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GRAMMATICAL COMPLEXITY IN A CROSS-LINGUISTIC PERSPECTIVE

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Abstract

In this paper, I address theoretical and methodological issues in the cross-linguistic study of grammatical complexity. I identify two different approaches to complexity: the absolute one – complexity as an objective property of the system, and the relative one – complexity as cost/difficulty to language users. I discuss the usability of these approaches in typological studies of complexity. I then address some general problems concerning the comparison of languages in terms of overall complexity, and argue that in typological studies of complexity it is better to focus on specific domains that are comparable across languages. Next, I discuss a few general criteria for measuring complexity. Finally, I address the relationship between complexity and cross-linguistic rarity.

1. Introduction

The study of language complexity has recently attracted a lot of interest in the field of linguistic typology. The consensus that all languages are equally complex is being challenged by a growing number of authors (e.g., McWhorter 2001; Kusters 2003; Shosted 2006). This paper addresses theoretical and methodological issues concerning the study of grammatical complexity, especially from a cross-linguistic perspective.[1] Complexity has been approached either from the absolute or the relative point of view in linguistics; Section 2 will introduce these perspectives and discuss their pros and cons in typological research. In Section 3, I will address two general problems concerning the comparison of languages in terms of global (overall) complexity, viz. the problems of representativity and comparability. Especially the latter problem leads to the conclusion that typological studies of grammatical complexity should focus on specific domains that are cross-linguistically comparable. Functional domains provide feasible tertia comparationis for such studies. A few general criteria of complexity introduced in the literature are discussed in Section 4, and two general principles for approaching the complexity of functional domains are proposed. Section 5 addresses the relationship between complexity and cross-linguistic rarity, discussing it in the light of absolute vs. relative complexity. The most important points made in the paper are summarized in Section 6.

2. Absolute complexity and (relative) cost/difficulty

In Miestamo (2006a,b), I identified two different points of view from which complexity has been approached in linguistics: the absolute (theory-oriented, objective) approach defines complexity in terms of the number of parts in a system, whereas the relative (user-oriented, subjective) one defines it in terms of cost and difficulty to language users. In this section I will discuss the two approaches at more length, paying special attention to their applicability to cross-linguistic studies of complexity. Note that Dahl (2004: 25-26) uses the terms absolute and relative complexity in a different sense, but these terms do not play a very prominent role in his approach to complexity.

An absolute approach is adopted, e.g., by McWhorter (2001, this volume, forthcoming) and Dahl (2004). The basic idea behind the absolute approach is that the more parts a system has, the more complex it is. To give a simple example, a language that has 34 phonemes, e.g., Kwazá (Kwaza; van der Voort 2004: 45-46), has a more complex phoneme inventory than one that only has 18, e.g., Tauya (Trans-New Guinea, Madang; MacDonald 1990: 21-31).[2] Obviously, the idea behind counting parts of systems does not always mean looking at lists of elements that make up an inventory, and the parts are not always as straightforwardly countable – this idea is to be

taken in a more general sense. The same notion is behind, e.g., seeing a high number of interactions between the components of a system as increasing complexity (cf. Fenk-Oczlon and Fenk, this volume).

Information theory (beginning with Shannon 1948) provides some basic principles that allow us to make the idea of "number of parts" more generally applicable. In accordance with the basic principles of the complexity measure known as Kolmogorov complexity (see Li and Vitányi 1997), Dahl (2004: 21-24) argues that the complexity of a linguistic phenomenon may be measured in terms of the length of the description of that phenomenon; the longer a description a phenomenon requires, the more complex it is – the 34-member phonemic inventory of Kwaza requires a longer description than the Tauya system with 18 phonemes. A less complex phenomenon can be compressed to a shorter description without losing information. On a high level of abstraction we may say that we are still dealing with the number of parts in a system, but these parts are now the elements that constitute the description of the system. Applications of the notion of Kolmogorov complexity often make use of computerized compression algorithms; Juola (1998, this volume) provides an example within linguistics (see discussion below). I will adopt the basic idea on a very general level, and will argue for its usability with descriptive tools developed by linguists rather than mathematicians or computer scientists. Furthermore, since we focus on grammatical complexity here, we will be concerned with what Gell-Mann (1994) calls effective complexity; this

notion pays attention to the length of the description of the regularities or patterns that an entity, e.g., the language system, contains, leaving everything that shows no regularity or patterning outside its scope.[3]

A relative approach is adopted, e.g., by Kusters (2003, this volume) and Hawkins (2004). This approach defines complexity in terms of cost and difficulty to language users, i.e., how difficult a phenomenon is to process (encode/decode) or learn. The more costly or difficult a linguistic phenomenon is, the more complex it is according to the relative view. A central issue to be taken into account in this approach is that a phenomenon that causes difficulty to one group of language users (e.g., hearers) may facilitate the task of another group (e.g., speakers). In his study of the complexity of verbal inflection, Kusters (2003: 51-52, 56-57; this volume) examines several phenomena that occur in inflection and discusses them from the point of view of different types of language users. He argues, based on different psycholinguistic studies of processing and acquisition, that, for example, redundant agreement is difficult for speakers and L2 learners, but facilitates the task of hearers and L1 learners, while fission (one meaning expressed by many forms syntagmatically) aids hearers but causes difficulties to the three other types of language users.

Given this, the question "complex to whom?" is central to the relative approach to complexity. Whether a phenomenon is to be seen as simple or complex, depends on whether one takes the point of view of the speaker, hearer, L1 acquirer or L2 learner. The approach that one chooses to take

naturally depends on the goals that one's research has. Kusters (2003: 6-7, this volume) defines complexity in relation to adult learners of language, and therefore those properties of languages that cause difficulties for L2 learners are defined as complex. The simplifying effects of sociolinguistic factors such as language contacts are a central topic in Kusters' study, and the difficulties experienced by adult learners of language are therefore important; the primary relevance of L2 learners is clear in this case. However, the primacy of L2 learners is by no means obvious if we are looking for a maximally general view of language complexity. They could in fact be considered the least important of the four groups mentioned – every natural language has (or has at least had) speakers, hearers, and L1 learners, but L2 learners are in most cases a much more marginal group of language users. The latter may form the majority of the users of a given language as is the case in English and Swahili, but this is an uncommon situation in the world's languages, and even in these cases it would be hard to argue for the position that this group of language users is in some sense primary in comparison to native speakers. If we were to choose a group of language users whose difficulties general statements of the complexity of a given language should be based on, L2 learners would certainly not be the first user type to think of.

The question "complex to whom?" causes a general problem for a relative approach to complexity. There will always be some conflict between definitions of complexity based on difficulty for different groups of

language users. No general user-type-neutral definition of complexity is possible. One of these groups can be chosen as criterial for the definition of complexity in studies such as Kusters (2003), where the primacy of adult learners of language has a clear motivation; similarly, if we are using the concept of complexity for the purposes of a study of L1 acquisition, we can use a definition of complexity relative to L1 learners. But for a general approach to complexity, such a choice cannot be made. Furthermore, both L1 and L2 learners are also speakers and hearers, and even if we choose either group of learners as criterial, situations will arise where speaker and hearer perspectives will be in conflict. To define relative complexity in more general terms, all groups of language users should be taken into account. There should be a way of measuring the difficulty of each linguistic phenomenon under study for each group of users and then seeing what the contribution of each type of difficulty would be to the general complexity of the phenomenon. Such a measure is clearly not possible. It is true that for some phenomena there will be less conflict between the different groups of users – e.g., structural homonymy is either neutral to or preferred by all the user types mentioned by Kusters (this volume, Table 1) – but in general, the relative approach to complexity cannot avoid this problem.

There is a second general problem that a relative approach to complexity has to face. Estimations of the cost or difficulty of each piece of language for the different groups of language users can only be made on the basis of psycholinguistic studies of processing and acquisition. However,

the availability of such research is far from sufficient for this purpose. Kusters (this volume) also acknowledges the problem, saying that there is not enough research that could be used to characterize the difficulty that all the aspects of verbal inflection that he studies cause for different types of language users. When we move beyond verbal inflection, the magnitude of the problem naturally increases. In general, when looking at language complexity from a broad cross-linguistic point of view, we are likely to encounter countless phenomena for which we simply cannot determine with satisfactory accuracy what kinds of difficulties they cause to different groups of language users.

Given these problems, I suggest that in general, and especially in broad cross-linguistic studies, complexity be defined in absolute terms. The absolute approach to complexity allows us to leave these problems aside and define complexity in more objective terms – objective in the sense that it does not depend on any particular group of language users or on incomplete knowledge of cognitive processes. Complexity should therefore be defined, to put it in the most general terms, as the number of parts in a system or the length of its description. Whether and how the different aspects of complexity defined this way contribute to difficulty for different types of language users is a very important question, but a separate one, to be addressed with the help of psycholinguists studying language processing and acquisition.

Dahl (2004: 39-40) suggests that the term complexity be entirely reserved for an objective (information-theoretic, i.e., absolute) conception of complexity, and when talking about cost and difficulty, one should use the terms cost and difficulty, not complexity. This is indeed a terminologically sound approach – especially since complexity (in the absolute sense) is a widely used concept in theories of complexity and information in many different fields of scholarship – and will reduce misunderstandings about the nature of complexity. In complexity theories that have applications across disciplines, complexity is defined objectively as a property of systems, and interesting observations can then be made as to what consequences the increase or decrease of complexity in a system has, or what the causes behind the increase or decrease of complexity are. Keeping the concepts of complexity and cost/difficulty apart in linguistics, enables us to make such observations, e.g., between grammar and psycho- or sociolinguistic phenomena, benefiting our understanding of both linguistic systems and psychological and societal phenomena. Absolute complexity connects to what complexity means in other disciplines and thus also opens possibilities for interdisciplinary research.

As I suggested above, in some cases it may be possible and theoretically motivated to define complexity in relative terms, as in Kusters' study where the effect of L2 learners to simplification is central; however, using the terms cost and difficulty instead of complexity when cost and difficulty are meant and reserving the term complexity for absolute

complexity would not take anything away from such studies. The relationship between (absolute) complexity and cost/difficulty is an important question, and approaching this question will become easier and more straightforward if the notions are kept apart by the use of clear terminology. McWhorter has a similar sociolinguistic agenda as Kusters, arguing for contact-induced simplification, but he chooses to define complexity in clear absolute terms. For Lindström (this volume), both complexity and difficulty are important but the concepts are explicitly kept separate. In the remainder of this paper, I will use complexity in the absolute sense, unless otherwise noted, and the terms cost and difficulty instead of relative complexity in appropriate places.

Description length depends on the linguistic theory in terms of which the description is made. Theories differ, and the phenomena to be described also differ in the sense that for the description of some phenomena there will be much more agreement among linguists than for the description of some others – linguists will probably find it easier to agree on the number of aspectual categories in a language than on the description of a syntactic phenomenon like passivization.[4] As we will see in Section 4 below, interesting cross-linguistic studies of complexity may be done using widely accepted theoretical concepts (cf. Dixon's 1997 notion of Basic Linguistic Theory, BLT), and many interesting things can be said about the complexity of different phenomena based on simple and straightforward criteria that are likely to be widely accepted by linguists of different theoretical persuasions.

Some linguistic theories aim at psychological reality, e.g., generative grammar when it claims to represent innate principles of human language, or theories of markedness that see a connection between cognitive/conceptual difficulty and linguistic markedness (see Haspelmath 2006 for an overview of the different uses of the concept of markedness). With such theories, description length could, at least in principle, be of some relevance in studying cost and difficulty as well; in practice this naturally depends on how well a given theory can live up to its claims of psychological reality (cf. also Section 5 below). Note also that the use of description length as a complexity measure is not the same thing as Chomsky's (1957: 49-60) evaluation procedure, which compares (the simplicity of) different grammatical descriptions of one and the same linguistic phenomenon (a specific structure or a whole language), whereas the point here is to compare the length of the description of different linguistic phenomena using the same theoretical principles in the description (whichever theory is chosen).

Juola's (1998, this volume) computational approach attempts to quantify complexity in maximally objective terms. He sees complexity in terms of compressability of texts – the shorter the compressed version of a text, the less complex the original. Cross-linguistic comparison is made using parallel corpora with translations of texts in different languages. Compression algorithms (Juola uses zip) operate on repetition of strings of characters, and some aspects of the complexity of word forms can be

captured by this approach. Morphological complexity is thus easier to investigate in these terms than the complexity of other domains of grammar, e.g., syntax or the meanings of the grammatical categories expressed. To take an example, the compression algorithms can detect word order patterns only when there are multiple instances of the same lexemes (in the same form) occurring together in similar or different orders, which is clearly not common enough in natural texts. More generally, we may also ask what the application of a mathematical algorithm on linguistic products (texts) can reveal about the complexities of the underlying systems (grammar, lexicon) that are needed to produce these texts.

In this section I have given several arguments for why complexity should be approached from the absolute point of view in cross-linguistic studies. Although the notions of complexity and difficulty are logically independent, and must be kept apart for theoretical and methodological reasons, their relationship is worth examining – complexity does not entail difficulty and difficulty does not entail complexity, but to which extent they correlate in language is an interesting question. In many cases, more complex structures can be expected to be more difficult as well (at least to some groups of language users), which also shows in that similar criteria have been used for measuring complexity and cost/difficulty (cf. Section 4); in each case, however, psycholinguistic studies are needed to verify this. After having examined linguistic phenomena from the point of view of

absolute complexity, we may, in many cases, be able to explain our findings in functional terms making use of the notions of cost and difficulty as well.

3. Global vs. local complexity

The question of global (overall) complexity of languages interests both linguists and non-linguists. With the latter, this usually means characterizing entire languages as easy or difficult to learn. Among linguists, the received view is that all languages are, overall, equally complex in their grammars; complexity differentials can be found in different areas of grammar, but complexity in one area is assumed to be compensated by simplicity in another. Hockett (1958: 180-181) formulates this as follows:

> Objective measurement is difficult, but impressionistically it would seem that the total grammatical complexity of any language, counting both morphology and syntax, is about the same as that of any other. This is not surprising, since all languages have about equally complex jobs to do, and what is not done morphologically has to be done syntactically. Fox, with a more complex morphology than English, thus ought to have a somewhat simpler syntax; and this is the case.
>
> Thus one scale for the comparison of the grammatical systems of different languages is that of average degree of morphological

> complexity – carrying with it an inverse implication as to degree of syntactical complexity.

A more recent formulation can be found in Crystal (1997: 6). As is evident from most of the contributions to this volume, the received view is not shared by all linguists. In recent years, it has been most notably challenged by McWhorter (2001, this volume, forthcoming) and Kusters (2003, this volume).

McWhorter (this volume, forthcoming) proposes a metric for measuring and comparing the global complexity of languages, in order to study complexity differences between languages restructured and simplified by contact (e.g., creoles) and languages that have not been affected by contact in such a way. The metric pays attention to overt signalling of distinctions beyond communicative necessity on different levels of language. The following three criteria are used (McWhorter, this volume):

1. Overspecification
2. Structural elaboration
3. Irregularity.

Overspecification refers to the "marking of semantic categories left to context in many or most languages, such as evidential marking", and accordingly, designates language A as more complex than language B to the

extent that it makes more (unnecessary) semantic/pragmatic distinctions in its grammar. Structural elaboration is about the "number of rules mediating underlying forms and surface forms, such as morphophonemics", the global complexity of a language increasing with the number of rules in its grammar. According to the third criterion, Irregularity, the more irregularities a grammar contains, the more complex it is overall. Note that in an earlier version of the metric (McWhorter 2001), a slightly different set of criteria is used, but the basic idea behind the two versions of the metric is the same. I will come back to the criteria in Section 4.

In Miestamo (2006a), I introduced two general problems that all attempts to measure global complexity will have to face: representativity and comparability. The problem of representativity means that no metric can pay attention to all aspects of grammar that are relevant for measuring global complexity. Even if this were theoretically possible, it would be beyond the capacities of the mortal linguist to exhaustively count all grammatical details of the languages studied, especially in a large-scale cross-linguistic study. This problem is acknowledged by McWhorter (2001: 134). The problem of representativity may perhaps be solved in the sense that it may be possible to arrive at a level of representativity that enables one to identify very clear complexity differences.

The problem of comparability is about the difficulty of comparing different aspects of grammar in a meaningful way, and especially about the impossibility of quantifying their contributions to overall complexity.

McWhorter's three criteria are not commensurable: imagine language A with a lot of overspecification, language B with extensive structural elaboration and language C with large amounts of irregularity – how do we decide which criterion weighs more? The same problem applies within the scope of each criterion: to take a random example from Overspecification, how to make the number of distinctions made in deictic systems commensurable with that made in tense systems? The problem of comparability concerns the comparison of all systems and subsystems of language regardless of the criteria used in the complexity metric. How should we compare, e.g., syntactic and morphological complexity and quantify their contributions to overall complexity?[5]

Comparison of languages in terms of global complexity becomes possible only when the complexity differences are very clear so that the criteria one uses do not give conflicting results. If one has a set of criteria to measure and compare the complexity of languages A and B, and each criterion designates language A as more complex, then there is no need to assess the contribution of each criterion. McWhorter's metric is designed for bringing out clear complexity differences between languages simplified by contact and languages without a heavy contact past. It seems to work in the cases examined, providing thus a useful tool for the intended purpose. The same can be said about Parkvall's study (this volume), where a group of languages is designated as less complex than other languages by all (or at least an overwhelming majority of the) criteria used. But when the

complexity differences of the languages compared is not so clear and the criteria give conflicting results, there should be a way of quantifying the contribution that each criterion makes to global complexity. In the absence of such quantifiability, studies of global complexity can only bring out very clear global complexity differences between languages. Similarily, as to the problem of representativity, the attainable level of representativity may be enough to show differences between the global complexity of the languages when the differences are very clear – as seems to be the case in McWhorter's (2001) comparison of creoles and non-creoles.

As I have argued in Miestamo (2006a), given the problem of comparability, the cross-linguistic study of grammatical complexity should primarily focus on specific areas of grammar, i.e., on local complexity. We can compare only what is comparable. Many areas of grammar can be meaningfully compared across languages and the choice of these areas naturally depends on one's theoretical goals and orientations. The areas to be compared may be essentially formal, such as phonological inventories or morphological systems, or essentially functional, i.e., various functional domains such as (the encoding of) tense, aspect or referentiality. As typologists argue (e.g., Stassen 1985, Croft 2003), cross-linguistic comparability is best achieved in functional terms, and this also provides a good basis for the cross-linguistic study of grammatical complexity. We can thus compare the encoding of similar functional domains across languages and then make cross-linguistic generalizations about the complexities of

these domains, provided of course that languages grammaticalize similar domains – some languages grammaticalize tense, others aspect and yet others both; a language where tense is not grammaticalized will naturally not be included in a comparison of the domain of tense. It should be noted that even when focusing on comparable functional domains, we still need to pay attention to the problem of comparability between the different criteria we use to examine the complexity of these specific domains.

Typologists often talk about poor and rich systems, e.g., of tense, but often these are only loose characterizations of the complexity of the domains. More exact quantification of minimal, average and maximal complexity of domains would certainly contribute to a better understanding of these domains in general. It would also allow for the examination of typological correlations between the complexity of different domains, which would provide answers to the question whether complexity in one domain is compensated by simplicity in another. Although testing the equi-complexity hypothesis will hardly be possible at the level of global complexity (cf. above), examining possible trade-offs between specific domains is worthwhile in many respects – not only because it will give us important insights into the relationships between the domains, but also in the more general sense that it may provide evidence for or against general cognitive mechanisms responsible for such trade-offs (cf. also Sinnemäki, this volume, who examines trade-offs between the use of different coding means within the domain of core argument marking).

4. Criteria for complexity

In Section 2, I discussed the general principles behind the different approaches to complexity. I will now take up some more concrete criteria in terms of which complexity can be and has been approached. McWhorter (2001, forthcoming, this volume) and Kusters (2003, this volume) have provided the most explicit criteria for comparing grammatical systems in terms of complexity and I will start by discussing their proposals (on a rather general level – for more concrete examples, see their papers in this volume). I will then propose two general principles for measuring complexity from a cross-linguistic viewpoint.

McWhorter (2001: 134-135) explicitly states that his approach to complexity is independent of processing concerns, i.e., he approaches complexity from an absolute point of view. Indeed, if we look at the three criteria used in McWhorter (forthcoming, this volume), briefly introduced in Section 3 above, we can see that they are quite straightforwardly understandable in terms of description length: Overspecification refers to the number of grammaticalized distinctions made and the more distinctions a language makes within a domain – e.g., in the domain of evidentiality, to use the example given by McWhorter – the longer the description of this domain becomes in the grammar of the language. Structural Elaboration is

about the number of rules and is directly interpretable as description length. Finally, Irregularity also increases the length of a description: the more irregularity, the longer the list of separate items in the grammar.

The relative basis of Kusters' (2003, this volume) definition of complexity was discussed in Section 2. I will now take a closer look at the actual criteria he uses. The complexity of verbal inflection is measured with the following principles: 1. Economy – restriction of the number of overtly signalled categories, 2. Transparency – clarity of the relation between meaning and form, and 3. Isomorphy – identity of the order of elements in different domains. The principle of Economy is violated when verbal inflection overtly signals agreement or categories like tense, aspect or mood. The principle of Transparency is essentially about the principle of One-Meaning–One-Form, and it is violated by phenomena like allomorphy (one meaning – many forms paradigmatically), homonymy (many meanings – one form paradigmatically), fusion (many meanings – one form syntagmatically) and fission (one meaning – many forms syntagmatically). Finally, the principle of Isomorphy is violated when the order of inflectional affixes expressing given verbal categories is different from cross-linguistic preferences in the mutual ordering of affixes expressing these categories; cross-linguistic preferences are taken to reflect functional-level preferences. Kusters (2003: 45-62) discusses how the various possible violations of these principles affect different types of language users. I will not go into these details here, but the point is that those violations that cause difficulty to L2

learners (to the extent that psycholinguistic studies are available to assess this) are interpreted as complexity. Note that although the principles are developed for (and used in) a study of the complexity of verbal inflection, it is clear that they can be used for characterizing any kind of morphological complexity; furthermore, as they are quite general in nature, there is no reason why their applicability should be restricted to morphological complexity. I will therefore interpret them as more general criteria of complexity and compare them with those proposed by McWhorter.

It is notable that although McWhorter approaches complexity from the absolute point of view and Kusters from the relative one, the criteria they use are in many respects similar. McWhorter's Overspecification is close to Kusters' Economy. Those violations of Kusters' Transparency that have any regularity would be subsumed under McWhorter's Structural elaboration – phenomena like fusion and allomorphy increase the number of rules mediating underlying forms and surface forms in McWhorter's view. And finally, McWhorter's Irregularity would take care of those violations of Transparency that have no regularity. As these examples show, the concrete criteria used in absolute and relative definitions of complexity may in many cases look very much alike, but as these definitions have different bases, the motivations to use a given criterion and the way it is to be interpreted are different.[6]

In Miestamo (2006b), I proposed that two very general principles can be used as criteria in an absolute approach to complexity, especially when

taking functional domains as the point of departure: the principle of Fewer Distinctions and the well-established principle of One-Meaning–One-Form.[7] Violations of these principles increase the complexity of a linguistic entity. The two principles overlap with McWhorter's and Kusters' criteria in many ways. In the following, I will discuss the advantages of the two principles I propose.

When we investigate the complexity of a functional domain in our languages of study, we may pay attention to two aspects of grammar: grammatical meaning and the encoding of grammatical meaning. In investigating grammatical meaning we pay attention to the meanings languages express grammatically within a functional domain irrespective of the formal means by which these grammatical meanings are encoded. In the study of the encoding of grammatical meaning we pay attention to the relationship between the meanings and the forms that encode them. Methodologically, the investigation of grammatical meaning precedes the investigation of the encoding of grammatical meaning in a cross-linguistic study of the complexity of a functional domain – we must first investigate what meanings are expressed before we can pay attention to the formal details of their expression. The principles of Fewer Distinctions and One-Meaning–One-Form are applicable to the study of grammatical meaning and the encoding of grammatical meaning, respectively. It should perhaps be emphasized that the principles are by no means restricted to morphology but can be used for examining morphosyntactic phenomena in general.

The principle of Fewer Distinctions can be seen in terms of description length as follows: language A, where more functional distinctions are grammaticalized within a given functional domain, requires a longer description for that functional domain than language B, where fewer distinctions are made; language A thus shows more complexity in this respect. To take a simple example, Hdi (Afro-Asiatic, Biu-Mandara) with its three tense categories – (referential) past and two futures (Frajzyngier 2002) – is less complex in this respect than Nasioi (East Bougainville) with its elaborate metric tense system – two futures, present, and three past tenses, to mention only the categories that are not combinations of tense and aspect in Hurd and Hurd (1970). The length of a description depends on the theory in terms of which a phenomenon is described, but the more a theory allows languages to be described in their own terms and not in terms of categories imposed by other languages, the more probable it will be that a large number of tense distinctions, for example, will require a longer description than a small one. (The interaction of the tense system with other functional domains may of course be more complex in the language with a smaller number of distinctions.)

The One-Meaning–One-Form principle can be connected to complexity in the absolute sense, since a situation where the morphosyntactic coding of a function strictly adheres to the One-Meaning–One-Form principle can be given a shorter description than one where the principle is violated. When the form-function correspondences are not one-

to-one, either syntagmatically or paradigmatically, the description of the system needs additional specification concerning these form-function relationships. I will now illustrate this with examples from the expression of negation in declarative clauses (references to the original sources are given with the examples, but for analysis, see also Miestamo 2005).

Syntagmatic violations of the One-Meaning–One-Form principle can be found in Kiowa (1) and Kemant (2).

(1) Kiowa (Kiowa-Tanoan) (Watkins 1984: 158, 204, 214)

a. *k'yą́ˈhį̂ˊ Ø-cán*

man 3SG-arrive.PFV

'The man came.'

b. *hón mátʰòn Ø-cą́ˈn-ôˊ kʰíˈdêl-gòˊ*

NEG girl 3SG-arrive.PFV-NEG yesterday-since

'The girl hasn't come since yesterday.'

(2) Kemant (Afro-Asiatic, Central Cushitic) (Appleyard 1975: 333-334)

a. *was-* 'hear', IMPF

	AFF	NEG
1SG	*wasäkʷ*	*wasägir*
2SG	*wasyäkʷ*	*wasäkar*
3SG.M	*wasäkʷ*	*wasäga*
3SG.F	*wasät(i)*	*wasäkäy*
1PL	*wasnäkʷ*	*wasägənir*
2PL	*wasyäkʷən*	*wasäkänar*
3PL	*wasäkʷən*	*wasägäw*

b. *was-* 'hear', PFV

AFF	NEG
wasəɣʷ	*wasgir*
wasyəɣʷ	*waskar*
wasəɣʷ	*wasga*
was(ə)t(i)	*waskäy*
wasnəɣʷ	*wasgənir*
wasinəɣʷ	*waskänar*
wasənəɣʷ	*wasgäw*

In Kiowa negatives, we find one meaning corresponding to many forms syntagmatically: negation is expressed by a discontinuous marker involving a particle and a suffix. The description of this system is lengthened by the need to specify two forms for one meaning. Many meanings correspond to one form syntagmatically in negatives in Kemant: the meanings of negation, person-number-gender, and aspect are fused in verbal suffixes. A description of this system needs to specify each suffix separately, which increases its length; a small number of generalizations would be enough to

describe a more agglutinative system where each meaning is expressed by exactly one form.

Paradigmatic violations of the One-Meaning–One-Form principle can be found in Koyraboro Senni (3) and Karok (4).

(3) Koyraboro Senni (Nilo-Saharan, Songhay) (Heath 1999: 8-9, 57)

a. *n ga koy*
2SG.SUBJ IMPF go
'You are going.'

b. *war si koy*
2PL.SUBJ NEG.IMPF go
'You are not going.'

c. *ay koy*
1SG.SUBJ go
'I went.'

d. *ya na koy*
1SG.SUBJ NEG go
'I didn't go.'

(4) Karok (Karok) (Bright 1957: 67)

a. *kun-iykár-at*
3PL>3SG-kill-PST
'They killed [him/her].'

b. *pu-ʔiykar-áp-at*
NEG-kill-3PL>3SG-PST
'They did not kill [him/her].'

Koyraboro Senni has one meaning corresponding to many forms paradigmatically in its system of negation: negation is expressed with different negative constructions using different negative elements with perfective and imperfective aspect. This clearly increases the length of the

description as each construction must be separately described. A similar situation is found in Karok, where in addition to the affixes marking negation, different sets of person-number cross-reference markers are used for affirmative and negative verbs; as a general rule, there are thus two forms for one person-number meaning. However, when second or third person singular subjects act on first person singular objects, the affirmative and negative markers are homophonous, prefix *ná-* in both cases (Bright 1957: 60). This is an example of the fourth possible violation of the principle: many meanings corresponding to one form paradigmatically. This makes the description longer in that many meanings (affirmation vs. negation, second vs. third person acting on first person) have to be specified for one and the same form, including information on which meaning it has in which morphosyntactic and semantic environment.[8]

A few words about the similarity and difference between these two principles and Kusters' and McWhorter's criteria are in order. The principle of Fewer Distinctions resembles McWhorter's Overspecification, but is indifferent as to whether some distinctions go beyond communicative necessity – all that matters is the number of distinctions that a grammar makes within a functional domain. In practice, communicative necessity is very hard to define. How do we decide whether a distinction is or is not necessary for communication? Very few if any grammatical distinctions are necessary in the sense that they would be made in each and every language of the world. McWhorter (cf. above) mentions evidentiality as an example

of overspecification; it is true that fewer languages have overt marking of evidentiality than of tense for example, but in the languages that have a highly grammaticalized evidential system, evidential distinctions are important in the network of grammatical meanings that the languages operate with. If needed, meanings expressed by a given rare grammatical category in one language can always be expressed in other languages lexically if not by other grammatical categories. The One-Meaning–One-Form principle corresponds roughly to McWhorter's Structural Elaboration and Irregularity: the more the relationship between meaning and form deviates from the ideal of One-Meaning–One-Form, the more rules are needed in rule-based grammatical models (Structural Elaboration), and irregularities are completely idiosyncratic deviations from One-Meaning–One-Form (Irregularity); the One-Meaning–One-Form principle is more analytic and accounts for a range of phenomena for which McWhorter needs two separate criteria. As to Kusters' principles, my principles of Fewer Distinctions and One-Meaning–One-Form are similar to Economy and Transparency, respectively, but differ from these in their fundamental basis – they are intended in an absolute sense, i.e., as such, independent of (insufficient) psycholinguistic evidence of ease of processing by different types of language users.

The complexity of the system of grammatical meanings that languages distinguish within functional domains is by no means exhaustively accounted for by counting the number of distinctions. The principle of

Fewer Distinctions provides a start but many other dimensions need to be taken into account as well. Here I will not enter into a discussion on how such aspects of meaning should be dealt with in terms of complexity, but only mention possible paths to follow. We may for example pay attention to choice-structure relations (Dahl 2004) between meanings distinguished within (or across) functional domains; the use of a given category may determine the availability of other grammatical categories. In Jarawara (Arauan), to take a random example, the choice of past tense enables the speaker to choose between eye-witnessed and non-eye-witnessed evidential categories not available in other tenses (Dixon 2004: 195). Another aspect where the interaction between domains comes in is paradigmatic neutralization of grammatical distinctions in specific environments, e.g., in negation where many languages show loss of grammatical distinctions regularly made in affirmative contexts; in Miestamo (2006b) I have shown how complexity is increased by such paradigmatic restrictions (as well as by other kinds of asymmetries between affirmation and negation, or more generally, between other comparable domains). As to the One-Meaning–One-Form principle, it can cover the whole territory of the complexity of the relationship between meaning and form, but needs to be supplemented with more detailed sub-criteria.

5. Complexity and cross-linguistic rarity

Newmeyer (2007) argues, in a generative perspective, that there is no correlation between grammatical complexity and cross-linguistic rarity. He discusses a number of linguistic phenomena and shows that higher complexity of syntactic derivation (in different versions of generative theory) does not necessarily mean cross-linguistic rarity. Now, in the heart of this issue lies the question what we mean by complexity – how we define it.

When we define complexity in strictly absolute terms, there is no necessary connection between complexity and cross-linguistic rarity. Cost and difficulty (relative complexity), by contrast, are expected to correlate with cross-linguistic frequency: the more costly or difficult a linguistic feature is to process or learn, the less frequent it should be in the world's languages. Cost and difficulty are naturally not the only factors in determining what is common and what is rare.[9] But I would argue, in accordance with Hawkins (2004), that structures that are easy and efficient tend to be preferred in performance and they also find their way more often to grammatical conventions; conversely, difficult and inefficient structures are dispreferred in performance and less often grammaticalized. As we have seen above, (absolute) complexity and cost/difficulty do often go hand in hand, and therefore, in many cases, we could expect increases in absolute complexity to imply cross-linguistic rarity as well. This is however not

necessary, and to what extent absolute complexity matches rarity is a separate question.

If we take Newmeyer's approach to complexity as an absolute one, complexity seen as the length of syntactic derivation – length of description – the observation that complexity does not always mean rarity poses no problem. However, to the extent that the syntactic derivations examined by Newmeyer are meant to be psychologically real processing phenomena (cf. the claims of the innateness of UG), such a complexity measure could be seen as an attempt to measure complexity in relative terms, and then the dissociation of complexity and rarity would become problematic given what has been said above about the expected correlation between difficulty and cross-linguistic rarity. My first reaction to this problem is that it casts doubts on the claims of psychological reality of the theory rather than refuting the proposed correlation between cost/difficulty and cross-linguistic rarity. In a footnote Newmeyer seems to agree with the view advocated here: "[T]ypological generalizations, in particular word order preferences, stem from pressure to reduce parsing complexity" (Newmeyer, 2007, note 9).[10] To some extent at least, the difference thus lies in what is seen as grammar, and what is merely usage in generative theory.

I will now briefly return to the relationship between absolute complexity and cross-linguistic rarity. According to Kusters (this volume), the rule "yes/no questions are related to their affirmative counterpart by a complete reversal of all syllables" would be formally simpler than "a rule

that relates these two by assuming complex syntactic structures", but extremely difficult to process, and is therefore not found in any language. Kusters' example may be beside the point in the sense that what his formulation really is, is only a general description of what the rule does, and the rule itself is a very complex recursive mathematical operation. In any case, if one could come up with a large number of genuinely simple rules (or more generally, phenomena with short descriptions) that few or no languages possess, it would be clear that absolute simplicity could not predict much about cross-linguistic frequencies. Be it as it may, if we take an inductive approach and look at what is actually found in the world's languages, and then try to evaluate the absolute complexity of those structures, it is highly likely that there will be some correlation between absolute complexity and cross-linguistic rarity. Perhaps (absolute) simplicity does not always mean ease of processing, but surely (absolute) complexity does in many cases add to processing difficulty.

6. Summary

In this paper I have addressed issues that I consider to be of central importance when language complexity is approached from a cross-linguistic point of view. In Section 2, I discussed two alternative approaches to complexity – absolute and relative – arguing that for theoretical and

methodological reasons, an absolute approach to complexity is to be preferred. In Section 3, I addressed the question of global vs. local complexity concluding that languages can usually only be compared in specific areas of grammar, e.g., in terms of functional domains, and that the concept of global complexity is a problematic one. Section 4 discussed some criteria for studying and comparing languages in terms of complexity, and proposed the principles of Fewer Distinctions and One-Meaning–One-Form as criteria for examining the complexity of functional domains across languages. Finally, Section 5 discussed the relationship between complexity and cross-linguistic rarity from the point of view of the distinctions between (absolute) complexity and cost/difficulty. The focus of the paper has been on theoretical and methodological issues. I have tried to identify some problems encountered in the cross-linguistic study of complexity and clear away some potential misundertandings by arguing for clear terminological and conceptual divisions. It is my hope that the points I have made here will be of use in future studies of language complexity.

Abbreviations

1 first person

2 second person

3 third person

AFF affirmative

F feminine

IMPF imperfective

M masculine

NEG negative/negation

PFV perfective

PL plural

PST past tense

SG singular

SUBJ subject

Notes

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2. These are the numbers of indigenous (non-borrowed) phonemes in these two languages according to the authors of the grammars. The names and genealogical affiliations of the languages mentioned in the paper follow the classification by Dryer (2005).
3. Grammar is the domain of regularities and patterns, whereas a description of the lexicon has to resort, to a much larger extent, to merely listing the elements that the system contains. In that sense, the characterization of the complexity of the lexicon, is more

about plain description length ("pure" Kolmogorov complexity), and the notion of effective complexity plays a much less important role.

4. One might want to say that absolute complexity is *relative to* the theory chosen (cf. Kusters, this volume), but I wish to reserve this formulation for user-relativity.
5. In principle, if linguists could one day achieve a comprehensive and completely objective theory of language ("the Theory of Language"), the lengths of the descriptions of different languages in terms of this theory could be used for measuring the global complexity of these languages.
6. The similarity is understandable since absolute and relative approaches to complexity work within the same theoretical traditions – similar theoretical concepts are interpreted against different backgrounds. Relative approaches have not founded linguistic theory anew, based purely on psycholinguistic experiments, and furthermore, the experiments referred to are themselves naturally also made within existing linguistic theories.
7. The One-Meaning–One-Form principle, known under this name since Anttila (1972), is sometimes referred to as the principle of isomorphy in the literature; to avoid confusion with Kusters' principle of Isomorphy, I will not follow this usage here.
8. The following clarification may be useful to better understand the many-meanings–one-form situations in terms of description length: I have argued above that *cross-linguistic identification* should be based on meaning/function, not form. This does not mean that linguistic *description* should take this perspective exclusively, only describing how each meaning is formally expressed.
9. The frequency of linguistic features is also affected by accidental statistical properties of the current language population, cf. Maslova (2000). The stability of features is one factor that comes into play here, the frequency of stable features being more likely due to survival from ancestor languages and thus directly linked to the histories of language

communities (hegemony relations, survival, death). The frequency of less stable features is more easily affected by functional factors such as cost and difficulty.

10. Newmeyer's article was consulted prior to its publication, and the version consulted may differ from the published version.

References

Anttila, R. 1972. *An Introduction to Historical and Comparative Linguistics*. New York: Macmillan.

Appleyard, D.L. 1975. A descriptive outline of Kemant. *Bulletin of the School of Oriental and African Studies* 38: 316-350.

Bright, W. 1957. *The Karok Language* [University of California Publications in Linguistics 13]. Berkeley: University of California Press.

Chomsky, N. 1957. *Syntactic Structures*. The Hague: Mouton.

Croft, W. 2003. *Typology and Universals*. 2nd ed. Cambridge: Cambridge University Press.

Crystal, D. 1997. *The Cambridge Encyclopedia of Language*. 2nd ed. Cambridge: Cambridge University Press.

Dahl, Ö. 2004. *The Growth and Maintenance of Linguistic Complexity* [Studies in Language Companion Series 71]. Amsterdam: John Benjamins.

Dixon, R.M.W. 1997. *The Rise and Fall of Languages*. Cambridge: Cambridge University Press.

Dixon, R.M.W. 2004. *The Jarawara Language of Southern Amazonia*. Oxford: Oxford University Press.

Dryer, M.S. 2005. Genealogical language list. In *The World Atlas of Language Structures,* M. Haspelmath, M.S. Dryer, D. Gil and B. Comrie (eds), 584-644. Oxford: Oxford University Press.

Frajzyngier, Z. with Shay E. 2002. *A Grammar of Hdi* [Mouton Grammar Library 21]. Berlin: Mouton de Gruyter.

Gell-Mann, M. 1994. *The Quark and the Jaguar: Adventures in the Simple and the Complex*. New York: W.H. Freeman and Co.

Haspelmath, M. 2006. Against markedness (and what to replace it with). *Journal of Linguistics* 42: 25-70.

Hawkins, J.A. 2004. *Efficiency and Complexity in Grammars*. Oxford: Oxford University Press.

Heath, J. 1999. *A Grammar of Koyraboro (Koroboro) Senni* [Westafrikanische Studien 19]. Köln: Rüdiger Köppe Verlag.

Hockett, C.F. 1958. *A Course in Modern Linguistics*. New York: Macmillan.

Hurd, C. and Hurd, P. 1970. Nasioi verbs. *Oceanic Linguistics* 9: 37-78.

Juola, P. 1998. Measuring linguistic complexity: The morphological tier. *Journal of Quantitative Linguistics* 5: 206-213.

Kusters, W. 2003. *Linguistic Complexity, the Influence of Social Change on Verbal Inflection* [Ph.D. Diss., University of Leiden]. Utrecht: LOT.

Li, M. and Vitányi, P. 1997. *An Introduction to Kolmogorov Complexity and its Applications*. 2nd ed. New York: Springer.

MacDonald, L. 1990. *A Grammar of Tauya* [Mouton Grammar Library 6]. Berlin: Mouton de Gruyter.

Maslova, E. 2000. A dynamic approach to the verification of distributional universals. *Linguistic Typology* 4: 307-333.

McWhorter, J.H. 2001. The world's simplest grammars are creole grammars. *Linguistic Typology* 5: 125-166.

McWhorter, J.H. Forthcoming. *Language Interrupted: Signs of Non-native Acquisition in Standard Language Grammars*. New York: Oxford University Press.

Miestamo, M. 2005. *Standard Negation: The Negation of Declarative Verbal Main Clauses in a Typological Perspective* [Empirical Approaches to Language Typology 31]. Berlin: Mouton de Gruyter.

Miestamo, M. 2006a. On the feasibility of complexity metrics. In *Finest Linguistics. Proceedings of the Annual Finnish and Estonian Conference of Linguistics. Tallinn, May 6-7, 2004*, K. Kerge and M.-M. Sepper (eds). Tallinn: TLÜ.

Miestamo, M. 2006b. On the complexity of standard negation. In *A Man of Measure: Festschrift in Honour of Fred Karlsson on His 60th Birthday* [Special Supplement to SKY Journal of Linguistics 19], M.

Suominen, A. Arppe, A. Airola, O. Heinämäki, M. Miestamo, U. Määttä, J. Niemi, K.K. Pitkänen and K. Sinnemäki (eds), 345-356. Turku: The Linguistic Association of Finland.

Newmeyer, F.J. 2007. More complicated and hence, rarer: A look at grammatical complexity and crosslinguistic rarity. In *Clausal and Phrasal Architecture: Syntactic Derivation and Interpretation (Festschrift for Joseph E. Emonds)*, S. Karimi, V. Samiian and W.K. Wilkins (eds), 221-242. Amsterdam: John Benjamins.

Shannon, C.E. 1948. A mathematical theory of communication. *The Bell System Technical Journal* 27: 379-423, 623-656. [Reprint with corrections at <http://cm.bell-labs.com/cm/ms/what/shannonday/Shannon1948.pdf>.]

Shosted, R.K. 2006. Correlating complexity: A typological approach. *Linguistic Typology* 10: 1-40.

Stassen, L. 1985. *Comparison and Universal Grammar*. Oxford: Blackwell.

Voort, H. van der. 2004. *A Grammar of Kwaza* [Mouton Grammar Library 29]. Berlin: Mouton de Gruyter.

Watkins, L.J. 1984. *Grammar of Kiowa*. Lincoln: University of Nebraska Press.