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The 'word' in polysynthetic languages: phonological and syntactic challenges*

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Polysynthesis presupposes the existence of 'words', a domain or unit of phonology and syntax that is extremely variable within and across languages: what behaves as a 'word' with respect to one phonological or syntactic rule or constraint may not behave as such with respect to other rules or constraints. Here we develop a system of variables that allows cataloguing all verb-based domains in a language in a bottom-up fashion and then determining any potential convergence of domains in an empirical way. We apply the system to case studies of Mapudungung and Chintang. These confirm earlier observations that polysynthetic languages do not operate with unified units of type 'word' in either phonology or syntax.

Keywords: word, clitic, affix, incorporation, head

1 Introduction

Consider the following data from Mapudungun (unclassified; Chile and Argentina), a canonical polysynthetic language:[1]

(1) Mapudungun
  a. *entu-soyüm-yaw-küle-i.*
  remove-shrimp-PERAMB-PROG-IND
  'They are going around gathering shrimp.' (Salas 2006:179)

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[1] For the Mapudungun data cited in this article, we follow the traditional *Alfabeto Mapuche Unificado* convention still widely used by linguists in Chile, which is specific about segmental representation but, quite like other spelling conventions (like the one used in Argentina, or the *Azümchefi*), not prescriptive in a principled way when it comes to word boundaries. With respect to the latter, we follow the sources cited almost everywhere — except when the issue of wordhood and/or morpheme type is at the center of attention and we draw the reader's attention to alternative or less conventional segmentation.

b. *pepi-rume-küme-wentro-nge-tu-rke-i-ngu.*
can-very-good-man-be-TEL-REP-IND-3DU

'Both of them were able to turn into very rich (lit. good) men, they say.' (based on Salas 2006:181)

Even though all studies that address examples like (1a) agree in treating them as instances of nominal incorporation, it is in fact an open issue whether the elements *entu-* 'remove', *soyüm* 'shrimp', and *yawküley* '[they are] going around V-ing…' indeed make up a single word, be it in syntax (syntactic word) or phonology (phonological word). While the case for this can be made, this is, as we will see in this chapter, a challenging enterprise. Mapudungun constructions like (1b) add another complexity: arguably under the influence of Spanish spelling conventions, those rare speakers of the language who write the language, would most likely choose a different spelling from the one chosen by Salas and other linguists, viz. something like *pepi rume küme wentru ngeturkeingu.* This would suggest that such speakers perceive or construe the whole construction as significantly larger than a word – as consisting of a modal marker *pepi* 'can', an NP *rume küme wentru* 'very rich man' and a semi-copula-like element *ngeturkeingu* 'both have become X, they say'. Lastly, note that (1a) and (1b) represent different kinds of complex expression: the former consists of a lexical verb root and a subject and a lexical object or incorporated patient, whereas the latter consists of a lexical NP that is the dependent of the semi-copula or is verbalized by some verb-like material and is subordinated to a modal element. Do we know that these two cases represent the same kind, and the same degree, of cohesion, either syntactically or phonologically?

Similar challenges arise in many languages that have been labelled polysynthetic in the literature. Our aim in this chapter is to highlight these problems and to sketch the outlines of the analytical tools that are neeed for solving them. We begin with a theoretical discussion of the parameters (variables) that are needed for addressing polysynthetic wordhood (Section 2) and then proceed to applications in invidual languages, focusing on Mapudungun and Chintang (Sino-Tibetan, Nepal) in Section 3, two systems which are quite different from each other and thus give a sense of the diversity that there is in polysynthesis. Section 4 concludes the chapter.

2 A multivariate approach to polysynthesis

Most explications of polysynthesis start from the observation of multiple 'semantically heavy' elements inside a word, variously explicated as 'heads', 'stems', 'lexical elements', 'predicates', 'arguments' etc.. But what is a semantically heavy element, and what is a word? Over the past few decades much progress has been made with regard to the second question. The notion of word has been successfully decomposed into phonological and syntactic words (starting in the modern sense with Dixon 1977),[2] and within these domains, it has become clear that many languages distinguish various non-isomorphic sub-domains: various phrase-structural projection ($\bar{X}$) levels or more vs. less tightly knit phrases in syntax, and various groupings like

[2] Terminology varies: instead of phonological, some authors prefer 'prosodic'; instead of syntactic, some authors prefer 'grammatical', 'morphological' or 'morphosyntactic'. We gloss over any difference that authors might make here because we find the space of variation to be bigger than any such distinction would imply.

the 'clitic group' or the 'prosodic stem' in phonology. We will briefly summarize the state of the art in these areas below and sketch a tentative system of variables that allows us to capture the diversity we find in polysynthetic word domains.

However, before getting to this, we need to address the first question: what are in fact the elements that are combined in a polysynthetic word? Is it heads? Predicate and argument stems? Or heads and affixes? Stems and affixes? And what are heads? Stems? Affixes? How are stems and affixes distinct from clitics and particles? Without resolving these issues, polysynthesis remains elusive: how can we tell whether the examples in (1) consist of several independent heads that are combined syntactically, or of various lexical elements that are morphologically fused with auxiliaries and affixes? Turning to questions of cohesion alone does not help, as long as it is unclear what it is that coheres.

2.1 Building blocks: *what* is combined?

Taking a fairly traditional perspective, one would like to start from a notion of independent vs. dependent or free vs. bound occurrence: unlike an affix, a semantically heavy element is a 'minimal free form' as Bloomfield (1933) famously put it — a form that has enough content that it can be used on its own. But that does not take us far (Haspelmath 2011): many morphemes that one would think of as semantically heavy — indeed as heads — cannot occur freely on their own, e.g. intensional (and other syncategorematic) adjectives (e.g. *former*, *mere*) require the presence of a noun that they can qualify. Conversely, an auxiliary in a periphrastic tense construction depends on a verb stem or participle. This would suggest that is not a free form, more like an affix. But at the same time, auxiliaries enjoy considerable syntactic freedom in many languages, as if they were heads. It is notoriously unclear whether elements such as auxiliaries are free or bound, whether they belong to verb morphology or to syntax.

A natural and equally traditional alternative is the idea that semantically heavy elements are lexical elements, i.e. stems, as opposed to grammatical elements, i.e. affixes. But when is a morpheme lexical? Is a hodiernal past tense marker grammatical or lexical? If such a marker is grammatical, isn't a word a like *today* grammatical too? What about modal (e.g. 'must'), phasal ('begin') or desiderative ('want') markers (such as Inupiat *-allak* 'begin to V' as in *avaala-allak-* 'begin to yell', with the verbal host *avaala-* 'yell')? Calling these lexical if they occur as independent elements in syntax, but grammatical if they appear as 'affixes', would bring us back to square one: a heavy element is something that can occur as a free form… So, an appeal to semantics does not solve the problem. Also, some languages, indeed especially those called 'polysynthetic', show an abundance of what is known as lexical affixes that behave differently from stems (e.g. in Eskimoan languages), something that is impossible to distinguish from stems if the stem vs. affix distinction is equated with the lexical vs. grammatical distinction.

If the lexical vs. grammatical distinction does not help, this also means that we cannot just use lexical category labels like 'noun', 'verb' etc. as definitional criteria of heavy elements although of course providing such a category label is one of the things that one expects from a semantically heavy element when this is formally explicated as a head. But also affixes can come in several lexical categories (e.g. various sets of so-called postbases in Eskimoan languages), and the function of affixes is often precisely to establish or change lexical categories (nominalization,

verbalization). Not surprisingly, some models of grammar assume that it is affixes, not stems, that are the key locus for category establishment.

A further alternative is to identify semantically heavy elements as open class elements, in contrast to closed class elements. Yet this immediately runs into serious problems in languages where the elements that behave as stems (and category providers) are a closed class, as for example in languages with a finite number of inflecting verbs, such as Jaminjung (Schultze-Berndt 2000) (or, as we will see, in Chintang, although the set is much larger in this language). Conversely, one of the properties often associated with polysynthesis is precisely that some affix-like slots in a verb can be filled by a seemingly open-ended class of incorporated and other lexical elements. Thus, the question of class size and productivity is fully orthogonal to what counts as a heavy element.

A possible way out starts again from the observation that some elements cannot occur as free forms, but now keeps this notion distinct from whether or not forms are included in specific word domains (i.e. the question of cohesion, which we discuss in Section 2.2). Also, we distinguish two ways in which elements can be free or require other elements: When an expression — i.e. a morpheme[3] or a morpheme complex — requires the presence of another expression, this can either mean that the expression requires the other expression as a host for realization, or as further material for fitting the expression into a syntactic context. Requiring a host means that the expression has a HOST-SELECTION constraint, e.g. a tense marker might need a verb stem where it can dock on for realization. Requiring further material means that the expression needs INFLECTION in the sense of Bickel & Nichols (2007), i.e. a verb might require some marking that responds to the context in which the expression is used. We elaborate these two variables in what follows.

2.1.1 Selection

Expressions vary in the complexity of what they select: does an expression select a single morpheme, a stem (as when English *-ed* selects a verb stem), or does it select a complete phrase (like the English genitive *'s*), or some intermediate level (like English determiners)? Another important dimension of variation is the category of what is selected: a morpheme may select a phrase of any category, or only phrases of specific categories, e.g. only noun phrases (defining various kinds of phrasal affixes and clitics), or an element can be attached to various stems (e.g. Algonquian person prefixes on verbs or nouns), or to only, say, noun stems (a classical affix), or only to a small subset of stems (e.g. English negative *-n't*).

Selection is defined independently of whether two elements make up a coherent word unit: an intensional adjective like *former* selects an NP as its host. Yet it does not cohere with its host in any respect (e.g. other words can intervene: *the former American president*). Conversely, an element that does not select any kind of host, and can freely occur without a host, can nevertheless be encapsulated inside a coherent domain of other morphemes: this then is the

[3] We use the term 'morpheme' here as an abstract concept of a minimal Saussurian sign of any kind (including e.g. a past tense meaning expressed by an ablaut or tone rule), and we take no position on whether morphemes are represented by strings or realization rules, whether their combinations are modeled as derivations, as constructions, or as paradigms. These are questions of technical modeling that are independent of our concerns.

classical case of incorporation. For example, a Mapudungun noun like *wentru* 'man' can occur as a head of an independent NP, but it can also occur inside a domain that coheres in terms of phonological and syntactic rules:

(2) *adkintu-wentro-yaw-küle-i*
look.after-man-PERAMB-PROG-IND
'S/he is going around looking for men.'

The phonologial cohesion of (2) is shown by the fact that in word-final position *wentro* is normally realized as *wentru* while in non-word-final position, *o*-to-*u*-raising is only optional. The syntactic cohesion of (2) is evidenced by the fact that no additional (e.g. adverbial) element could be inserted at any position in the string and the order of elements is strictly fixed.

Selection is also a critical parameter in verb compounding. While such compounds in Mapudungun form a coherent word domain, stems critically differ from each other (and have changed over time) in whether they select a host. A stem like *kim* 'know' does not need a host but it can combine with another verb into a single word (cf. 3a vs. 3b), parallel to noun incorporation. By contrast, the stem *pepi* 'can' obligatorily selects another verb stem as a host. The stem can no longer be used without such a host (cf. 3c vs. 3d):

(3) a. *kim-fi-i*
know-3P-IND
's/he knows him/her'

b. *kim-lef-i*
know-run-IND
's/he knows how to run'

c. * *pepi-i lef-n*
can-IND run-INF
's/he can run'

d. *pepi-lef-i*
can-run-IND
's/he can run'

Crucially, there is no difference in the extent to which *kimlefi* 's/he knows how to run' and *pepilefi* 's/he can run' form word domains in phonology or syntax. The difference is only in the selection behavior of the first verb stem.

2.1.2 Inflection

Expressions sometimes require the presence of additional morphemes or morpheme complexes so that they can be appropriately used in a sentence. There is substantial variation in what exactly is required, ranging from individual morphemes and particles to auxiliary complexes. For example, most Indo-European verb stems require tense/aspect/mood and agreement marker for use in independent sentences. In the Mapudungun examples (1-3), verb stem *adkintu* 'look after' requires the presence of some marker (or a zero marker under special circumstances), here the indicative suffix *-i*.

Often, these requirements include elements that do not cohere with the stem in any way. This is the case with auxiliaries or tense/aspect particles that are common in many languages. When assessing the amount of morphology and polysynthesis in a language, it clearly makes a big difference whether or not one counts such elements as part of morphology. Consider for example the English perfect tense where the auxiliary does not need to be adjacent to the verb

stem (*he's gone* vs. *has he gone*?): the auxiliary is required by verb inflection and from this point of view, the resulting periphrastic form is a verb form, hence a word. At the same time, the auxiliary is a syntactically independent entity which does not form a word together with the verb stem.

Such contradictory conclusions are resolved once inflection is kept as a distinct parameter from cohesion. Saying that an element X is part of the inflection of an element Y is then completely independent of whether or not X and Y form coherent words in either syntax or phonology.

2.1.3 Variation

Selection and inflection define a large space of variation in what kinds of building blocks exist in a given language because each of these parameters spans many possible values: selection across the many different elements that are selected (kinds of stems, phrases etc); inflection across the many different elements that are required in context (types of markers and marker complexes). Some locations in this space come close to traditionally recognized units, but many do not. For example, affixes are traditionally differentiated from clitics by what they select (affixes select stems, clitics phrases). But clitics differ in whether or not they select specific phrases (English *'s* only attaches to NPs, whereas the Turkish interrogative clitic attaches to a larger variety of phrases, including entire sentences). Also, clitics differ in whether or not they inflect themselves (e.g. English auxiliaries do, the English genitive *'s* does not). Further, some affixes require stems as their host, but it does not need to be verb stems, i.e. they are less selective than what would expect from a traditional affix. For example, Algonquian person prefixes combine with both verb and noun stems. Or the Swiss German diminutive *-l(i)* attaches to both noun stems (*blüem-li* 'small flower' from *blueme* 'flower') and verb stems (*schäffe-l-e* 'work a bit' from *schaffe* 'work'). Attempts at reducing such variation and capturing it with a simple taxonomy tend to fail (as also noted by Spencer & Luís 2012). Further, as long as nobody has demonstrated empirically that some locations in the space of variation are preferred when languages evolve, we see no grounds for privileging the locations implied by traditional terminology.

But even when allowing such rich variation, a challenge remains: the challenge of morpheme identity. Consider a morpheme like *thand* in Chintang. This usually translates as 'bring downhill' when it occurs alone (see 15 below for illustration) and usually as a morpheme for any caused downward movement when it occurs right next to a verb stem (as in 11b below). If we analyze *thand* as a single morpheme with the abstract meaning 'cause to change place along a downward trajectory', coupled with a stereotype implicature to a concrete transportation event, then *thand* will be analyzed as not selecting anything: *thand* can freely occur with or without a verb. But if we posit two morphemes, $thand_1$ 'bring downhill' and $thand_2$ 'caused downward motion', only $thand_1$ will be non-selective, while $thand_2$ will select a verb host. The same issue arises in many languages with morphemes that translate as 'give' when used alone and as benefactives when used with other verbs: are two morphemes, or an abstract morpheme meaning 'do in favor of' that has a stereotype implicature of concrete giving when used alone?

These are fundamental and frequent questions of morpheme identity. They are important empirical issues in the diachronic build-up, the ontogenetic development and the processing

of languages. However, the questions are orthogonal to the formal constraints that an expression imposes on its combinatorial potential. Morpheme identity is ultimately a probabilistic, gradient notion that is driven by the way in which forms and meanings build up networks of association during acquisition and in processing. With regard to polysynthesis, critical insight here comes from psycholinguistic research into the associations between incorporated and free-standing nouns (e.g. in lexical retrieval, or memory associations). For example, if indeed the Mapudungun processing system treats *wentro* 'man' in (2) as being lexically the same as the free form *wentru* in an NP like *chi wentru* 'the man' (with the determiner *chi*), this is genuine incorporation in a psycholinguistically real, fully synchronic sense.

An alternative to this psycholinguistic view is based on lexical semantic analysis. While this is certainly an option, it is fraught with substantial uncertainty and heavy dependence on the assumption of one's favorite language-description theory. Take the case of 'give' and benefactives: how can we demonstrate that we have two morphemes here, rather than a more abstract benefaction semantics which, when used alone, is pragmatically enriched to denote a stereotypical, concrete giving event? Speaker intuitions may not be the same as how morphemes are represented and processed in the brain, and it is far from clear what such intuitions eventually reveal.

Finally, the question of morpheme identity can of course be approached from a diachronic perspective. This presupposes that we know the synchronic states (which is a tall order), but it is an important dimension since we know (e.g. from grammaticalization research) that such identities change.

As noted before, the two variables of selection and inflection each span a large variety of options. In addition, each of these options can associate with (i) lexical or grammatical meanings (however one wants to define this, possibly as a gradient), (ii) closed or productive classes (or any value in between if this is conceptualized as a gradient), and (iii) any kind of category (pronouns, nouns, verbs, nominalizers, verbalizers etc.).

These three additional variables enlarge the space of variation even more. Yet, we submit, this is the space that one needs for a proper analysis of polysynthesis. Still, it is just the first step because the next question is how each of the many possible types that a language may have can combine into larger domains.

2.2 Domains: *how* are building blocks combined?

One of the major results of recent research on phonological and syntactic wordhood is that languages operate with many more diverse domains than a simple word vs. phrase dichotomy would suggest. This has been clear in the arena of syntax for a long time, and grammarians often talk about multiple bracketing structures within a word and multiple structures inside phrases.[4] In phonology, some authors argue for a simple hierarchy of domains, allowing basically only one unified 'word' domain that is then expanded and diversified by a technical apparatus for capturing deviations from this (e.g. Vogel 2009). A more direct approach simply admits multiple

[4] We note, however, that a quest for unified syntactic word definitions seems to persist in many corners; see Haspelmath (2011) for a review.

domains from the start, based on whatever domains are referenced by a specific language (e.g. Bickel et al. 2009, Schiering et al. 2010, 2012, Hildebrandt 2014).

Here, we adopt an approach that allows multiple syntactic and multiple phonological domains between morphemes and phrases, and between syllables and phrases, respectively. Also, there is no reason to expect an isomorphism between syntactic and phonological domains (as any cliticized pronoun, such as in English *meet them*, attests), and there is no reason to expect isomorphism within phonology, or within syntax. For example, the domain of Turkish vowel harmony is not isomorphic to the domain of stress assignment (Kabak & Vogel 2001). In syntax, the domain of inflection-hosting is sometimes smaller than the domain established by what cannot be interrupted. This is the case, for example, with bipartite stems in Nakh-Daghestanian, where gender agreement markers attach to a smaller unit than what is established by the unit that cannot be interrupted by other material (e.g. Andi [*a*-[*b*-*ch*-*o*]] '[wash-[AGR-wash-PST]]', where the agreement prefix *b*- is inserted before the second part of the stem *ach*-, which appears as an uninterruptable unit in most other regards; Bickel & Nichols 2007).

In both syntax and phonology, the identification of each domain rests on formal, empirically demonstrable properties that are tied to the specific grammatical system of each language. For example, a commmon property of syntactic words is that their constituents cannot be freely moved. But this is obviously only relevant if the language allows some general kind of movement to begin with. Likewise, a property of a phonological word may be final devoicing, and this obviously depends on the presence of a voicing contrast to be at all critical in a given language. This means that for capturing syntactic and phonological word domains, we need a large array of variables, each of which not only has the values 'holds of a given string' vs. ' does not hold', but always also includes the possibility of being a structural 'NA', where the variable is just irrelevant. Here are rough indications of some of the variables that are most often cited in the literature:[5]

(4) *X* is part of the same syntactic domain as *Y* if *X* and *Y* behave as an arbitrarily defined single unit with respect to:
   a. modification by an attributive element (e.g. an adjective, an adverb, a subordinate clause)
   b. string integrity:
      i. other elements can be interspersed only if these other elements select *X* or *Y* or are required by the inflection of *X* or *Y*
      ii. neither *X* nor *Y* can be deleted without concomitant deletion of another element (corresponding to what is sometimes called cross-slot dependencies of affixes)
      iii. neither *X* nor *Y* can be displaced (i.e. extracted, moved, copied) by a general operation independently of each other

[5] Some of the work that contains similar lists include Zwicky & Pullum (1983), Bresnan & Mchombo (1995), Dixon & Aikhenvald (2002), Bickel et al. (2007) and van Gijn & Zúñiga (2014a), but they all seek criteria that are expected to converge on unified notions of phonological and syntactic words in a given language, whereas we leave open the number and possible convergence of domains in a language.

iv. the relative order of X and Y is fixed arbitrarily (as opposed to be driven by semantics, information structure or random processes)

c. the determination of lexically-conditioned allomorphy ('idiosyncracies'; 'flexivity')

d. ...

(5) X is part of the same phonological domain as Y if X and Y behave as an arbitrarily defined single unit with respect to:

a. stress assignment

b. tone shift rules

c. phonotactic requirements (e.g. onset requirements, final devoicing etc.)

d. phonological alternations at the boundary between X and Y (e.g. intervocalic voicing)

e. harmony rules (e.g. vowel harmony, consonant harmony, nasalization etc.)

f. epenthesis/prothesis and other liaison and sandhi effects

g. length requirements: minimum or maximum numbers of moras, syllables, feet etc.

h. prosodic subcategorization (e.g., when X attaches to a certain phonological domain anchored in Y)

i. ...

We call the variables in (4) and (5) variables of 'COHESION': the more of them hold for a given string, the more does this string form a coherent unit, a 'word'. But it is worth re-iterating that such an accumulation of cohesion is by no means necessary: it is very well possible that a string behaves as a unit in only one regard (e.g. blocking the interspersion of non-selecting elements), but that the same string disintegrates into many smaller units in other regards (and so for example allows re-ordering based on scope properties). In the same vein, we do not expect properties of cohesion to converge on what one might want to call 'lexical': it is an empirical issue whether cohesion in one or the other property goes together with idiosyncracy (non-compositionality), with containing derivational morphemes, or with being structure-preserving in phonology — to name just a few of the many readings of the term 'lexical'.

The literature sometimes adds other variables than what we list here. But some of these are problematic because it is in fact unclear what they really pick up: for example, properties like 'potential for pauses', 'semantic compositionality', 'lexical storage', or 'anaphoric island status' arise from a blend of many different factors of speech production, string memorization and conceptual construal during language acquisition and processing. These are not necessarily tied to a grammatical structure, and so it is no suprise that they often do not (as Haspelmath 2011 observes) differentiate between domains in any clear-cut manner .

As in the case of morpheme identities discussed before, these psycholinguistic dimensions cross-cut the nature of grammatical constraints, and it helps to keep them separate. For language acquisition, for example, what is of key interest are morphemes that select some host or require some inflection. These properties induce grammatically constrained co-occurrence patterns that need to be learned as such early on, often posing a considerable challenge (see the chapter by Stoll et al, this volume). The cohesion of the morphemes is however independent

of such co-occurrence patterns: cohesion relies on more advanced phonological and syntactic generalizations. For other purposes, e.g. research on lexical access in comprehension, however, aspects of cohesion, specifically phonological cohesion, may be the key issue of interest, while selection and inflection behavior may be less relevant.

Finally, it is important to bear in mind that some criteria that are sometimes mentioned in the literature are not really diagnostic of cohesion but just follow from the kind of selectivity an element may have. For example, if an element selects a phrase rather than a stem, it follows that it can be gapped in coordinated expressions if they form a phrase (cf. English [$_{\text{NP}}$ *my mum and dad*]*'s house*). Such properties need not be stated separately.

2.3 Other variables

The variables we surveyed so far are all orthogonal to several other dimensions. First, there are what one may call variables of POSITION (Klavans 1985): these are the various ways in which elements can be placed with respect to each other, e.g. with respect to the phonological host (prefixes vs. proclitics; suffixes vs. enclitics, etc.), or if they select a phrase, with respect to their position in the phrase (before the last element, in second position, variably depending on the host category, or freely variable, etc). Then, there are variables of BEHAVIOR (Bickel & Nichols 2007) (or what Dench & Evans (1988) call 'domain conventions'): does an element appear only once in a phrase, or does it spread inside it? For example, plural marking spreads inside a noun phrase in German, but not in English.

When one brings all variables together, it becomes clear that the space of variation in possible polysynthetic words is gigantic. We will explore and illustrate this space in detail in the two case studies on Mapudungun and Chintang below (Sections 3.1 and 3.2). We will encounter substantial variation in both languages, and it is clear that positing a single notion of a polysynthetic word will fail to do justice to the empirical complexities. There are many conflicting domains and in order to describe them we need to keep distinct the variables that define morpheme types (selection and inflection) from the variables that defined domains (phonological and syntactic cohesion). In some cases we will also need variables of position and behavior because some affixes escape traditional expectations about 'words' by spreading to adjacent hosts.

It is certainly possible to pick any one value in any one variable as definitional of polysynthesis. For example, one could say that a word is polysynthetic iff it contains at least two elements that don't select anything (e.g. freely usable verb and noun stems), belong to open classes and cohere with each other with respect to all (or most) cohesion variables. This would capture a traditional notion of incorporation. However, on closer inspection, not many phenomena will satisfy such a definition because most 'polysynthetic' words escape one or the other cohesion variable; instead of fully open classes one might find various restrictions (not all nouns can be incorporated); and instead of being non-selective some elements might select verb stems (e.g. some verb-like elements need hosts). One could of course loosen some of the criteria, e.g. some or all requirements of cohesion. But then the definition would quickly include many phrasal phenomena that one might not want to associate with polysynthesis, such as syntactically tightly knit verb+object, noun+adposition, or noun+intensional adjective phrases in many languages. The same problems apply to the other criteria.

Rather than hunting for the right definition and 'true polysynthesis', an alternative approach is to work with canonical or prototypical definitions that bring together what are expected to be typically or frequently associated properties. But it is not clear to us what a canon (in Corbett's (2005) sense) would yield beyond the array of variables that we already need anyway. For prototypes, one would first of all need a large database that carefully codes for all relevant variables and then one would need to perform similarity measures and clustering computations. But this work has not been done yet, and we first need to explore the space of variation more deeply.

3 Implications for analysis

Given the large space of variation we sketched in the preceding, it is clear that the questions we raised in the introduction defy simple answers. It doesn't help to try to conclude that the examples in (1) are 'words' or 'phrases'. Instead, we want to know how the constitutive elements behave. In what follows we apply the multivariate analytical apparatus that we propose in two case studies, one on Mapudungun and one on Chintang. In each case, we concentrate on the verb complex, i.e. a verb stem plus any other morphemes that show some kind of cohesion with the stem in at least some regards.

3.1 Mapudungun

3.1.1 Building blocks

Table 1 gives an overview of the morpheme types that need to be distinguished on account of their behavior in Mapudungun. The table defines these types in terms of the variables outlined in Section 2.1, suggests practical labels, and provides a rough illustration of the range of meanings covered.

SELECT	INFLECT	*label*	*content*
—	—	NP; nonrelational N	lexical
X	—	clitic particles (CL)	illoc. force, presupposition-relation, etc.
—	TAMP, AGR	V	lexical
V	—	infl.; redupl.; DERIV	most agr., TAMP, nonfin.; nominalizers
V(P),NP	—	INFL	some 3NSG agreement
V	(AGR)	V1, V3	derivations, lexical
V,NP	–	reportative	

Table 1: Overview of major morpheme types involved in Mapudungun verb complexes, with practical labels and rough illustration of the kind of content covered. X stands for any part of speech category; TAMP for tense, aspect, mood and polarity; AGR for agreement (Note that only some V3 elements control independent agreement inflection, as explained in the main text.)

Non-selecting formatives without inflection include non-relational nominal roots (an open class), like *wentru* 'man' and *soyüm* 'shrimp', as well as possibly some particles whose functions

are still somewhat unclear. Non-selecting formatives with inflection include verb roots, like *entu-* 'remove', and adjective-modifying adverbs, like preposed *rume* 'very'. (Note that all Mapudungun adjectival roots are also verbal roots, typically with an inchoative-stative temporal structure unless some morphology forces another aspectual interpretation. Thus, the element meaning 'good' in (1b), viz. *küme*, can also occur as the root of the verb 'be(come) good'.)

Verbal roots are an open class. Augusta (1916), the most complete dictionary of the language to date, lists some 400 adjectival and ca. 1,000 strictly verbal roots — as opposed to ca. 1,600 nominal roots. Their segmental/syllabic make-up varies within the overall phonotactic restrictions of the language, cf. *i-* 'eat', *pi-* 'say, tell', *kon* 'enter', *af-* 'end', *amu-* 'go', *illku-* 'get angry', *dungu-* 'speak', *ramtu-* 'ask', *kutran-* 'hurt, get sick', and *ütrüf-* 'throw'; monosyllables are possible, but not frequent, and roots with three syllables or more (e.g. *arofü-* 'sweat' and *üngapu-* 'yawn') are rare — the default root is disyllabic and possibly C-initial. Elements borrowed from Spanish behave just like all other roots (e.g. *kansha-* 'get tired' ≺ Sp. *cansar* 'tire'). Some verbs have an apparently lexicalized element *-tu* (which is not lexicalized when occurring with many, perhaps most, other roots), like *ülutu-* 'perform a (particular) healing ceremony' and *papeltu-* 'read, study' (≺ Sp. *papel* 'paper'), but these are not bipartite stems.

Selecting formatives without inflection requirements include nominalizers like *-fe*, the nominal plural marker *pu* (e.g. *pu wentru* 'men'), and (derivational or inflectional) verbal affixes of various types, e.g. *-i* 'INDICATIVE', *-yaw* 'PERAMBULATIVE', *-küle* 'PROGRESSIVE', *-rke* 'REPORTATIVE', *-tu* 'TELICIZER', *-ngu* '3DUAL', *pepi-* 'can' (cf. example 3d above), and nonfinite suffixes. Such elements are heterogeneous, however. The nominalizer *-fe* can occur either after a verb-only element (e.g. *küdaw-fe* 'worker', built on *küdaw-* 'work (v.)') or after a complex stem, i.e. with nominal incorporation, e.g. *dungu-ñma-che-fe* [speak-APPL-person-NMLZ] 'lawyer, intercessor', but not after a whole (non-incorporated) NP.

The reportative/mirative *-rke* typically occurs as a verbal suffix (cf. example (1b) above), but it can also occur on Ns or NPs, e.g. (*kurü*) *trewa-rke!* 'why, a (black) dog!'. The indicative, the progressive, and future *-a*, on the other hand, occur only on verbs (which can have an incorporated nominal).

The behavior of the verbal third person nonsingular markers *-ngu* (dual) and *-ngün* (plural) is more complicated in that these markers systematically differ along phonological and syntactic cohesion; the following examples illustrate their appearance as syntactically bound elements after a V host (6a), after an NP host (6b), after a VP (or possibly a clause) (6c), and after a plain verb (6d).

(6) a. *kuñifall-nge-i* ***ngu.***
abandon-PASS-IND **3DU**

'They were both left behind / abandoned.' (*-ngu* after V)

b. *ñi* *chaw* ***engu***
3.POSS father **3DU**

'their (du) father' (*engu* after an NP)

c. *anü-m-ka-i* *pinu* ***yengu.***
sit.down-CAUS-CONT-IND cane **3DU**

'Both of them planted cane.' (*=(y)engu* after VP/clause)

d. *tripa-pe* ***(y)engu****!*
exit-3.IMP **3DU**

'May both of them go out!' (*-(y)engu* after V)

Nonfinite suffixes like *-yüm*, used in temporal adverbial clauses, require that the subject of the verb forms they occur on be marked as possessive pronouns, but the latter are not obligatory:

(7) a. *amu-yüm* ∅ *waria mew, ngilla-meke-i asukura.*
go-NFIN town POSP buy-HAB-IND sugar

'When s/he goes to town, s/he buys sugar.' (Harmelink 1996:221)

b. *dew i-kunu-yüm engün, ka llitu-ke-i-ngün tüfa ngillatun.*
already eat-stay-NFIN 3PL.POSS other begin-HAB-IND-3PL this rogation.ceremony

'When they have already eaten, they start with the rogation ceremony one more time.' (Salas 2006:168)

Roughly, reduplication is an operation used to express iterativity that repeats a portion of the verb and cooccurs with either *-tu, -ye, -nge* or ∅. The repeated portion is typically the root, can be a whole stem and occasionally includes even inflectional material (see Zúñiga & Díaz-Fernández 2014 for details).

The number of inflectional formatives that verbs take is not unexpected for a head-marking language of South America: three persons and three numbers are marked via dedicated formatives that show virtually no allomorphy, future tense has *-a*, there are about half a dozen aspectuals and half a dozen modal markers (up to a dozen modality-related elements if one counts the obsolescent ones), and the negative suffix comes in three mood-dependent forms: indicative *-la*, subjunctive *-no* and imperative *-ki*. Nonfinite affixes are also about half a dozen (but may have been more numerous in the past). Nominal derivational and inflectional morphology is comparatively less developed and shows less than a handful of such affixes. Other selecting formatives without inflection include directionals (cislocative *-pa*, translocative *-pu*, andative *-me*, and others) and other assorted, mostly modal(-like) affixes, up to about a dozen. This is, therefore, quite a different situation from the one found with pervasive lexical affixation, like in Algonquian, Eskimoan, or Northwest Coast languages.

Finally, selecting formatives with inflection include causatives and applicatives, which require a verbal host and alter the predicate's argument structure in that they add an object to the clause (typically an animate entity that is often interpreted as beneficiary/goal with *-(l)el* and as maleficiary/source with *-(ñ)ma*):

(8) a. *ngilla-i kiñe kawellu.*
buy-IND one horse

'S/he bought a horse.'

b. *ngilla-lel-fi-i* (*Antonio*) *ñi kawellu.*
buy-APPL-3P-IND A. 3.POSS horse

'S/he bought a/the horse for him/her (Antonio).'

c. *ngilla-ñma-fi-i* (*Antonio*) *ñi* *kawellu.*
buy-APPL-3P-IND A. 3.POSS horse
'S/he bought a/the horse from him/her (Antonio).'

The new argument, in this case a third person, is obligatorily marked via the third person agreement marker *-fi*, and it is optionally expressed by an overt NP (here: Antonio, a proper name). All these valency-changing suffixes, like the applicatives *-tu* and *-ye* on the one hand and the causatives *-l* and *-m* on the other, precede the TAMP and person-number-direction inflection and cannot occur at the end of phrases, or on nouns.

Another important set of selecting and inflecting elements are the closed class of morphemes labelled V1 and V3 in Table 1. These can occur either before or after the main verb (cf. Zúñiga, this volume):

(9) *pepi-ütrüf-püra-m-i* *tüfa-chi* *kura.*
can-throw-ascend-CAUS-IND this-ATTR stone
'S/he can throw this stone upwards.'

The main verb here comes from an open class and is *ütrüf-* 'throw'; the leftmost element *pepi-* 'can' (V1, formerly a verb in its own right) and the causativized verb *püra-m-* 'lift' (V3) select a verb (in different ways: *pepi-* can no longer occur on its own, as noted in (3), and *püra-m-* must agree in valency with the main verb). More generally, some V3 elements impose their own argument structure on the whole verbal complex and require specific inflection accordingly; most V3 elements and all V1 elements, however, simply inherit the argument structure of their V host and follow a simple same-subject or same-subject+same-object rule (cf. below for more on this effect of "transitivity harmony"). Unlike raising affixes in some North American languages, V1 and V3 elements cannot have TAMP values that differ from the ones taken by their V host.

3.1.2 Cohesion

In-depth work on phonological cohesion in Mapudungun still needs to be done (e.g. on length requirements and prosodic subcategorization, on which nothing is known), but some things can be said about this dimension. First, regarding stress assignment, the basics are as follows: disyllables in isolation are typically stressed depending on syllable structure (although a few, like *iNA* 'near, by', have lexically assigned stress), with closed syllables attracting stress, e.g. *KOna* 'young man', *WENtru* 'man', *soYÜM* 'shrimp', and *tralKAN* 'thunder'; monomorphemic trisyllables have secondary stress on the antepenultima, e.g. *AchaWALL* 'hen'; plurisyllabic verb forms are usually more complex, with some inflectional affixes attracting stress (e.g. *fi* '3P') and word candidates in phrase candidates following more intricate patterns that are not well understood yet (cf. Zúñiga 2006:63f and Zúñiga 2014 for more details). Overall, however, it is not sufficiently clear yet under which conditions these elements behave as prosodically independent domains.

As to phonotactic requirements, only syllable-final obstruents are excluded, but there is an optional "word-final" *o* ~ *u* alternation with many strings consisting of more than one syllable, e.g. *wentro* ~ *wentru* 'man'. With respect to phonological alternations, a case in point is the

limited fortition of some non-obstruents before causative *-(ü)m* (e.g. *nag-* 'descend' ≻ *naküm-* 'lower' and *lef-* 'run' ≻ *lepüm-* 'make run' vis-à-vis the default pattern in *wadkü-* 'boil (itr.)' ≻ *wadkü-m-* 'boil (tr.)'). There are no other harmony rules, except for an obsolescent root-internal harmony of interdental consonants versus denti-alveolar ones (cf. *l̪afken̪* 'sea, lake', with interdental /l̪/ and /n̪/, and *entu* 'remove', with denti-alveolar /n/ and /t/). Lastly, epenthesis is frequent in order to break up consonant clusters (maximal syllable structure is CVC, so all clusters of more than two consonants trigger *ü*-insertion). There is also an optional "word-initial" homorganic glide prothesis, e.g. *(y)iwiñ* 'fat', *(g)üñüm* 'bird', *(w)ule* 'tomorrow'.

More is known about syntactic cohesion in the language. Lexically conditioned allomorphy does not appear to exist outside the realm of causatives: some verbs take either the *m-* or the *l*-causative based on causation type (related to control and animacy of the causee) but many verbs take only one of them, often in a non-predictable fashion (Golluscio 2007). As to the hosting of agreement markers, the adjectival nonsingular marker *-ke* is in principle obligatory on all adjectival words, but this is perhaps not a bona fide agreement marker. Verbal person and number marking is obligatory (and right-end) on every finite verb form with a first or second person argument (unless the inflectional string is a candidate for wordhood, in which case it is 'auxiliary-final') and is in complementary distribution with nonsingular third person NPs, with varying degrees of phonological cohesion depending on clause structure and mood.

Relative order is largely fixed arbitrarily for verbs (and totally fixed for other words), albeit roughly following the tendency mentioned in Bybee et al. (1994) as to inflection being more peripheral than derivation, which is closer to the root; within the derivational domain, when numerous such affixes are present, some "modal" affixes seem to be able to change slots without any semantic/pragmatic/syntactic consequence whatsoever ('voice' affixes never do). Finally, as far as the modification by an attributive element is concerned, coordinated elements with only one adjective/adverb are rare; there is a clear and strong tendency to repeat the adjectives and adverbs with every head. (This needs more research, however, especially in the context of subordinate clauses.)

As to string integrity and insertion potentials, linear adjacency is the rule for all of verbal and nominal morphology, with the proviso that nominal incorporation inserts a nominal element (a root, a compound, or a limited NP) into a verb. Adverbs cannot be inserted into nouns or verbs. There is a cross-slot dependency, with verbal stem composition ('transitivity harmony': *rüngkü-tripa-* 'jump up', consisting of the intransitive roots *rüngkü-* 'jump' and *püra-* 'ascend', vis-à-vis *ütrüf-püra-m-* 'throw up', consisting of the transitive root *ütrüf-* 'throw' and the causativized stem *püra-m-* 'lift').

Possible bans on displacement apply to all verb morphology except nominal incorporation, but to different degrees in the case of 3NSG markers; as mentioned above, depending on whether verb forms are finite or nonfinite, and with the latter, on whether they are indicative, subjunctive or imperative, the dual *-(e)ngu* and the plural *-(e)ngün* cohere differently (Zúñiga 2014).

3.1.3 Position and behavior

The morphology of Mapudungun is basically suffixing (nouns, verbs, adjectives), with some minor prefixing (verbs; probably mostly former verb roots that have lost their autonomous

cognate counterparts) and extensive compounding (nouns, verbs). Proclitics seem to be limited to prepositions and articles, but enclitics are more numerous (see Zúñiga 2014 for an overview of enclitic formatives and an in-depth discussion of selected enclitics). Regarding behavior, neither nominal nor verbal morphology has been found to spread in any way.

3.1.4 Summary of domains

The data and analyses available to us at the moment suggest that (i) there are systematic mismatches between phonological cohesion and syntactic cohesion, with phonological domains being typically smaller than syntactic domains, and (ii) there are different phonological domains, some of which coincide with a syntactic domain. This is summarized in Table 2 in terms of the building blocks defined in Table 1.

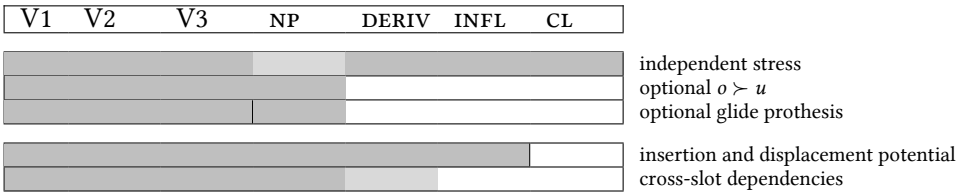
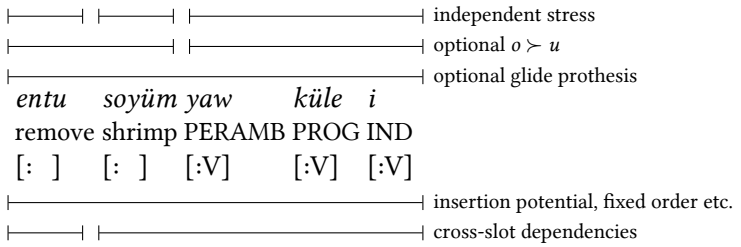
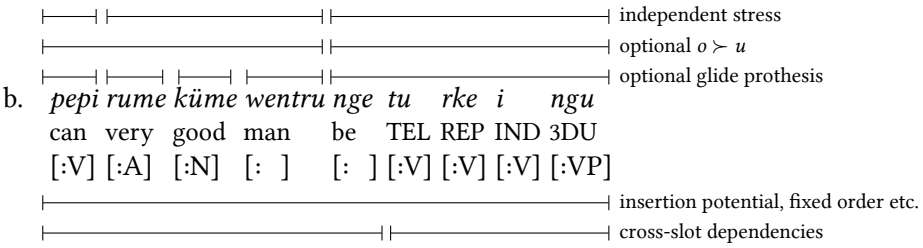


Table 2: Overview of word domains in Mapudungun phonology and syntax in terms of the building blocks defined in Table 1: grey-shaded combinations of elements behave as a coherent unit with respect to at least one syntactic of phonological rule or constraint. Light shading means optionality. A vertical bar inside a grey-shaded cell means that the element to the right (e.g. an NP) starts its own domain if it occurs.

While derivational and inflectional morphology, and especially verb stems and/or incorporated NPs appear to show some phonological autonomy, syntactic rules and constraints lead us to postulate larger units. Moreover, the two types of complexes, viz. nominal incorporation and NP verbalization, seem to behave differently regarding phonological cohesion (signified as a light shading in Table 2): perhaps unsurprisingly, the optional glide prothesis rule does not work as robustly with verbalized NPs, although the optional *o/u* alternation rule works more robustly in such cases.

These and other details are made concrete in what follows, analyzing the data in (1). Elements after a colon define the categories that a morpheme selects. Lines indicate the domains whithin which the relevant rules and constraints apply, above the example for phonology and below the example for syntax.





We briefly explain in the following how each constraint applies in these two examples:

- **Independent stress**: This is found with NPs and nouns and (at least some) verb stem strings; derivational and inflectional affixes following complex verb stems behave as units (except for some individual affixes that attract stress and disrupt such sequences).
- **Optional o ≻ u**: This is basically found at the end of NPs and nouns; adverbs (which could potentially occur within the incorporated NP) might show this behavior as well, but more research is needed on this.
- **Optional glide prothesis**: This seems to operate between verb stems and demarcating NPs both externally and internally.
- **Insertion and fixed order**: There is no single position in the examples where one could insert any other NP or noun, adverbs, or any other syntactic unit. The strings have to occur in the order given above. (To be sure, there is a non-incorporating counterpart of (10a), where the NP occurs outside the string, but this is a different construction; the NP is then less restricted regarding their internal structure – it can accommodate numerals and determiners, for example – and the predicate is bivalent rather than monovalent. To the best of our knowledge, there does not exist a non-verbalizing counterpart of (10b), e.g. a nominal predication featuring a non-verbal copula, which is used in equative constructions in the language.)
- **Cross-slot dependencies**: Different mood affixes require person markers from different sets; in (10b), if indicative *-i* were to be replaced by subjunctive *-l* or imperative -∅, an additional 3rd-person marker *-e* or *-pe* would intervene between the mood affix and the third person dual marker *-du*, respectively. More importantly, the verb stems at the beginning of the string normally fulfill specific argument structure requirements, i.e. host Vs and V3 elements normally have the same valency, and all Vi elements share the subject (and objects, if any).

Even though phonological cohesion needs to be studied in much more detail in this language, these preliminary results make clear that the received notion of a 'Mapudungun word' is problematic at best. Different phonological and syntactic operations target different domains, essentially with potentially large syntactic units consisting of smaller phonological words.

3.2 Chintang

Chintang is a member of the Kiranti group of Sino-Tibetan, a group that is radically different from the usual images that come to mind when thinking of the more famous members of the family, such as Chinese, Burmese or Tibetan: Kiranti verb complexes are exceedingly complex, especially those of the Eastern branch, to which Chintang belongs. In the following we first

analyze the range of morpheme types that go into the verb complex and then discuss various aspects of cohesion.

3.2.1 Building blocks

Table 3 gives an overview of the morpheme types that need to be distinguished on account of their behavior in the language. The table defines these types in terms of the variables SELECTION and INFLECTION as outlined in Section 2.1, suggests practical labels, and provides a rough illustration of the range of meanings covered.

SELECT	INFLECT	*label*	*content*
—	TAMP, AGR	V	lexical
V	—	affixes (PF, SF)	agreement, TAMP, nonfinite forms
V	(TAMP, AGR)	V2	derivations, lexical, aspect
VP	—	phrasal affixes (PA)	optative, some clause linkage markers
XP	—	free phrasal affixes (FPA)	nominalizers, conjunctions, IS markers, etc.
X(P)	—	clitics (CL)	IS markers
X	—	reduplication	intensifying functions

Table 3: Overview of major morpheme types involved in Chintang verb complexes, with practical labels and rough illustration of the kind of content covered. IS stands for information structure; X for any part of speech; TAMP for tense, aspect, mood, and polarity; and AGR for agreement. (With V2 elements, the choice here is in many cases subject to harmony constraints, as explained in the main text)

The non-selecting morphemes of the Chintang verb complex control a series of obligatory agreement, tense, aspect, mood, and polarity markers and can therefore be best referred to as verb stems (label 'V' in Table 3). Native Chintang verb stems consist of a CV(C) root which may or may not be followed by a coronal 'augment'. Augments chiefly (but not exclusively) derive from proto-Sino-Tibetan valency and Aktionsart markers. Although they are now mostly semantically opaque, they behave differently in phonology than root-final coronals.[6] Since the core root follows a strict one-syllable template and there are only two augments that can follow CVC roots, there is a theoretical maximum of 2,346 stems, i.e. the class of verb stems is closed. Of these, about half are attested in our corpus (which comprises a dictionary of over 11,000 lemmas and about 1 million running orthographic words from 258 hours of recording). Additional stems are bipartite, resulting from lexicalizations of formerly independent elements (*kha-siŋs-* 'ask' or *som-tukt-* 'love'); there are 34 such formations attested (and used fairly frequently). Borrowed stems are obligatorily marked as such by a special nativizer suffix and require an auxiliary verb to be used in Chintang (Stoll et al. 2015).

All other morphemes that show some cohesion with verb stems select these stems, or they select a larger category or phrase that includes verb stems. Morphemes that select verb stems –

[6] The main difference is that augments only surface before vowels while root finals always surface in some form, e.g. *pha+t-*: *phade* 's/he helped' vs. *phama* 'to help' with an augment *+t* in contrast to *phat-*: *phade* 's/he exchanged' vs. *phaiʔma* 'to exchange' with a root-final /t/. In our corpus work (`http://www.clrp.uzh.ch`) and the examples here, we use a pratical notation that marks augments by different stem-final symbols, e.g. *phad-* instead of *pha+t-*.

'affixes' in a narrow sense — include 8 prefixes and 37 suffixes, expressing inflectional categories like agreement (in three persons, three numbers and with up to two arguments), tense, aspect, mood, polarity and various non-finite formations (participles, infinitives etc.).

Another important class of verb-selecting morphemes are themselves verb stems. These are traditionally labelled 'V2 stems' or 'vector verbs' in research on Kiranti languages. V2 stems select not only a general class of verbs but impose various constraints on valency and Aktionsart, specific to each V2. Some V2 specify whether they combine with monovalent or polyvalent verbs. For example, the V2 *thi-* selects monovalent verb stems (11a), *thand-* polyvalent stems (11b):[7]

(11) a. *jamma hod-a-**thi**-a-ŋs-e-ta.*
all break-PST[3sS]-V2:move.down.INTR-PST-PRF-IND.PST-FOC
'It's all broken down.' [CLLDCh1R12S03.697]

b. *yo dhukkur-a apt-u-**thand**-u-ku-ŋ paĩ.*
DEM.ACROSS dove-NTVZ shoot-3[s]O-V2:move.down.TR-3[s]O-IND.NPST-1sA today
'I'll shoot that dove over there down today.' [CLLDCh1R05S05.303]

Other V2 stems combine with verbs of any valency, e.g. *-loĩs* 'move out' combines both with mono-valent and bivalent predicates (whereas closely related *-lond* 'go out' seems to be limited to monovalent stems):

(12) a. *phaŋ-mo su?wa-lo pend-a-loĩs-e*
buzz-CIT wasp-SURP fly-PST-V2:move.out-IND.PST
'The wasp flew out with a buzz' [story_tiger.124]

b. *ba-khi u-nap-yaŋ u-lem-ŋa tott-u-**loĩs**-e.*
PROX-MOD 3sPOSS-snot-ADD 3sPOSS-tongue-ERG [3sA-]prick-3[s]O-V2:move.out-IND.PST
'She snatched out her snot with her tongue like this.' [CLLDCh2R12S04.581]

Such differences are not predictable, and they thus represent selection properties intrinsic to each V2.

V2 stems behave morphologically like other verb stems, except that they require a two-syllable template as their host. This template consists of a verb stem and as much finite verb morphology as is needed to fulfill the two-syllable constraint (Bickel et al. 2007).[8] In (11), the templates are satisfied by the combination of the stems *hod-* 'break' and *apt-* 'shoot' with single-vowel markers (*-a* 'PST' and *-u* '3[s]O', respectively). If there is no suitable inflectional material available, as happens to be the case for example in third person subjunctive forms, a dummy syllable *na* is inserted in order to meet the two-syllable constraint. This is shown in (13), where the V2 stem *ca-* denotes some kind of self-benefaction:

[7] In our practical orthography word boundaries are based on whether or not items can receive stress. See Section 3.2.2 for other phonological word domains.

[8] In non-finite forms, the two-syllable constraint is optional, and there are a few lexically defined exceptions.

(13) *mai-met-th-a, joso-ta num-na-**ca**-ne-na.*
NEG-do-NEG-IMP[2sS] whatever-FOC do-NA-V2:enjoy.for.onself[3sS.SBJV]-OPT-INSIST
'Don't do that, let her do whatever she wants on her own.' [CLLDCh1R02S04.0781]

V2 can be added recursively but examples like the following, with three V2 in a row, are rare:

(14) *jo-go-yaŋ na-khutt-i-**ca**-i-**hatt**-i-**bir**-i.*
whatever-NMLZ-ADD 3[s]>2-steal-2pO-V2:eat-2pO-V2:move.away.TR-2pO-V2:do.for-[SBJV.]2pO
'It (a cat) may steal everything from you and eat it all up!' [story.cat.204]

Some V2 elements control their own agreement morphology (e.g. those with a causative or benefactive meaning component like in 13) and some also control their own tense morphology (e.g. a V2 which marks imperfective aspect and requires past tense morphology, a phenomenon to which we return below). Other V2 follow the agreement and TAMP pattern of their host.

Most V2 bear etymological resemblence to regular, non-selecting verb stems, and it is sometimes unclear whether there is one morpheme used in two ways or two morphemes. Compare the use of *thand-* as a V2 in (11b) and as an independent verb in the following case:

(15) *ba com-ce-ta a-**thand**-u-ce haŋ i?s-akt-e?*
DEM.PROX sort-ns-FOC 2[s]S-move.down-3O-3nsO[SBJV] if be.not.good-PST-IPFV-IND.PST
'Wouldn't it be good if you brought down this sort of (stuff)?' [CLLDCh3R12S04.448]

Similar examples can be found with several other V2 stems. For example *ca-* has an abstract meaning in (13) but a very concrete one of eating in (14). In the concrete meaning, *ca-* is a regular stem that can also be used as such (e.g. *ca!* 'eat!'). Whether or not speakers have acquired a generalized representation or at least a dense association network covering all such usages is an open issue. There may be variation across individuals. From a diachronic point of view, it seems clear that V2 stems originate from regular verb stems and have gradually acquired the selection properties of V2 stems.

Beyond these two classes of verb-selecting morphemes, the verb complex can also host various markers that select entire phrases, either flexibly phrases of various kinds, or only verb phrases. An example of a morpheme that selects VPs is the optative marker *ne* and the 'insisting' marker *na* which attach to verb phrases and can be gapped when the forms are coordinated (see Bickel et al. 2007 for further discussion):

(16) *ta ki khi-ne-na!*
come[3sS.SBJV] SEQ quarrel[3sS.SBJV]-OPT-INSIST
'Let him come and fight!' [CLLDCh1R04S05.0556]

Morphemes that combine not only with VPs but phrases of any category ('XP' in Table 3) include various information structure markers and conjunctions, such as the sequential coordinator *ki* in (16). Even more radically promiscuous are morphemes that need some host but do not specify whether this is a phrase or terminal node, or what category is required (notated 'X(P)' in Table 3). There are four information structure markers with this behavior: *le* marking restriction, *lo* surprise, *ta* focus and *yaŋ* additive focus. These morphemes can be attached to phrases or entire clauses, as in (17a), as much as to single affixes, as in (17b) (Bickel et al. 2007):

(17) a. *utti* *para* *paisa-ŋa-**yaŋ*** *miʔmuŋ* *na-laiʔ-yokt-e*
that.much over.there money-ERG-ADD a.little 3[s]>2[s]-be.enough.for-NEG-IND.PST

*kina-**yaŋ**.*
SEQ-ADD

'It was also because the money wasn't quite enough over there.' [kamce.talk.0065]

b. *a-kha-**yaŋ**-mai-paiʔ-yokt-e* *naŋ.*
2[s]A-1nsO-ADD-NEG-call-NEG.PST-IND.PST but

'But you also didn't call us.' (i.e. also us) [RM.JK.talk01.041]

Finally, we note reduplication as an abstract morpheme (cf. Note 3) that combines with various stems (notated 'X' in Table 3)

3.2.2 Cohesion

The building blocks surveyed in Table 3 combine into strings that show various kinds of cohesion. To allow concise overview representations, we use the following abbreviations apart form V and V2: PF and SF for pre-positioned and post-positioned inflections (prefixes and suffixes), CL for clitics, PA for phrasal and FPA for free phrasal affixes. Reduplications always cohere with the stem in all variables, and we leave them out from the discussion in the following.

We first discuss syntactic cohesion. The key variables that are relevant and that have been analyzed in Chintang are insertion and displacement potentials, ordering constraints and cross-slot dependencies.[9] These define several non-isomorphic syntactic word domains:

Insertion potential: [PF-V-V2-SF-CL-PA-FPA]. *Evidence:* neither adverb nor noun phrases can be inserted in such a string (see data in Bickel et al. 2007).

Displacement potential: [PF-V-V2-SF-CL-PA-FPA]. *Evidence:* All elements are strictly local and cannot be displaced independently of each other.

Cross-slot dependencies: [PF-V-V2-SF]. *Evidence:* PF and SF depend on each other in multiple ways. For example, the negation PF *mai-* requires the concomitant appearence of a SF *-t*, or the person, number and role specification of agreement markers relies on a combination of PF and SF markers (see data in Bickel et al. 2007 and the discussion of example 26 below). Also, the PF and SF elements of V2 elements must agree with those of the V element, no matter where they are licensed. For example, the V2 *yakt-*, which marks imperfective aspect, requires both V and V2 to be marked as past tense, as for example in a form like *pid-a-yakt-a-ce* 'give-PST-V2:IMPFV-PST-DU' 'we (dual inclusive) were giving it to him/her', where *yakt-* enforces the tense markers *-a* after both stems (Bickel et al. 2007:68). Conversely, if a V stem is marked as past tense, a V2 must follow suit. This can be seen in the form *pendaloĩse* 'flew out' in (12a), where both stems are inflected in the past tense (*pend-a-* 'fly-PST' and *loĩs-e* 'V2:move.out-IND.PST', with *-e* also marking

[9] An additional variable is whether adverbs can independently modify V2 stems. There is no evidence that they can, but more research is needed to establish this firmly.

indicative mood, a choice that is only available at the end of the string.) As far as we know, no such constraints involve phrasal affixes or clitics.

Ordering [V(2)-SF-PA-FPA]. *Evidence:* The linear order of suffixes and phrasal affixes is arbitrarily fixed after a verb or V2 stem, following a strict template of morphological slots. By contrast, the ordering of V and V2 is driven by content and the position of PF and CL elements is freely variable. As shown in Bickel et al. (2007), all logically possible permutations of the prefixes in curly brackets in (18a) are possible without any effect on meaning or situational felicity. Prefixes can also precede V2 stems, where they follow the two-syllable unit selected by these stems (*kosa* in 18b):

(18) a. {*u-kha-ma-*}*cop-yokt-e*
3snA-1nsO-NEG-see-NEG-PST
'They didn't see us.'

b. ***u****-kos-a-gond-e* ~ *kos-a-****u****-gond-e*
3pS-walk-PST-V2:do.here.and.there-IND.PST
'they walked around'.

An example of a clitic inserted into the prefix string is the form *a-kha-****yaŋ****-mai-pai?-yokt-e* 'you also didn't call us' in (17b). The additive focus clitic *yaŋ* could just as well follow most of the other prefixes here (see Bickel et al. 2007 for details), or as we saw above, it could occur at the end of the entire clause. Clitics between a V-based and V2-based string are illustrated by the following examples:

(19) a. *akka lud-u-****yaŋ****-****ta****-wakt-u-h-ẽ-kha.*
1s tell-3[s]O-ADD-FOC-V2:IPFV-3[s]O-1sA-IND.PST-NMLZ
'I was also really telling it to her.' [CLLDCh2R07S02.1606]

b. *khad-a-****yaŋ****-loĩs-e* *kina.*
[3sS-]go-PST-ADD-V2:come.out-IND.PST SEQ
'It (the dirt) has also gone.' [CLLDCh3R06S04.605]

Turning to phonological cohesion, we again observe that different rules and constraints target partly different domains:

Independent stress [PF-V-V2-SF-CL-PA-(FPA)] vs. [FPA]. *Evidence:* This unit has a single main stress on the V stem (or occasionally on the V2 stem), followed by an optional dactylic pattern of secondary stress in the SF and PA string. Some but not all free phrasal affixes can be stressed on their own. Examples are *ki* 'and' in (16) or *naŋ* 'but' in (17b). (The possibility of stress is what guides orthographic word breaks in our transcripts.)

Onset requirement [V(2)-SF] vs. [PF] vs. [CL-PA-FPA]. *Evidence:* Each of these domains require a syllable onset on their left edge; if there is no onset in the underlying representation, this results in optional glottal stop prothesis, e.g:

(20) *mai-a-ep-t-e* > *maiʔaʔepte*
NEG-2[sS]-get.up-NEG-PST
'You didn't get up.' (Bickel et al. 2007)

Inside the domains, hiatus is never resolved in this way but by various patterns of vowel coalescence or diphtongization. This is true both of suffix-suffix sequences and clusters of clitics.

Four frequent V2 stems (*hatt-* 'move away sth completely (transitive)', *hat-* 'move or be(come) away (intransitive)', *dhend-* 'complete', *yakt-* ~ *wakt-* 'imperfective') have newly developed vowel-initial variants *att-, at-, and-* and *akt-* that cohere with the V stem: they do not trigger onset prothesis, no longer impose a two-syllable constraint on their host, and they no longer form prosodic subcategorization domains (on which see below). This results in a special unit [V-{*att, at, and, akt*}-SF] (Bickel et al. 2007).

Voicing [V(-V2)-SF]. *Evidence:* Single stops are regularly voiced between vowels or between nasals and vowels inside, but not between [V(-V2)-SF] domains. Some V2 alternate between cohesion and separation in this regard, e.g. *kuŋs-* 'go down, do in a downward manner' is found both as *kuŋs-* and as *guŋs-* after vowels while other V2 always cohere, e.g. *gond-* 'do here and there' is never attested as **kond-*. Some of the free phrasal affixes elements cohere. An example is the nominalizer *-ko*, which mostly occurs after vowels or nasals and is therefore voiced (21a). The voiceless variant survives optionally after suffixes with an underlying coda such as the indicative nonpast marker *-nok* ~ *-noʔ* in (21b):

(21) a. *paraya u-si-a-**go*** *maʔmi-ce jamma Rai-ta.*
almost 3nsS-die-PST-NMLZ person-ns all Rai-FOC
'Almost all people who died were Rais!' [Story.chintang.015]

b. *u-ko-no-**ko**-ce* *sa-ŋa* *hɨŋ-ma* *hid-u-ku-ce?*
3nsS-roam-NPST-NMLZ-ns who-ERG keep.alive-INF [3sA-]be.able-3O-NPST-3nsO
'But who can feed the people who roam around here?' [RM.JK.talk01.073]

Most free phrasal affixes and all clitics, however, escape voicing and therefore do not cohere with their hosts in this regard (e.g. the conjunctions *para* 'if' or *ki(na)* 'and, and then' are not attested with voiced onsets). Suffixes cohere and are therefore voiced (except when they go back historically to geminates), but prefixes are outside the voicing domain. Compare the fate of /t/ at the prefix-stem vs. the stem-suffix boundary in the following examples of *tat-* in V (22a) and V2 (22b) function:

(22) a. *phak-sa-ta* *u-**tad**-e.*
pig-meat-FOC 3nsS-bring-PST
'He brought pork.' [CLLDCh4R05S05.0713]

b. *u-mu-ba-ŋa* *ramese-ŋa* *ek* *jora* *lab-u-**tad**-e.*
DIST-DEM.DOWN-LOC-ABL Rameś-ERG one pair [3sA-]take-3[s]O-V2:bring-IND.PST
'Rameś has brought one pair from down/there' [CLLDCh2R12S07.874]

Prosodic subcategorization [V(2)-SF] vs. [PF] vs. [PA-FPA]. *Evidence:* These three domains are the possible hosts of prefixes and clitics and they are isomorphic to the domain defined by onset requirements (Bickel et al. 2007). When prefixes attach to the [PF] and the [V-SF] domain, the result appears as free permutation of the kind illustrated by (18a). When they attach to the [V2-SF] domain, the result is prefixes following suffixes, as in the second variant of (18b). Clitics subcategorize for the same domains, but they follow these domains. In (19), the focus markers *yaŋ* and *ta* follow a [V…] domains, right before a subsequent [V2…] domain; in (17a) *yaŋ* follows phrasal affixes.[10]

3.2.3 Behavior

Agreement prefixes cannot be displaced by a general rule of syntax nor do they attach to entire phrases. However, under two tightly constrained conditions, they allow spreading behavior in the sense of Bickel & Nichols (2007). First, we occasionally observe agreement prefixes to be copied to borrowed verb stems, e.g. onto *man-* 'observe, honor' (≺ Nep. *man-*) which combines (obligatorily) with the nativizer suffix *-e* and an auxiliary verb *numd-* 'do':

(23) *dasai **a**-man-e* *__a__-numd-o* *kina*
Daśaĩ 2[s]A-observe-V.NTVZ 2[s]A-do-[SUBJ.NPST.]3[s]O SEQ

a-kaʔ-na-ca-no.
2[s]S-come.up-NA-V2:complete-IND.NPST
'So when you are to observe the *Daśaĩ* festival, you come up.' [DR.exp.0762]

Evidence that this is spreading is that borrowed verb stems cannot host any prefixes outside this construction, and that the borrowed verb stem must be strictly adjacent to the auxiliary (potentially forming a single word domain in this regard).

Second, when (and only when) infinitives occur in strict adjacency to raising verbs, agreement prefixes can occasionally appear on the infinitive instead of the verb that controls them. This is shown by the data in (24a), which is a variant of the more common construction in (24b):[11]

(24) a. *hicce **na**-teĩ-ma* *lapt-i-ki* *paĩ.*
two 3[s]>2-beat-INF be.about-2pO-IND.NPST today
'She's going to beat the two of you.' [CLLDCh2R03S01.198]

[10] There is one suffix which can host prefixes and clitics, the negation marker *-yokt*. This marker behaves like a V2 in terms of its ability to form a host for prefixes and clitics and it also selects a verb stem as its host, but unlike V2 morphemes, *-yokt* does not impose a two-syllable constraint on the host. This suggests the existence of an exceptional domain [*yokt*-SF].

[11] Thanks to Robert Schikowski for drawing our attention to these data.

b. *ma?mi-ce-ŋa the?nuwa thuk-ma* ***na****-lapt-i-ŋs-i-hẽ.*
person-ns-ERG saliva spit.at-INF 3[s]>2-be.about.to-2pO-PRF-2pO-IND.PST
'People are about to spit at you.' [CLLDCh3R08S01.1021]

Evidence that *na-* has spread in (24a) is that the form *laptiki* would be ungrammatical in this context without *na-* nearby, while infinitives are nominal forms that cannot host agreement prefixes outside a raising context.

There are a few other morphemes that allow spreading in Chintang, but these are all free phrasal particles. A particle that spreads relatively often is the reportative marker *pho*, which can appear several times in a clause (subject to ill-understood pragmatic conditions):

(25) *dosi-ko phak-****pho*** *thippa-ŋa-ta sed-o-ko-****pho****.*
Daśaĩ-GEN pig-REP grandpa-ERG-FOC [3sA-]kill-3[s]P-IND.NPST-REP
'I heard it's grandpa who will kill the pig for the *Daśaĩ* festival.' [CLLDCh1R13S02.1469]

3.2.4 Summary of domains

Table 4 summarizes the word domains in Chintang in terms of the building blocks defined in Table 3. There is not much overlap within and across syntax and phonology, except for a recurrent relevance of an all-encompasing 'major word', and a general tendency for domains to exclude prefixes (in line with world-wide tendencies: Bickel et al. 2007, Schiering et al. 2012, Himmelmann 2014 and references cited there). If we also consider the special behavior of agreement prefixes which can spread onto adjacent verb complexes (Section 3.2.3), the 'word' in Chintang becomes even more elusive: under certain conditions, inflectional morphology can even distribute across larger syntactic units.

What is of most interest in discussions of polysynthesis is the combination of 'lexical' elements (incorporated nouns or verbs, lexical affixes) in coherent strings. What comes closest to this in Chintang are V2 stems. These cohere in most phonological and syntactic regards, but they start their own domains with regard to ordering constraints in syntax (where their position is governed by semantics and syntax) and some of them are exempt from a voicing rule.

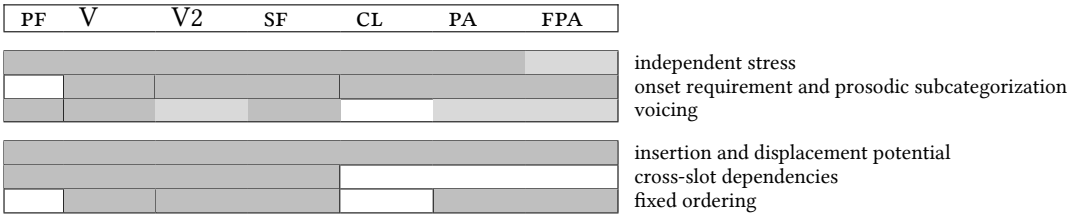
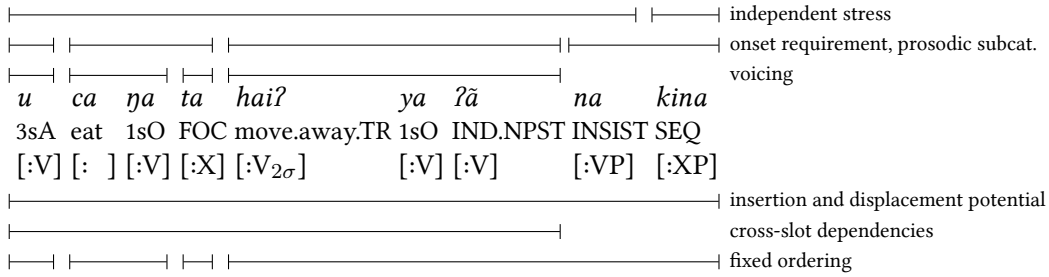


Table 4: Overview of word domains in Chintang phonology and syntactic in terms of the building blocks defined in Table 3: grey-shaded combinations of elements cohere with respect to the syntactic and phonological constraint listed on the right. Light shading means that only some elements cohere, depending on their lexical specification. A vertical bar inside a grey-shaded cell means that the element to the right (e.g. a V2) starts its own domain if it occurs.

To see the patterns in Table 4 in action, consider the following example (meaning 'after (the cat) will eat me', adapted from a folktale). Elements after a colon define the category that a morpheme selects (empty, if it does not select anything). The lines indicate the domains within which each rule or constraint applies, above the example for phonology and below the examples for syntax:



(26)

u	*ca*	*ŋa*	*ta*	*hai?*	*ya*	*ʔã*	*na*	*kina*
3sA	eat	1sO	FOC	move.away.TR	1sO	IND.NPST	INSIST	SEQ
[:V]	[:]	[:V]	[:X]	[:$V_{2\sigma}$]	[:V]	[:V]	[:VP]	[:XP]

We briefly explain in the following how each constraint applies in this example:

- **Independent stress**: This is found only in two places: on the first stem (*ca* 'eat') and then again on the sequential marker *kina* at the end, defining two separate domains.
- **Onset requirement and prosodic subcategorization**: The onset constraint is vacuously satisfied in most morphemes in the example because the elements have an onset underlyingly. The initial prefix *u-* by contrast receives an optional glottal stop: [ʔu-]. Likewise, if the main stem had no onset (as is the case in 20), the onset constraint would be satisfied by the optional prothesis of a glottal stop. The same holds at the beginning of the V2 element, but not anywhere else in the string. The onset requirement domains are isomorphic with the prosodic subcategorization domains. Therefore, the focus clitic *ta* can be inserted, as it is here, after the sequence *caŋa*. Alternatively, the clitic could be inserted after the third person singular agreement prefix *u-*,[12] or at the very end of the inflection string, right before the insistive particle *na*.
- **Voicing**: this can occur at the boundary between *ca-* 'eat' and a suffix although in the example the rule has no effect because there is no underlying voiceless element that could be voiced. If instead we had a combination of *tat-* 'bring' and the past tense suffix *-e*, the result would be *tade* 's/he came', showing the effect of voicing. No such effect is observed at the boundary between the suffix *-ŋa* and the focus clitic, which is realized as *ŋata*, not **ŋada*. Voicing again applies at the V2/suffix boundary, although again in the example the rule has no effect because of a general intervening rule that glottalizes *t*-final stems before palatal glides. Other V2/suffix boundaries show voicing, cf. e.g. the form *lab-u-tad-e* 'brought here' in (22b) where V2-final /t/ is voiced. The phrasal affixes in the example, by contrast, are outside the voicing domains, and so the sequential marker *kina* is realized without voicing even though it is flanked by vowels (**na-gina*).

[12] Bickel et al. (2007:61) found this to be ungrammatical. However we have now come across several examples in our corpus were *ta* attaches to an agreement prefix. The unacceptability in the 2007 report is better explained by the specific pragmatics of the example.

- **Insertion and displacement potential**: there is no single position in the example where one could insert any noun or adverb phrase or indeed any other syntactic unit. Likewise, no element could be extracted from the string.
- **Cross-slot dependencies**: The prefix *u-* and the suffix *-ya* depend on each other: agreement with a third person singular A argument triggers the *u*-prefix only when there is at the same time the first person singular O marker *-ya* (or one of its allomorphs). In no other context do third person singular A arguments trigger overt agreement morphology in Chintang. For example, when a third person singular acts on a second person, the form is *na-ca-no* [3>2]-eat-IND.NPST, without the *u*-prefix (Bickel et al. 2007).

As we see in the example, most constraints define slightly different domains. What we find is that different syntactic and phonological operations target different domains, similar to what has been reported for other Kiranti languages (Hildebrandt 2007). Like in Mapudungun, one does not gain much from trying to define a single 'word' domain in Chintang.

4 Conclusions

Polysynthetic 'words' are often not unified entities defined by a single domain on which all criteria would converge. They tend to be non-coherent in one way or the other. This has already been shown by Russell (1999) for Cree, by Rice (2000) for Athabaskan or by Evans et al. (2008) for Dalabon, and it has been confirmed by our own analysis of Mapudungun and Chintang. But then, it is important to note that this is by no means a pecularity of polysynthesis: languages generally tend to avoid fully convergent, unified word entities. Phonology and syntax are well known to target different domains. And over the past decade, it has become clear that is also true within phonology and within syntax.

We also observed that domains frequently do not nest, and this leaves little hope for prosodic hierarchies and similar generalizations. As with the overall approach to polysynthesis, one can of course pick any one word domain and declare it the central or canonical one, and then explain away all the others (e.g. claiming the relevant properties as irrelevant for wordhood). But it is not clear what one would gain with this, given that, one the hand, we do not know yet the full range of variation, and that on the other hand, we do know that different variables/dimensions have different relevance for acquisition and processing.

What is therefore needed now are (i) many more fine-grained analyses of each domain in each language, (ii) quantitative assessments of trends in how domain structures evolve over time and space, and (iii) more psycholinguistic research on how such domains are acquired and processed. For (i), there is an increasing number of collective volumes documenting diversity (Hall & Kleinhenz 1999, Hildebrandt et al. 2008, van Gijn & Zúñiga 2014b) and much descriptive work on individual languages. With regard to (ii), Bickel et al. (2009) and Schiering et al. (2012) have started to explore the phylogenetic stability and areal spread potential of phonological domains. Finally, for (iii), i.e. psycholinguistic perspectives, see the contribution by Stoll et al. in this volume (and references cited there).

Interlinear abbreviations

Abbreviations follow the Leipzig Glossing Rules with the following additions: A 'transitive subject', ADD 'additive focus', ATTR 'attributive', CONT 'continuative', DIST 'distal', DU 'dual', HAB 'habitual', INSIST 'insistive', NA (epenthetic syllable in Chintang), NFIN 'nonfinite', NTVZ 'nativizer', O 'object', OPT 'optative', PERAMB 'perambulative', POSP 'postposition', REP 'reportative', S 'intransitive subject', SEQ 'sequential', and TEL 'telic'.

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