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# 6

# Implicational hierarchies and grammatical complexity

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## 1 Introduction

This chapter examines the usability of Greenbergian implicational hierarchies (Greenberg 1966) in cross-linguistic research on language complexity.

Recently an increasing number of linguists have started to question the conventional wisdom according to which all languages are equally complex. McWhorter (2001a) proposes a metric for measuring the overall complexity of grammars of languages. One of the criteria employed in the metric pays attention to the number of grammatically expressed semantic or pragmatic distinctions: for example, a language that has a singular, a plural, and a dual is more complex in this respect than a language where only two number categories, singular and plural, are found. McWhorter further argues (p. 160) that such complexity differences can be translated into implicational hierarchies. Thus, the existence of number categories is regulated by the implicational hierarchy in (1) (adapted from Greenberg 1963; Greenberg formulated his Universal 34 as follows: "No language has a trial number unless it has a dual. No language has a dual unless it has a plural.").

(1) The number hierarchy
(SINGULAR) < PLURAL < DUAL < TRIAL

The hierarchy is interpreted as follows: if a language exhibits a given category on the hierarchy, it will also exhibit all the categories to the left of this category (i.e. in the direction of the arrowheads). Thus, if we know that a language has a dual, then we can expect it to have a plural (and a singular) as well, but we cannot infer anything about the existence of a trial in that language. McWhorter's criterion can then be recast as: the higher a language climbs on a given hierarchy, the more complex its grammar is in that respect.

In this chapter, I shall develop and critically examine this idea, and relate the concept of implicational hierarchy to the ongoing discussion on language complexity.

In section 2, I will discuss and define the notion of complexity adopted here. Section 3 presents the sample used in the study, and section 4 discusses in detail the implicational hierarchies investigated. The cross-linguistic results are given in section 5. Finally, section 6 discusses the relationship between implicational hierarchies and complexity in more depth and presents the main conclusions of the chapter.

## 2 Some background on the notion of complexity

As discussed in Miestamo (2006, 2008) and by Östen Dahl on pp. 50–2 above, complexity can be and has been approached in two different ways in linguistics: in *absolute* and in *relative* terms.

The absolute approach defines complexity in objective terms as the number of parts in a system, of connections between different parts, etc. Absolute complexity can be cast in information-theoretic terms, defining a phenomenon as the more complex, the longer its shortest possible description is (see also Dahl 2004 for more discussion). This is the basic idea behind the notion of Kolmogorov complexity (Li and Vitányi 1997). However, defining complexity as straightforward length of description would take total chaos as maximally complex: that is not the concept of complexity which interests us. Gell-Mann's (1994) notion of effective complexity pays attention only to the regularities within a system. The length of the description of the regularities in a system provides a usable definition of grammatical complexity. Examples of the absolute approach to complexity in recent typologically oriented discussion include McWhorter (2001a) and Dahl (2004).

The relative approach to complexity defines complexity in relation to language users: what is costly or difficult to language users (speakers, hearers, language learners) is seen as complex. Complexity is thus identified with cost and difficulty of processing and learning. However, the notion of relative complexity is problematic in typological research.

First, language use involves very different situations and roles, and what is costly or difficult for one class of language users (e.g. speakers) may ease the task of another user type (e.g. hearers). As noted by Kusters (2003), adopting a relative definition of complexity requires one to answer the question "Complex to whom?" For example, fission (many forms corresponding to one meaning syntagmatically), for example, discontinuous negation as in French *Je ne chante pas*, will be an extra burden for the speaker, but eases the hearer's

task of comprehension. Complexity would thus mean different things depending on whether we adopt the speaker's or the hearer's perspective (or that of the L1 or L2 learner).

How should we then decide which type of language use is primary and criterial for our definition? And do we want to make such a decision in the first place? In Kusters' (2003) study, the sociolinguistic orientation justifies the choice of L2 learners as criterial, but if we are aiming at a general definition of language complexity, the relative approach has no solution to this problem.

Secondly, our understanding of what is costly or difficult and what is easy for language users is far from being complete. For some phenomena we might have a fairly good understanding of cost and difficulty, but when looking at different domains of grammar, especially when doing this with an extensive sample of languages, we are likely to encounter many phenomena for which we cannot decide unequivocally what is easy and what is difficult in them for different classes of language user. There is simply not enough psycholinguistic research on all the relevant aspects of all the relevant phenomena. Kusters (2008) also acknowledges this problem.

Given these problems with the relative definition of complexity (see Miestamo 2006, 2008 for more detailed discussion), cross-linguistic studies of grammatical complexity should adopt an absolute definition of complexity. Accordingly, I follow Dahl (2004) in restricting the term "complexity" to absolute complexity, and using the terms cost and difficulty when cost and difficulty are intended. Whether complexity defined in absolute terms correlates with cost and difficulty is a highly important follow-up question – indeed one of the main factors that make the study of language complexity theoretically interesting.

Another important distinction is to be made between *global* and *local* complexity, the former term referring to the global or overall complexity of (the grammar of) a language, and the latter to a particular domain of grammar such as (to take two random examples) verbal morphology, or the system of spatial deixis.

The received view of global complexity is that all languages are equally complex, and that complexity in one area is compensated by simplicity in another – this is the equi-complexity hypothesis. There is, however, little empirical work to support this thesis. The most explicit attempt to measure the global complexity of grammars is the metric proposed by McWhorter (2001a, 2007). The 2007 version of the metric contains three criteria of complexity: *overspecification* (the extent to which a grammar makes semantic and pragmatic distinctions beyond communicative necessity), *structural elaboration* (number of rules mediating underlying forms and surface forms), and *irregularity*.

Miestamo (2006, 2008) identifies two general problems that any such metric of global complexity must deal with. The *Problem of Representativity* means that it is very difficult to account for all aspects of grammar in such detail that one could have a truly representative measure of global complexity. It may, however, be possible to achieve a sufficient level of representativity to show global complexity differences when these are very clear. The *Problem of Comparability* refers to the fact that the different criteria used to measure the complexity of a grammar are incommensurable. It is not possible to quantify the complexity of, for example, syntax and morphology so that the numbers would be comparable in any useful sense. This incommensurability obtains between the domains and subdomains of grammar in general. Therefore, only in cases where one language is more complex than another on (almost) all criteria can we identify differences in global complexity. Given these problems, one should focus in large-scale typological studies on the complexity of specific areas of grammar.

As argued in Miestamo (2006, 2008), functional domains provide a useful tertium comparationis for approaching the complexity of specific areas of grammar. Thus, we may study and compare the complexity of e.g. tense systems across languages, and say that according to the *Principle of Fewer Distinctions*, a language with two grammatical tense distinctions is less complex than one with five. Similarly, we may look at the way these tense distinctions are formally encoded and say that the more the formal coding of tense deviates from the *Principle of One Meaning–One Form*, the more complexity it involves. When we have gathered data from many different domains, we may see whether the complexities of different domains (e.g. tense, aspect, mood, deixis) show correlations, and this will then provide partial answers to the big question behind the equi-complexity hypothesis, namely whether the complexity of one domain is compensated by simplicity in another.

Implicational hierarchies provide one means of examining the complexity of functional domains. Many of them are straightforward complexity measures in terms of the Principle of Fewer Distinctions. This is the case with for example the number hierarchy in (1) above: a language that climbs higher on the number hierarchy makes more distinctions in the domain of number.

However, the connection between complexity and the hierarchies is not so straightforward in all cases, for example in the case of the accessibility hierarchy proposed by Keenan and Comrie (1977):

(2) The accessibility hierarchy
SBJ < DIRECT OBJ < INDIRECT OBJ < OBL < GEN

The syntactic structures used with subject relativization are usually the simplest, and complexity tends to increase when we climb up the hierarchy.

In this case, we are naturally dealing with language-specific structures, the complexity of which we have to describe separately in each language. (See J. A. Hawkins 2004 for a way to analyse the complexity of these structures, and cf. also Kirby 1997.) In what follows, I will explicate the connection between complexity and the hierarchies I discuss. In addition to the fact that many hierarchies are complexity measures as such, a further interest can be seen in that related hierarchies may be expected to show (inverse) correlations, and thus also allow us to test the equi-complexity hypothesis.

## 3 Sampling

The study is based on a sample of fifty languages. The sampling method follows the principles introduced in Miestamo (2005). It has two main goals: the sample should be as representative of the world's linguistic diversity as possible, and the languages should be areally and genealogically as independent of each other as possible. The latter goal is especially important in view of the statistical aims of the study. The sampling frame is therefore stratified both genealogically and areally.

The stratification is based on the notions of *genus* and *macroarea*, as understood by Dryer (1989, 2005). Instead of taking an equal number of languages from each macroarea, the method pays attention to the genealogical diversity of each area. The number of languages selected from each macroarea is determined by the proportion that the number of genera in that macroarea represents of the total number of genera in the world. Genealogically more diverse areas are thus represented by a higher number of languages in the sample than areas that show less diversity. In Dryer's (2005) classification, the world's languages are divided into 458 genera. Table 6.1 shows the distribution of the genera in the six macroareas.

**Table 6.1.** Genera and sample languages by macroarea

| | Genera | % | Sample |
|---|---|---|---|
| Africa | 64 | 14·0 | 7 |
| Eurasia | 38 | 8·3 | 4 |
| Southeast Asia and Oceania | 46 | 10·0 | 5 |
| Australia and New Guinea | 125 | 27·3 | 14 |
| North America | 91 | 19·9 | 10 |
| South America | 94 | 20·5 | 10 |
| Total | 458 | 100·0 | 50 |

The middle column shows the percentage that the number of genera in each macroarea represents of the total number of genera in the world. For example, Africa has sixty-four genera in Dryer's classification, which equals 14 per cent of the world's total of 458 genera. According to the sampling method adopted here, 14 per cent of the sample languages should come from Africa. With a sample size of fifty languages, this means seven African languages. The number of languages included in the fifty-language sample is shown in the rightmost column of Table 6.1. Every language in the sample must come from a different genus (and so far as possible, also from different families). The languages sampled from each macroarea are listed in Table 6.2; Fig. 6.1 shows the geographical distribution of the sample languages.[1]

**Table 6.2.** Sample languages by macroarea (primary sources consulted in brackets)

Africa (7 languages)
Khoekhoe (Hagman 1977), Hdi (Frajzyngier 2002), Koyra Chiini (Heath 1999), Krongo (Reh 1985), Ma'di (Blackings and Fabb 2003), Somali (Saeed 1999), Supyire (Carlson 1994)

Eurasia (4 languages)
Basque (Hualde and Ortiz de Urbina 2003), Lezgian (Haspelmath 1993), Lithuanian (Ambrazas 1997), Yukaghir (Kolyma) (Maslova 1999)

Southeast Asia and Oceania (5 languages)
Hmong Njua (Harriehausen 1988), Kambera (Klamer 1998), Meithei (Chelliah 1997), Semelai (Kruspe 2004), Thai (Iwasaki and Ingkaphirom 2005)

Australia and New Guinea (14 languages)
Alamblak (Bruce 1984), Arapesh (Conrad and Wogiga 1991), Daga (Murane 1974), Gaagudju (Harvey 2002), Imonda (Seiler 1985), Inanwatan (de Vries 2004), Kayardild (Evans 1995), Lavukaleve (Terrill 2003), Maybrat (Dol 1999), Nabak (Fabian et al. 1998), Sentani (Cowan 1965), Tauya (MacDonald 1990), Yelî Dnye (Henderson 1995), Yimas (Foley 1991)

North America (10 languages)
Greenlandic (West) (Fortescue 1984), Halkomelem (Galloway 1993), Koasati (Kimball 1991), Mixtec (Chalcatongo) (Macaulay 1996), Osage (Quintero 2004), Pipil (Campbell 1985), Purépecha (Chamoreau 2000), Slave (Rice 1989), Tiipay (Jamul) (A. Miller 2001), Wintu (Pitkin 1984)

South America (10 languages)
Awa Pit (Curnow 1997), Hixkaryana (Derbyshire 1979), Jarawara (Dixon 2004), Kwazá (van der Voort 2004), Mapudungun (Smeets 1989; Zúñiga 2000), Mosetén (Sakel 2004), Rama (Grinevald-Craig 1988), Sanuma (Borgman 1990), Trumai (Guirardello 1999), Yagua (Payne and Payne 1990)

[1] The names of the languages appear in the form they are listed in *The World Atlas of Language Structures* (WALS, Haspelmath et al. 2005). The map was generated using the WALS Interactive Reference Tool developed by Hans-Jörg Bibiko.

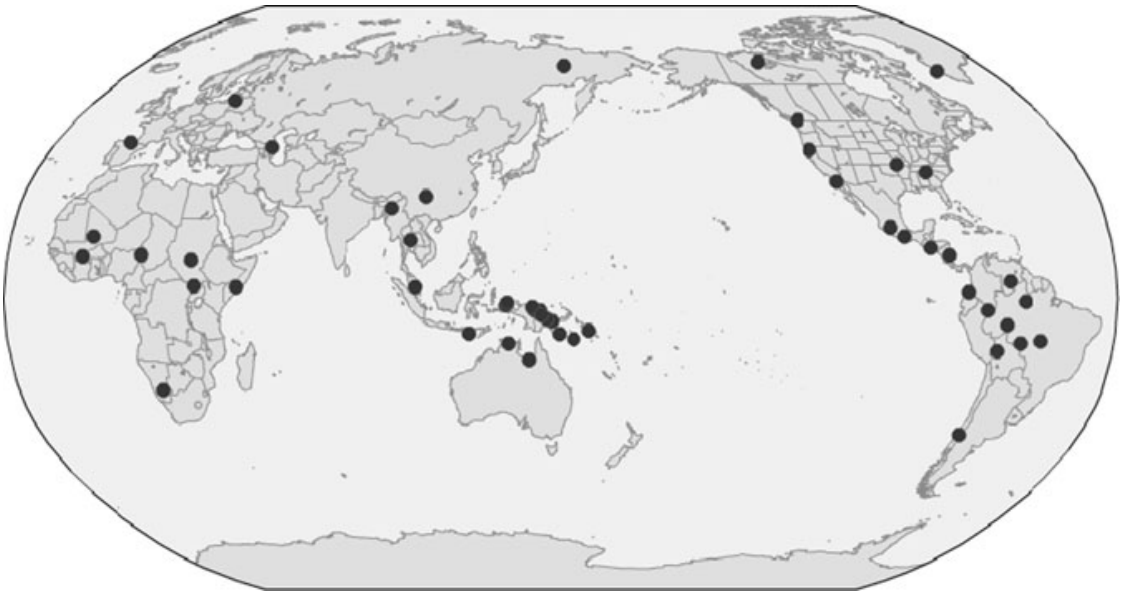

FIG. 6.1. Sample languages

## 4 The implicational hierarchies

To find suitable hierarchies for the study, I consulted the Universals Archive (UA),[2] which covers a large number of universals proposed in linguistic literature.

One methodological possibility would be to examine the cross-linguistic variation on all or most of the hierarchies found in such a database. This path was not followed, because with most of the hierarchies no connections to – and thus correlations with – other hierarchies would be expected (some unexpected correlations could of course turn up).

The research strategy adopted in this chapter concentrates on hierarchies that might be expected to show correlations. Two pairs of hierarchies found in the UA, surmised to be connected in the relevant sense, were chosen for case studies in this chapter: the agreement and case hierarchies on the one hand and the verbalization and copula hierarchies on the other.

### 4.1 *The agreement and case hierarchies*

The agreement and case hierarchies operate in the domain of the marking of clausal participants.[3] It should be noted that in this context case and agreement

[2] <http://typo.uni-konstanz.de/archive/intro/index.php>

[3] Note that the agreement hierarchy examined here is different from what Corbett (1979) refers to by that term.

are not understood as referring to bound morphology only, but "case" will also include dependent marking of grammatical relations with adpositions and "agreement" will also include head marking of grammatical relations with adverbal clitics or particles. The following representation (3) of the hierarchies is adapted from C. Lehmann (1988):

(3) Agreement and case hierarchies

| | 1 | | 2 | | 3 | | 4 |
|---|---|---|---|---|---|---|---|
| Agreement: | ABS | < | OBJ | < | INDIRECT OBJ | < | DIRECT ADJUNCT |
| | SBJ | < | ERG | < | LOC ADJUNCT | < | ABL ADJUNCT |
| | | | | | INS ADJUNCT | < | COM ADJUNCT |
| | 4 | | 3 | | 2 | | 1 |
| Case: | ABS | > | OBJ | > | INDIRECT OBJ | > | DIRECT ADJUNCT |
| | SBJ | > | ERG | > | LOC ADJUNCT | > | ABL ADJUNCT |
| | | | | | INS ADJUNCT | > | COM ADJUNCT |

The hierarchies in (3) read as follows. If a language codes a participant in a given column with agreement, it will code (at least some) participants in the columns to the left of this column with agreement. If a language codes a participant in a given column with case, it will code (at least some) participants in the columns to the right of this column with case. We may give the following interpretation to the hierarchies in terms of complexity: a language is the more complex the higher it climbs on either hierarchy, since agreement and case marking are means of coding relations overtly – overt marking is more complex than no marking because, other things being equal, it requires a longer description than no marking.

In this chapter I have restricted my investigation of agreement and case to verbal main clauses; furthermore, I have counted case only on full NPs, not on pronouns. As can be seen in (4a, b) (data from Hualde and Ortiz de Urbina 2003: 209, 411, 413), Basque has verbal agreement for absolutives, ergatives, and indirect objects (datives), but no agreement for the directional (allative) relation in (4c); overt case marking occurs on ergatives, indirect objects, and directional participants, but not on absolutives. For reasons of space, it is not possible to exemplify all the relations in the rightmost and next-to-rightmost columns of (3), but, apart from indirect objects, it is true in general in Basque that those relations show case marking but no agreement.

(4) a. *dakar-ki-zu-t*
bring.3.ABS-PRS-2S.DAT-1S.ERG
"I bring it to you."

b. *jon-ek* *miren-i* *ardoa* *ekarri* *dio*
Jon-ERG Miren-DAT wine[ABS] bring AUX.3.ABS.3.ERG.3.DAT
"Jon brought wine for Miren."

c. *autobus-era* *bultzatu* *gaituzte*
bus-ALL push AUX.1P.ABS.3P.ERG
"They pushed us into the bus."

Basque is thus assigned three points on the agreement hierarchy and three points on the case hierarchy.

All languages in the sample have case marking for at least one item in each of the rightmost and next-to-rightmost columns. Furthermore, in the fifty languages examined, there is only one instance of agreement with any of the adjunct relations, namely in Imonda, where comitatives have number agreement; this is the only instance of agreement extending to the rightmost column.[4] There is therefore little reason in the present study to distinguish between the rightmost and next-to-rightmost columns. Instead I have adopted simplified versions of the two hierarchies, as shown in (5):

(5) Agreement and case hierarchies, simplified

| | | | | | |
|---|---|---|---|---|---|
| | 1 | | 2 | | 3 |
| Agreement: | SBJ/ABS | < | OBJ/ERG | < | OBL |
| | 3 | | 2 | | 1 |
| Case: | SBJ/ABS | > | OBJ/ERG | > | OBL |

In (5) the two rightmost columns of (3) have been merged under the label "oblique". It is still the case that all languages score at least one point on the case hierarchy, i.e. in all languages we find dependent marking for at least some of the oblique relations,[5] but in order to preserve the symmetry between the two hierarchies, the oblique column was retained in the case hierarchy. Using the simplified hierarchies, Basque (4) is assigned three complexity points for agreement and two for case.

Restrictions on space preclude detailed discussion of the limits of what counts as case and what counts as agreement. Nevertheless, a few issues need to be mentioned here.

[4] There are naturally cases of head marking of different oblique relations, e.g. directional and instrumental affixes, but as they do not index the participant in question, these are not agreement or cross-reference.

[5] In the sample, Arapesh, where the use of prepositions is rather marginal, comes the closest to having no dependent marking for the oblique relations.

First, the agreement and case hierarchies are about grammatical relations, not directly about the expression of semantic roles. Thus, for example, direct objects may code various semantic roles in languages, but in the present context we pay attention to their status as grammatical relations, not to the semantic roles they may express. More concretely, when a language expresses recipients as direct objects, these are not counted as indirect objects in the hierarchy. Thus a language with a secondary object system, for example Mosetén, where subjects and objects are cross-referenced on the verb and where ditransitives mark the recipient rather than the theme as direct object, is assigned two points on the agreement hierarchy.

Secondly, the marking of participants with serial verb constructions (as in Maybrat) or with adpositional verbs (as in Halkomelem) is dependent marking and counted as case in the present context; note that it is common for such serial verbs to grammaticalize as adpositions – a development that is currently under way in Maybrat.

Finally, it should be noted that a few counterexamples to the hierarchies can be found in the fifty-language sample. There is one counterexample to the agreement hierarchy, namely Khoekhoe, where direct and indirect objects may be cross-referenced on the verb if there is no overt object or indirect object NP in the clause, but subjects are not cross-referenced. As to the case hierarchy, there are three languages where subjects show overt case marking but objects do not: Osage, Somali, and Jamul Tiipay. In these cases the complexity points are assigned according to the highest point the language reaches on the hierarchy regardless of the gap observed lower on the hierarchy: Khoekhoe scores three points on the agreement hierarchy, and Osage, Somali, and Jamul Tiipay score three points on the case hierarchy.

### 4.2 *The verbalization and copula hierarchies*

The verbalization and copula hierarchies concern the linguistic encoding of location, object, property, and action predicates.

Coding with a copula is here understood as referring to coding with any support item, be it a true copula or a locational support verb. Verbalization means, to put it simply, that the predicates show morphosyntactic properties of verbs in the language in question. The representation of the verbalization and copula hierarchies in (6) is adapted from Stassen (1992) and Croft (1991), respectively. Croft's copula hierarchy does not include locative predicates, but they have been included here to make the hierarchies symmetrical; extended this way (and defined as covering coding with any support item), the copula hierarchy is a valid cross-linguistic generalization in my sample.

(6) Verbalization and copula hierarchies

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 4 | | 3 | | 2 | | 1 |
| Verbalization: | LOCATION | > | OBJECT | > | PROPERTY | > | ACTION |
| | 1 | | 2 | | 3 | | 4 |
| Copula: | LOCATION | < | OBJECT | < | PROPERTY | < | ACTION |

The hierarchies can be read as follows. If a given type of predicate is coded by using a copula (a support item), then the predicate types to its left will also be. Similarly, if a given type of predicate is coded by verbalization, then the predicate types to its right will also be. In my fifty-language sample, there are no clear counterexamples to either hierarchy. Requiring a longer description (other things being equal), overt coding with a copula or by verbalization is more complex than its absence, and a language is thus the more complex the higher it climbs on either hierarchy.

As Stassen (1992: 193) notes, action predicates are verbalized by default and do not belong to the hierarchy in the same sense as the three others; in Stassen's (1997: 124) data, non-verbal coding of action predicates is very rare and never the sole option in languages. Cross-linguistic variation relevant in the present context can only be found in the coding of location, object, and property predicates. In this study, I have therefore disregarded action predicates, and focused on the three remaining predicate types. Furthermore, I have only taken into account stative predications, and left inchoative predications outside the study. The simplified form of the hierarchies adopted in this study is given in (7):

(7) Verbalization and copula hierarchies, simplified

| | | | | | |
|---|---|---|---|---|---|
| | 3 | | 2 | | 1 |
| Verbalization: | LOCATION | > | OBJECT | > | PROPERTY |
| | 1 | | 2 | | 3 |
| Copula: | LOCATION | < | OBJECT | < | PROPERTY |

In this chapter I have restricted my investigation of verbalization and copular coding to main clauses. The assignment of complexity points on the hierarchies is illustrated in (8) with examples from Kambera (Klamer 1998: 49, 107, 123, 166):

(8) a. *mbeni-ya-ka* *nú*
be_angry-3S.ACC-PFV DEICTIC
"People are angry."

b. *tau* *mayila-mbu-kai* *nyimi* *ná*
person poor-also-2P.ACC you DEICTIC
"Moreover, you are also poor people."

c. *la* *'uma-ya*
LOC house-3S.ACC
"(S)he is at home."

d. *ni-nya* *la* *uma*
be-3S.DAT LOC home
"(S)he is at home."

The language does not have a separate class of adjectives, property words being intransitive verbs (8a). Object and location predicates are also coded verbally, as the accusative verbal enclitic cross-references the subject (8b, c). Example (8a) shows that this is indeed a verbal enclitic (marking an impersonal subject in this example). Location predications can alternatively be construed with a support verb, as in (8d). Therefore Kambera is assigned three points on the verbalization hierarchy and one point on the copula hierarchy.

Again, lack of space prevents more detailed discussion and exemplification of the limits of what counts as copula coding and verbalization; but a couple of issues must be addressed. First, the support items that the copula hierarchy covers may be maximally abstract copular verbs or more concrete locational verbs, for example, posture verbs such as "stand", "sit", or "lie", but they may also be non-verbal copulas as in Ma'di, where the element ʔɨ̄ that is originally a focalizer acts as a non-verbal copula with object predicates.

Secondly, verbalization may mean fully verbal coding, as is the case in the cross-linguistically common pattern where property concepts are (stative) verbs and the language has no separate (open) class of adjectives, e.g. in Kambera (8a). In some cases, as in Kambera object and location predications (8b, c), the stative predicates do not show the full morphosyntactic characteristics of verbs in the language, but their coding is clearly verbal as verbal cross-reference markers (or other verbal marking) is used whenever these predicates occur.

There are two less clear cases of verbalization in the data. In Tauya, object words in predicate position show the same declarative mood marker as verbs, but unlike verbs, they lack cross-reference markers; however, since the mood marker is verbal, the language shows (at least some) verbal marking for object predicates, and therefore receives two complexity points on the verbalization hierarchy. In Semelai, location and object words are usually zero-coded as predicates, but they may carry the imminent aspect proclitic, which is a verbal marker, and again we must conclude that verbalization of location and object predicates occurs in the language.[6]

[6] It should be noted that Stassen's (1997) criteria of verbalization are somewhat more conservative than the ones used here.

## 5 Results

Tables 6.3 and 6.4 show the scores for each of the fifty sample languages on the hierarchies examined. (Language names are represented by their first three letters.) Figs 6.2 and 6.3 further visualize the cross-linguistic complexity variation along the hierarchies: Figs 6.2a, b and 6.3a, b show the individual scales, whereas Figs 6.2c and 6.3c combine the related hierachies, and thus show the overall complexity of each domain in terms of these hierarchies. The cross-linguistic means and medians are given in Table 6.5.

In Tables 6.3 and 6.4, complexity increases as we go higher on the *x* and *y* axes. If the hierarchies balanced each other out perfectly, only the shaded cells would be populated; in these cells the overall complexity of the domain is 3. The cells below and to the left of the shaded cline contain less complex cases (overall complexity 0–2), where one or more of the functions are not overtly marked with the marking devices observed in the hierarchies. The cells above

**Table 6.3.** Agreement and case data

| AGREEMENT | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 3 | | dag gaa kam yim | bas imo kho pur | koa som |
| 2 | | ala ara hal hix ina jar lav mad map mos nab pip sen sla | awa gre hdi kwa tau win yel | osa tii |
| 1 | | kro may mix ram | tru yag yuk | lit sem |
| 0 | | hmo sup koy tha | lez mei san | kay |

CASE

**Table 6.4.** Verbalization and copula data

| VERBALIZATION \ COPULA | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 3 | hdi sem | kam | | |
| 2 | | hal kwa pip tau | | kho |
| 1 | | ara lav may | hmo koa koy kro mei san tha tii yuk | ala gre jar lez map mix osa sla som sup tru win yim |
| 0 | dag mos | sen yel | mad | awa bas gaa hix imo ina kay lit nab pur ram yag |

**Table 6.5.** Means and medians

| | Mean | Median |
|---|---|---|
| Agreement | 1·70 | 2 |
| Case | 1·62 | 1 |
| Agreement + Case | 3·32 | 3 |
| Verbalization | 0·88 | 1 |
| Copula | 2·16 | 3 |
| Verbalization + Copula | 3·04 | 3 |

and to the right of the shaded cline contain more complex cases (overall complexity 4–6), where one or more of the functions are marked with more than one device.

The mean overall complexities of both domains are close to 3, but we can see some clear differences between them. The agreement and case hierarchies

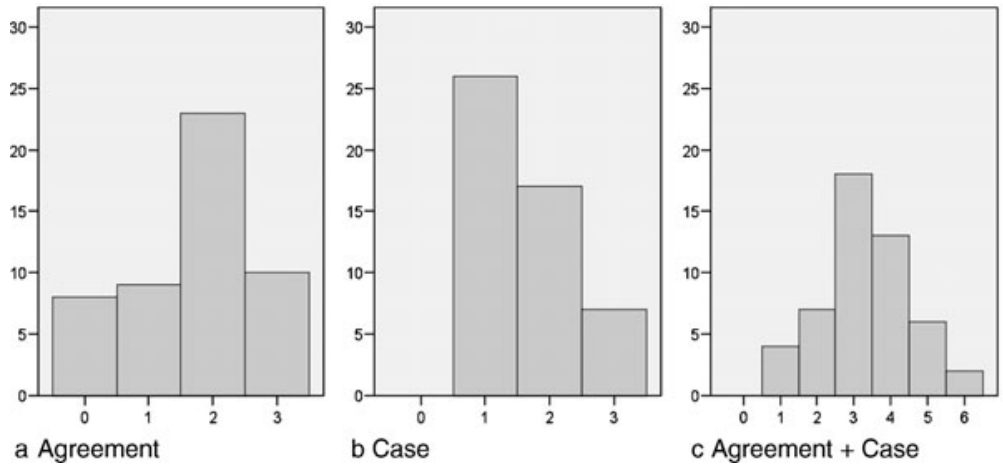


Fig. 6.2. Cross-linguistic variation on the agreement and case hierarchies

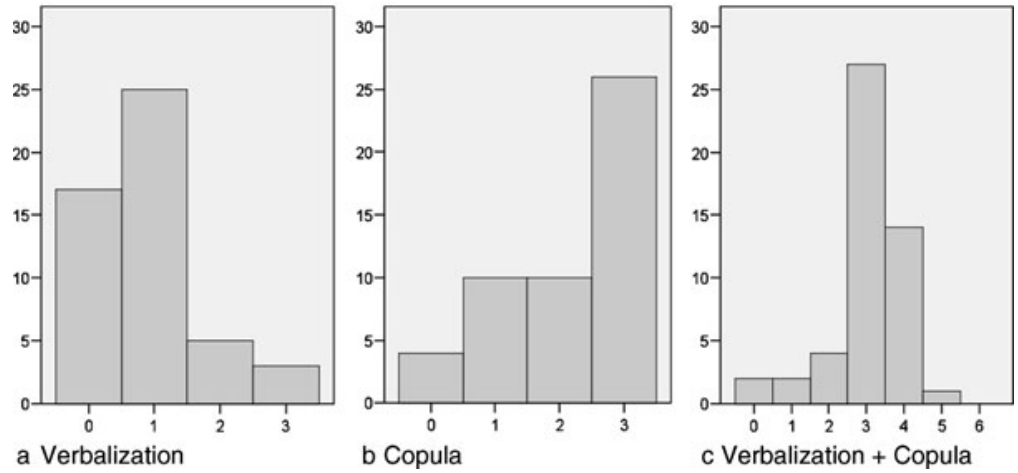


Fig. 6.3. Cross-linguistic variation on the verbalization and copula hierarchies

do not show any clear patterning along the shaded cline and the simplest and the most complex areas of the grid are well populated. (The picture is a bit skewed by the fact that all languages are assigned at least one point on the case hierarchy: cf. section 4.1.) The means and medians are slightly higher for the agreement hierarchy, as is the sum of all complexity points assigned in all sample languages: agreement 85, case 81. The overall complexity of the domain is normally distributed. The verbalization and copula hierarchies show fewer cases where overall complexity is very low or very high. The overall complexity values come close to the shaded descending cline, suggesting an inverse correlation between the hierarchies (we will come back to the correlations below). Overall complexity is not as clearly normally distributed

as in the domain of agreement and case. Compared to each other, the verbalization and copula hierarchies are very different, the former showing a skewing at the lower end of the scale and the latter at the higher end, the total points assigned in all languages being 44 for verbalization and 108 for copula.

It may be noted that the amount of redundancy cannot be directly read off the tables. Agreement and case may often occur simultaneously coding a given relation in a clause, but there are some cases in the data where they are in complementary distribution, e.g. Inanwatan and Khoekhoe. The hierarchies as presented here only pay attention to whether the language may have case or agreement coding for the relation in at least some (verbal main) clauses, without paying attention to whether they may occur simultaneously. As to verbalization and copular coding, they are mutually exclusive in a clause, so they can only co-occur in a language on the system level (in different contexts or as free variants). Tables 6.3 and 6.4 and Figs 6.2c and 6.3c therefore show the overall complexity of their respective domains on the level of the system, not on the level of individual constructions.

Correlations are to be expected between the agreement and case hierarchies on the one hand and the verbalization and copula hierarchies on the other. In the data of my fifty-language sample there is no significant correlation, positive or negative, between the agreement and case hierarchies (Kendall's tau-b = 0·012, $p$ = ·921),[7] but there is an inverse correlation between the verbalization and copula hierarchies which turns out to be significant at the 0·01 level (Kendall's tau-b = –0·353, $p$ = ·005).[8] One of the two hierarchy pairs expected to show correlations thus meets this expectation and the other one does not. I also checked if there were any (unexpected) correlations between the unrelated hierarchies (i.e. between copula and case, copula and agreement, verbalization and case, verbalization and agreement) and between the overall complexities of the two domains (i.e. between copula + verbalization and agreement + case): no significant correlations emerged.

Relating these correlations to the discussion of complexity, we can conclude that there is no compensation between the agreement and case hierarchies; but the complexities of copular and verbal marking of stative

[7] As a non-parametric test, Kendall's tau correlation test is not subject to the main criticisms in Janssen et al. (2006).

[8] I also selected a 50-language sample from Stassen's (1997) data following the principles of areal and genealogical stratification discussed above. I merged the locational and copula strategies in Stassen's data. As already mentioned, his definition of verbalization is slightly different from the present study. In this dataset, the verbalization and copula hierarchies showed a correlation that was almost significant at the ·05 level (Kendall's tau-b = −0·250, $p$ = ·052).

predicates do show a trade-off effect. This points towards the conclusion that while compensations are found in some domains of grammar, they are not an all-encompassing phenomenon; see Sinnemäki (2008) for a similar result. Why there is compensation in one domain but not in another needs to be explained in each case – and this naturally also requires a more detailed investigation of the domains in question; but such explanations will not be attempted in this methodological essay.

## 6 Discussion and conclusions

So far, we have seen that implicational hierarchies may be used for measuring aspects of the grammatical complexity of the domains in which they operate. Furthermore, we have seen that when we find related hierarchies operating within a given domain, we may look for correlations between them and thereby address the question of the existence of complexity trade-offs. The applicability of this research strategy is, however, to some extent limited by the fact that the implicational hierarchies proposed in the literature so far cover only a limited number of grammatical phenomena, and even fewer are related in such a way that correlations could be expected between them.

Nevertheless, using implicational hierarchies in the study of complexity (regardless of whether they show correlations) has the additional value of deepening our understanding of the relationship between complexity and cost/difficulty. The reasoning goes as follows. First, while cross-linguistic frequencies are not fully determined by ease of processing and learning, these factors play a significant role in what is preferred and what is dispreferred in the world's languages. In other words, the easier a given grammatical category or structure is to process or learn, the more frequently it will appear in discourse in a given language and the more frequently it will be grammaticalized in the world's languages (cf. the Performance–Grammar Correspondence Hypothesis proposed by John Hawkins 2004). Secondly, implicational hierarchies reflect cross-linguistic preferences: on any hierarchy the features at the least marked end are the most frequent ones cross-linguistically, and the marked end contains less frequent features. Drawing these two ideas together, implicational hierarchies can (to some extent at least) be interpreted as measuring cost/difficulty of processing and/or learning from a cross-linguistic point of view.

Moreover, we may assume that linguistic phenomena that are cross-linguistically frequent are relatively easy for all language users (speakers, hearers, learners). As to cross-linguistically less common phenomena, the question is more complicated, since a given category or structure may be rare because it

is costly or difficult for a particular class of language users while being easy for other classes. In any case, cross-linguistic preferences can be interpreted as reflecting (to some extent) cost/difficulty shared by all language users. Thus, in implicational hierarchies, the differences between different types of language user have been filtered away to a large extent, and the use of hierarchies as complexity measures allows us (partly) to bypass the question "Difficult to whom?" referred to in connection with the discussion of "relative complexity" above. This makes implicational hierarchies especially attractive in illuminating the link between complexity and cost/difficulty.

As a final note, we have seen that hierarchies may differ as to the location of the cross-linguistically most frequent point that languages reach. The preferred point may be situated anywhere between the simplest and the most complex ends of the scales. As seen above, the most commonly reached point on the verbalization hierarchy is close to the simplest end of the scale, whereas on the copula hierarchy it is at the most complex end. Naturally, the features at the simplest end are always the commonest ones and those at the most complex end the least common ones, i.e. copula coding for locational predications is more frequent than copula coding for property predications, even though property predications are the point that languages most frequently reach on the copula hierarchy.

That the most frequently reached point is not always at the simplest end of the scale shows that some complexity is needed for communication. Both speakers' and hearers' needs are reflected in these preferences.