plural                   1st dual inclusive

        [Anchor]                         [Anchor]                     [Anchor]
        /      \                         /      \                     /      \
    [L-RE]    [P-RE]                 [L-RE]    [P-RE]             [L-RE]      [P-RE]
      |        / \                     |        / \                |         /    \
    [Int]  [Part] [Indiv]           [Int]  [Part] [Indiv]       [Int]    [Part]  [Indiv]
      |      |     |                   |      |     |                      / \      \
  [S-Dist]  [A]  [Min]            [S-Dist]  [A]  [Group]              [S] [A]  [Group] [Min]
```
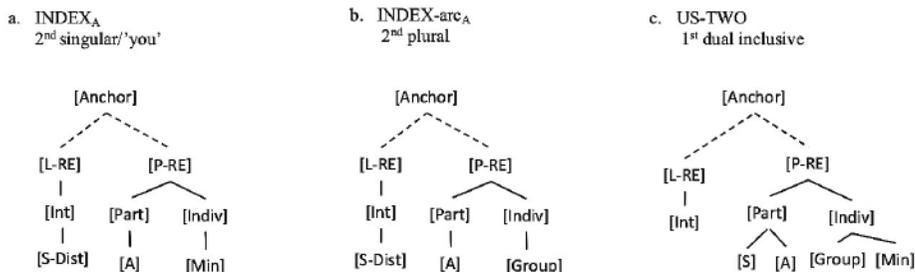
The sub-structures under the P-RE nodes in these sub-trees are otherwise similar to the sub-trees representing 2nd person RE in spoken languages (6c-d), but these sub-trees include the L-RE node, specifying the referent as interior to the discourse location. Since the discourse context includes only the source and addressee, the only available referent is the addressee. In (10a) the INDEX is directed at the addressee, wherever that person happens to be. Sub-trees corresponding to 2nd person plurals are represented with the Group node in (10b). The forms of these RE have a horizontal arc movement that includes the addressee's position within its sweep. The sub-tree for an inclusive dual RE referring to the source and the addressee is shown in (10c), with the κ-handshape (⟡) and a repeated movement between two referents. In the interests of space, the sub-trees for other dual RE with other combinations of referents are not presented here.

The sub-trees for non-1st RE referring to non-participating individuals are shown (11):

(11) RE referring to singular non-participants in ASL

```
a.  INDEX.int                  b.  INDEX.r-locus.              c.  INDEX.ext
    3rd singular interior          3rd singular shifted            3rd singular exterior

        [Anchor]                       [Anchor]                        [Anchor]
        /     \                        /      \                        /     \
    [L-RE]   [P-RE]               [L-Deixis]  \                    [L-RE]    [P-RE]
      |        |                     /  \      [P-RE]                 |         |
    [Int]   [Indiv]           [L-RE] [L-shift]  |                  [Ext]     [Indiv]
               |                |              [Indiv]                          |
             [Min]            [Ext]             |                             [Min]
                                              [Min]
```
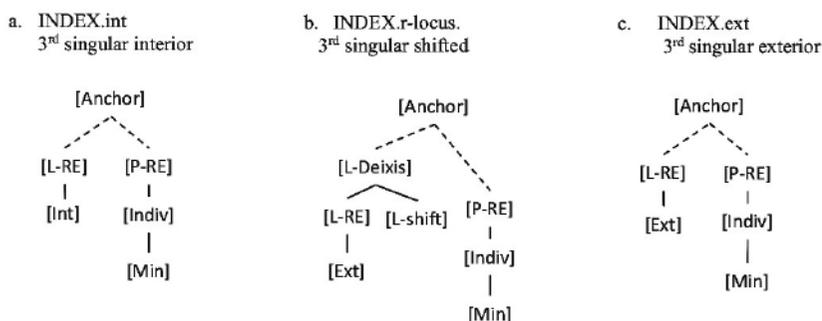
The sub-tree in (11a) represents RE referring to an individual or object that is physically present within the discourse location but not a discourse participant. For RE like this, the INDEX is directed towards its referent, which may be any referent other than the addressee. The different structures within the sub-trees in (10a) and (11a) reflect the fact that referents may be physically present without participating in the discourse. The sub-tree in (11b) represents RE referring to non-present or exterior referents that have been shifted to a R-locus within the signing space. RE referring to individuals that are exterior to the discourse

are represented in (11c). Most SL make use of the RE represented in both (11b) and (11c), but Kata Kolok is an exception, using only RE like that in (11c) to refer to non-participating individuals (Perniss and Zeshan 2008; de Vos 2012).

The sub-trees for RE referring to multiple non-participants are presented in (12). The forms of these RE in (12a-b) are otherwise similar to those represented by (10b), but must specifically exclude the addressee within the sweep of their horizontal arc movements. RE corresponding to (12a) refer to present non-participants with forms directed towards their physical position. In (12b) as in (11b), the locative value has been shifted to the signing space and the form is directed towards the R-loci representing the group. The form corresponding to (12c) is otherwise similar to that presented in (11c), but involves a repeated movement to indicate a group of multiple referents. The cluster of sub-trees represented in (12d) represents a single composite form composed of multiple points directed at individual referents, or a composite THEY.

(12) RE referring to plural non-participants in ASL
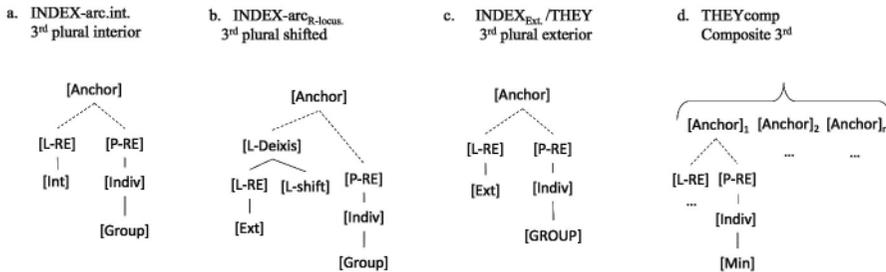
This section has shown how the grammatical contrasts relevant for RE in SL are analyzed using a grammatical feature geometry that incorporates locative, person and number contrasts into a single structure. The grammatical distinctions between RE referring to locations and those referring to persons are represented directly in the sub-trees of these RE. RE with fixed forms have sub-trees with only default values (HERE, ME) or otherwise lack locative nodes. RE with flexible forms include both locative and person nodes (the variants of INDEX). The POA and orientations of flexible RE are determined by context and are not represented within the xRE geometry.

4.5. Conclusion and Discussion

This proposal is intended as a theoretical patch to H&R's original analysis to allow it to be extended to RE in SL. It needed to tackle three issues: the apparent lack of 2nd and 3rd person contrasts in SL RE; the modality-specific combination of locative, person and number contrasts in some SL RE; and single RE systems with both categorical and analogue forms. Each of these issues are addressed with the xRE feature geometry. It is not the case that SL make three-way person contrasts with categorical morphemes in the same way that spoken languages do. SL have RE that refer to sources, addressees and non-participants

individually or in some combination that uniquely identify their intended referents. In feature geometric terms, this analysis shows that these contrasts are represented syntactically. In this view, it is accurate to claim that SL distinguish only 1st person RE with categorical forms, but SL RE also make grammatical distinctions between non-1st person RE referring to addressees and those referring to non-participants.

The RE systems in SL and spoken languages, regardless of their relative degrees of elaboration, are functional equivalents of each other because they have evolved to solve similar problems with each adapted to its specific modality. The otherwise 'unusual' combination of locative, person and number contrasts in SL RE is a result of this linguistic evolution. These grammatical contrasts are relevant in spoken languages, where locative contrasts and person and number contrasts are parts of separate systems. As a result of grammaticalizing both locative adverbial and personal RE from pointer gestures, these contrasts are incorporated into a single xRE feature geometry. This does not occur in spoken languages where locative adverbials and personal pronouns evolve separately (Heine and Kuteva 2012). This approach is consistent with the notion that syntax (SS), as part of universal FL, is uniform across all languages and involves the same sorts of features or contrasts. It is also consistent with the notion that languages evolve different ways of expressing these contrasts. The similarities in location and person marking in RE systems across unrelated SL can be attributed to the evolution of these traits from the same gestural precursors to fill the same linguistic niches or roles.

If as argued above, sub-trees of the xRE geometry are analyzed as defining grammatical niches within RE systems rather than properties of individual RE themselves, this proposal offers a way of analyzing all RE in the same terms regardless of whether their forms are fixed or flexible. The syntactic representations of all RE can be represented as sub-trees of the same xRE geometry. Locations in space or spatial representations are handled by CIS, not SS. RE forms, both categorical and analogue are represented at the interface between CIS and PS.

This brief proposal has focused exclusively on stand-alone personal pronominal and locative signs, but the same feature geometric approach may potentially be further modified and extended to other types of RE in SL. Koulidobrova and Lillo-Martin (2016) and McBurney (2002) have argued that the non-1st person RE glossed here as INDEX are best analyzed as or like demonstratives, which also involve variants of INDEX. If this is the case and the current proposal is on the right tract, then demonstrative RE would also be represented as sub-trees of the xRE geometry, perhaps with some additional modifications. There are also obvious similarities between personal pronominal signs and agreement/directional markers (Mathur 2012; Lillo-Martin and Meier 2011; Rathmann and Mathur 2002, 2011; Meir 2002, 2012; and others). At least a sub-set of these markers has been analyzed as person markers (Lillo-Martin and Meier 2011), and Quer (2011) argues that both person marking and spatial agreement markers can be unified under a single analysis. The xRE geometry offers one way of doing so. Only a sub-set of verbs are compatible with agreement markers, and it is unclear how a feature geometry can be modified to take verbal semantics into account, but this approach would allow locative, person and number contrasts to be represented together in the sub-trees corresponding to these markers.

Neither H&R's original nor the xRE geometry proposed here are able to represent class contrasts beyond two or three-way gender contrasts. Ideally, the sub-structure under the Class node would need to be elaborated to account for classifier morphemes in languages like Cantonese and the referential handshapes in SL classifier predicates (Sandler and Lillo-Martin 2006; Benedicto and Brentari 2004; Emmorey 2002, 2003; and many others). Classifier handshapes may provide important evidence relevant for the elaboration of the Class node, but these issues will be left for future research.

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