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### Linguistic complexity

*Interfaces and processing*

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## Linguistic complexity: interfaces and processing



The study of language has always centered around two sets of observable facts: the ease with which children acquire their native languages despite the wide typological variations that one can observe between these languages (e.g., French, Mohawk, Greenlandic, Gungbe, Kikongo, Xhosa, Mandarin Chinese, etc.), and the difficulties late learners (namely adult L2 learners) face in learning these same languages. Set against the difficulties that linguists have in establishing the (number of) rules necessary to describe some phenomena cross-linguistically, these two sets of facts about acquisition appear to relate to another research question that has led to a debate in the field for the past fifty years or so: How to account for the complexity of linguistic systems and to what extent do languages differ in complexity? Though different linguistic approaches exist that account for typological variation and related issues of acquisition, an implicit consensus in the field has been to assume that all languages are equally complex even though they may show different degrees of complexity in different modules (i.e., morphology, phonology, syntax, semantics, and pragmatics). Charles Hockett (1958: 180–1), cited in [Sampson \(2009: 2\)](#), expressed the consensus as follows:

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.

Recently, various views have been proposed in the literature which challenge this consensus, thus suggesting that languages can differ fundamentally in complexity and that the degree of complexity of a language may correlate with the context in which it emerged (e.g., L1 acquisition versus L2 acquisition), its age (e.g., pidgins/creoles versus older languages), or the size and social structure of its speaking community (small tightly related communities versus large and loose communities), see e.g., [Bickerton \(1981, 1984, 1988\)](#), [Dahl \(2004\)](#), [Trudgill \(2011\)](#), among many others. In such views, languages acquire more complex systems as they evolve, hence notions such as growth or maturation (or grammaticalization) as argued for in [Dahl \(2004: 2\)](#).

In this book, I look at grammaticalization in the perspective of what I call maturity—mature linguistic phenomena being those that presuppose a non-trivial prehistory: that is, they can only exist in a language which has passed through specific earlier stages. Grammatical maturation—processes that give rise to phenomena that are mature in this sense—in general adds to the complexity of a language [...] Complexity is here seen, not as synonymous with “difficulty” but as an objective property of a system—a measure of the amount of information needed to describe or reconstruct it.

Applied to the following examples from English and Gungbe, we may reach the conclusion that the morphosyntax of the English past verb is more complex than that of the Gungbe one. In English, one needs to specify that regular verbs must take an additional affix to encode past, while no such affix is required in Gungbe: the verb is always bare in this language and past is the default interpretation for eventive (or so-called dynamic) verbs (cf. [Aboh, 2004a](#)).

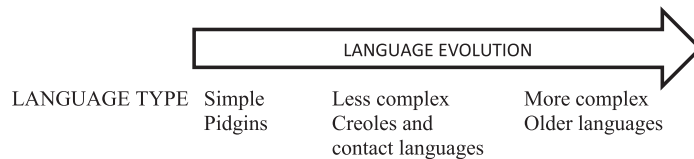
- (1) a. John cook-ed        beans  
       b. Ján    dà        àbòbò

While this characterization of complexity may sometimes suggest that more superficial distinctions in a language may increase complexity, this need not be the case since what matters here is the amount of information required to describe or reconstruct the system (cf. [Dahl, 2004](#), [Audring](#), this volume).

## 1. Against a surface approach to complexity

Yet, common views of complexity tend to primarily focus on ‘visible’ (or audible) cues that the linguist can incorporate in her complexity metrics. Such views therefore take a surface approach to complexity. As is often the case, surface cues mainly involve morphological distinctions and related morphosyntactic rules. In this regard, a set of languages that are often cited in the literature as being systematically less complex because having less morphosyntactic, phonological and semantic distinction are creole languages and similar nativized contact languages (but see [Dahl, 2004](#), chapter 6, [Aboh and DeGraff, 2016](#) for a critique). Such ideas about creole simplicity derive from the much entertained, though lacking supportive evidence, pidgin-to-creole cycle hypothesis in creolistics: creoles being nativized vernaculars have more distinctive properties than their pidgin predecessors. Consequently, the description/reconstruction of creoles would require more information than needed for describing pidgins. Because of a shallow history, which does not give them enough time to acquire mature phenomena, creoles and similar contact languages would in turn require less information for their description/reconstruction than one would need for older languages (cf. [McWhorter, 2001, 2011](#)). According to this scenario, the complexity cline in human languages can therefore be represented as in (2).

(2)



For scholars like Derek Bickerton, this developmental path makes pidgins and creoles the most relevant empirical domain for studying the emergence of language in human species (but see [Mufwene, 2001](#) for a critique). Since complexity appears to grow in human language, this view implies that it is an objective property that linguistic systems wear on their sleeves which the linguist can list and evaluate against her complexity metrics. As a consequence, it is not uncommon that complexity metrics result in a list of overt morphosyntactic manifestations that one can detect in a language as compared to another. An example of such a surface complexity metric can be found in [McWhorter \(2001: 128\)](#) who after comparing the expression of past tense in Kikongo and Japanese claims that “Kikongo, in happening to have evolved as fine-grained an overt subdivision of pastness [...] has a more complex past-marking system than Japanese.” Applied to grammar as a whole, this view led [McWhorter \(2001: 135, 136\)](#) to the following metrics:

First, a phonemic inventory is more complex to the extent that it has more marked members.

Second, a syntax is more complex than another to the extent that it requires the processing of more rules, such as asymmetries between matrix and subordinate clauses (e.g., Germanic verb-second rules), or containing two kinds of alignment rather than one (i.e., ergative/absolutive and nominative/accusative).

Third, a grammar is more complex than another to the extent that it gives overt and grammaticalized expression to more fine-grained semantic and/or pragmatic distinctions than another.

Fourth, inflectional morphology renders a grammar more complex than another one in most cases. [...] Inflection more often than not has wider repercussions in a grammar [...] which are complexifying factors in terms of exerting a load upon processing.

Under these claims, the size of a paradigm (e.g., morphology) or the number of putative morphosyntactic rule combinations and their related morphological exponents (e.g., verb placement and verbal inflection) is sufficient to evaluate linguistic complexity because these are “complexifying factors in terms of exerting a load upon processing”. Though processing is called upon in defining some of his complexity metrics, [McWhorter](#) provides no experimental data to support his claims. Instead, much of his discussion focuses on distinctions that can be detected on surface forms. This surface approach to linguistic complexity is not unproblematic though.

## 2. Beware the internal/external syntax

First a surface approach to complexity mixes levels of analysis thus blurring a distinction made in [Dahl \(2004\)](#) and relevant studies between ‘objective complexity’ and ‘difficulty’. Likewise, many chapters in this volume show that the claim “more morphology (or surface distinctions) implies more processing” must first be demonstrated on an empirical ground, and the correlation does not systematically hold for all relevant cases. On conceptual ground, such a list of features as provided by [McWhorter](#) and related studies implies that a pair like (3) involves two sentences of a similar structure. In French and English, the verbs are marked for third person singular in present and the two sentences contain the same number of arguments and modifiers:

- (3) a. Jean mange du pain dans son bureau  
 b. John eats bread in his office

A superficial evaluation of these sentences based on verbal morphology only is misleading. There is indeed a wealth of literature showing that the verbs in French and English do not surface in the same position (cf. Pollock, 1989; Cinque, 1999). This can be easily shown in the examples in (4) in which the French verb occurs to the left of the adverb while the English verb follows it.

- (4) a. Jean **mange** souvent [du pain] [dans son bureau]  
 b. John often **eats** [bread] [in his office]

We have good reasons to believe that the verb in French and in English starts out in the predicate domain within the VP in which the arguments are licensed and thematic roles discharged. If we further make the hypothesis that the adverb *often/souvent* is generated in the same position cross-linguistically (as already proposed in the literature by Cinque, 1999) we reach the conclusion that in addition to encoding person and number specifications (just as in English) the French verbs must occur in a displaced position to the left of the adverb slot as depicted in (5a) for French and (5b) for English.  $\checkmark$  represents the merge site of the verb within the VP in French.

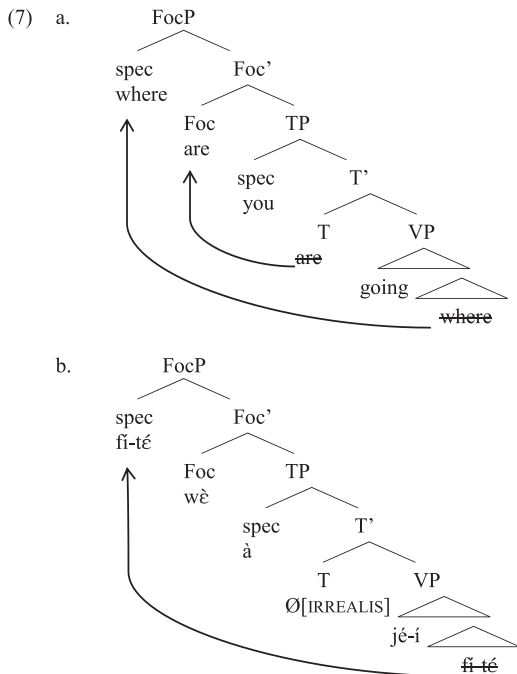
- (5) a. Subject...V...souvent...[<sub>VP</sub>... $\checkmark$  du pain dans son bureau]  
 b. Subject...often...[<sub>VP</sub>...V bread in his office]

Based on this description, we can see that the French verb morphosyntax involves more syntactic rules than the English counterpart even though both languages require the same amount of information to describe their morphological form. This indicates that by themselves, external specifications such as morphological distinctions on lexical items and their related paradigms are not sufficient to evaluate linguistic complexity. The examples in (4) and (5) suggest that we need minimally two dimensions: the external properties of the lexical and functional items and their internal structural make up.

The following sets of examples from English and Gungbe show that this distinction is important. Let us first consider the examples in (6) involving a wh-question in English and Gungbe, respectively.

- (6) a. Where are you going? [English]  
 b. Fí-té wè à jé-í? [Gungbe]  
 place-Q FOC 2SG want-go  
 ‘Which place/Where are you going?’

Partial derivations of the English and Gungbe sentences are provided in (7a) and (7b), respectively.



Note from these two representations that the two sentences have the same structure involving the predicate domain (Bowers, 1993) where the verb is inserted together with its argument, an inflectional domain headed by the tense phrase (TP) and a clausal periphery containing the focus projection (Rizzi, 1997). It therefore seems that these two structures only differ in English and Gungbe as to how they are spelled out. At this stage of the discussion, we can conclude that the clausal structures in (7a–b) must have been generated by a unique computational process and their structural complexity is identical. Actually, most surface approaches to complexity do not go this far.

As the chapters in this volume show, getting to the description in (7) is not enough to evaluate linguistic complexity properly. We must go beyond this first step. In this regard, one way to further probe into the complexity of these structures would be to adopt Progovac's (2009) definition of structural complexity, which appears to be more informed than those commonly proposed in surface complexity metrics. In terms of Progovac (2009: 207) structural complexity can be quantified as follows:

- (i) All other things being equal, a grammar which operates with only one layer of clausal structure (small clause layer) is syntactically simpler than a grammar which, in addition to that, has a functional layer of tense/TP (or comparable functional projection) superimposed upon it.
- (ii) Related to (i), all other things being equal, a grammar which involves only the principle of Merge is syntactically simpler than a grammar which also involves the principle of Move (which typically serves to connect different syntactic layers).
- (iii) Also related to (i), all other things being equal, a grammar which involves structural case distinctions (associated with DP and TP in English) is more complex than the one which shows no such case distinctions.

Under (i) the structures in (7a) and (7b) receive equal complexity scores: both structures involve IP-related functional projections including TP. The same conclusion arises based on (iii) since neither English nor Gungbe really show morphological case distinctions on DPs (i.e., outside the pronominal domain), even though one could argue for both languages that nominative case is assigned in TP, while accusative case is assigned within the VP-shell. The only measure where one could try to tease Gungbe and English apart is (ii) which suggests that a grammar that has internal Merge (i.e., Move) in addition to external Merge is more complex than a grammar that involves external Merge only. As Berends, Hulk, and Sleeman (this volume) also show on the basis of clitic pronouns in French and Dutch, however, things are not so clear cut.

To see this, consider the following facts from English and Gungbe in (6). In both English and Gungbe, the *wh*-phrase must move from its base position to the focus position in [spec FocP]. One could say that English, with its two syntactic movements (i.e., *wh*-movement, auxiliary movement) is more complex than Gungbe. Such a conclusion, however, must be weighed against a detailed analysis of *wh*-questions in the two languages. Indeed, while the *wh*-phrase *where* appears to be a simplex form in English, the Gungbe form *fi-té* (lit. which place) is a complex phrase which Aboh (2004a,b) has shown to involve a DP-internal movement of the phrase headed by the noun *fi* 'place' into a corresponding DP-internal position prior to pied-piping of the DP *fi-té* to [spec FocP] at the clausal level. Accordingly, looking at the internal syntax of *wh*-phrases in Gungbe reveals that this language also involves two types of movements: one inside the DP and one outside that raises the DP as a whole to the focus position. This means that while based on the external syntax of *wh*-questions one could claim English to be more complex than Gungbe, taking into account the internal syntax of *wh*-phrases reveals a different picture. This conclusion is compatible with the fact that close scrutiny of the morphosyntax of questions in Gungbe and English shows that while English resorts to auxiliary inversion to lexicalize the focus head under (7a), Gungbe uses a dedicated focus marker whose syntax has a broader domain of application because it forms a paradigm with Gungbe discourse markers (cf. Aboh, 2004a, 2015). The discussion therefore shows that linguistic complexity must be based on a precise evaluation of both external and internal structures (see Don, this volume for a similar conclusion, though based on different empirical facts).

### 3. Form-meaning mapping and processing

Given that linguistic structures are specified for meaning and that the function of language is to map form onto meaning, it is necessary to evaluate linguistic complexity based on form-meaning mapping that is, processing. In addition to evaluating the external and internal syntax of linguistic expressions, we also have to probe into language users' ability to process these expressions. It is only through this study that we can correlate external and internal structural aspects of the form to identification of its meaning. The following examples from Haitian and Mauritian creoles show why such an approach to linguistic complexity is necessary. Let us first consider the following two contexts in which the Haitian pronominal form *nou* is used.

*Context A:* In this context, the speaker is telling the addressee about the wonderful weekend he just spent with his family.<sup>1</sup>

In this context, the form *nou* is interpreted as first person plural 'we' because the speaker is referring to her family. This is not the case in context B below.

<sup>1</sup> I'm grateful to Michel DeGraff for providing me with these data and helping me with the description.

- (8) Nou pase yon wikenn ak anpil emosyon.  
 1PL pass DET weekend with ample emotion  
 ‘We spent a nice weekend full of emotion.’

*Context B:* In this context, the speaker calls the addressee on the phone and engages the conversation by a greeting.

- (9) Kouman **nou** ye maten an?  
 How 2PL ye morning DET  
 ‘How are you (as a group/family) doing this morning?’

Because the question is uttered in the context of a greeting, the default interpretation of *nou* will be second person plural ‘you’. Consider now context C in which *nou* appears to be ambiguous.

*Context C:* Suppose there have been talks about a group of colleagues visiting New York for business. One of the colleagues was not aware of this discussion until he met with two other colleagues who were talking about a trip to New York, and asks:

- (10) Nou pral Nouyòk?  
 1/2PL FUT.go New York  
 ‘Are you/we going to New York?’

If the speaker in context C is part of the group of senior colleagues who usually go on business visits, then question (10) could be interpreted as “Are we going to New York (this time)?” On the contrary, if only the two addressees usually go on such business trips then the question could mean “Are you going to New York (this time)?” Now suppose none of the participants usually go on business visits then the question will be ambiguous between the two readings. As Michel DeGraff (p.c. 27-01-2016) suggested to me, one way to disambiguate this question would be by pointing to the group during the utterance or by asking instead “*Nou twa a pral Nouyòk?*” (i.e., Are the three of us/you going to New York?). In this case, pointing to the people in question allows the speaker to use *nou* either inclusively (1PL) or exclusively (2PL).

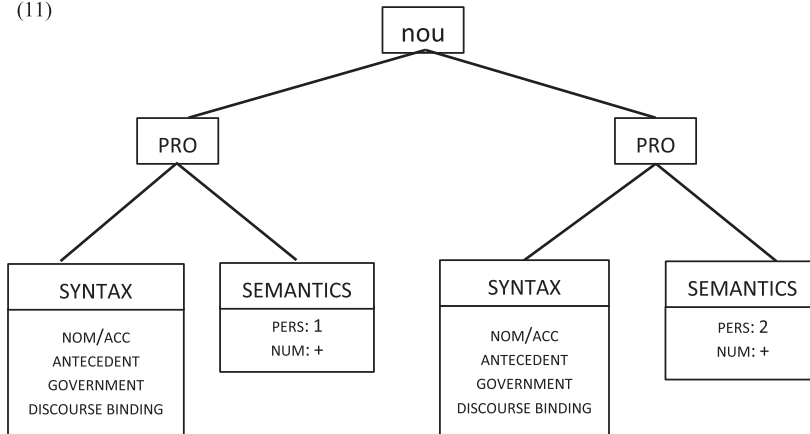
These examples indicate that Haitian is not like its source languages: French and the Gbe languages. French makes a formal distinction between *nous* (first person plural) and *vous* (second person plural). Likewise, the Gbe languages distinguish between these two pronouns based on tone. In Gungbe, for instance, *mí* (with high tone) encodes first person plural, while *mì* (with low tone) encodes second person plural. Applying surface complexity, one would conclude that Haitian developed a much simpler system reducing nominative subject pronouns from 6 forms in both French and Gbe to 5 forms only, as shown in Table 1.

**Table 1**  
 Nominative pronouns in French, Gungbe and Haitian.

	Singular	Plural
<b>French</b>		
1	je	nous
2	tu	vous
3	il/elle	ils/elles
<b>Gungbe</b>		
1	ùn	mí
2	à	mì
3	é	yé
<b>Haitian</b>		
1	mwen	nou
2	ou/w	
3	li	yo

Note that first and second person plural forms (*nous* versus *vous*) and (*mí* versus *mì*) constitute minimal pairs in French and Gungbe, respectively with the distinction in Gungbe being merely tonal. Given that creoles emerged in a multilingual setting involving speakers of different profiles (e.g., L1, 2L1, early and late L2, etc., see Aboh, 2015, 2016), it is not farfetched to hypothesize that competition between such forms (i.e., *nous* versus *mí* and *vous* versus *mì*) could have led to the disappearance of tone distinction (Haitian is not a tone language) thus creating a competition between *mí* (1PL; 2PL) versus *nous* (1PL) and *vous* (2PL). The syncretism in Gbe versus French could have led subsequent learners to postulate the new syncretic form found in Haitian in which *nou* covers two distinct functions as represented in (11).

(11)



Under this description, Haitian combines properties of syntax and semantics from the competing languages in various ways thus developing a new licensing condition for interpreting the underspecified pronoun *nou* which must be discourse-bound. It was mentioned in previous paragraphs that pointing may help disambiguate *nou* in context. But since such extra linguistic disambiguating devices presumably vary from speaker to speaker and from context to context, the Haitian learners must develop a strategy that allows licensing of *nou* based on discourse. No such a discourse-binding mechanism is needed in French or Gungbe to assign the relevant interpretation to first and second person plural pronouns. Accordingly, *nou* syncretism in Haitian can be seen as a source of local complexity because identification of *nou* involves interfaces between morphosyntax, semantics, and pragmatics, a property that presumably increases processing load (cf. Aboh and DeGraff, 2014, 2016, and Schaeffer this volume). What we see here is that it is not the profusion of distinct morphological exponents but the lack thereof that is likely to increase processing loads.

Similar local complexity arising from syncretism and its related interaction between different linguistic modules (e.g., syntax, lexico-semantics, pragmatics) and interfaces has also been shown by Bonami et al. (2011), based on inflectional paradigms in Mauritian. Similarly to many French-based creoles, Mauritian exhibits two verb forms characterized as long versus short in the literature. Example (12a) instantiates the long form and sentence (12b) the short form. These examples are taken from Henri and Abeillé (2008: 379).

(12) a. *Mo ti manze (\*manz).*

1SG PST eat

‘I ate.’

b. *Mo ti manz (\*manze) kari.*

1SG PST eat curry

‘I ate curry.’

As indicated by the parentheses, the short form is excluded from context (12a) and so is the long form in context (12b). At first sight, one could imagine that the long form cannot be followed by a morphologically realized complement, while the short form would require such a complement. Yet, various proposals have been made in the literature showing that things are not this simple (cf. Hertz and LiPookTan, 1987; Seuren, 1990; Syea, 1992). Henri and Abeillé (2008), for instance, conclude that the phenomenon involves lexical, syntactic as well as pragmatic constraints. This would mean that the Mauritian learner would have to pay attention to these different contexts in order to master the alternation between long and short forms, in addition to acquiring which verb forms allow for the alternation.

Compared to French inflectional morphology, the Mauritian long versus short form alternation certainly corresponds to a paradigm reduction that could be characterized by some as simplification. Simply counting verbal inflection, French has more exponents than Mauritian does (assuming the long versus short form can be analyzed as a form of inflection). Yet, as Bonami et al. (2011) show, the Mauritian system appears to be more opaque (and therefore less predictable) than the French system. These authors were interested in morphological learning in relation to the Paradigm Cell Filling Problem (PCFP) as defined in Ackerman et al. (2009: 54): *What licenses reliable inferences about the inflected (and derived) surface forms of a lexical item?* Under this view, inflectional morphology (and its potential related complexity) is not defined by the number of exponents

that a language exhibits but rather in terms of what predictable value these forms have and how they may impact learning (cf. Seinhorst, this volume). [Bonami et al. \(2011\)](#) conclude that: “although there is less morphology in Mauritian than in French, it does not follow that the system is simpler; the PCFP seems to be more complex in Mauritian.”

Put together, these facts indicate that linguistic complexity is a multifaceted phenomenon: one cannot evaluate complexity efficiently by looking at one dimension only (e.g., external structure, internal structure, form-meaning mapping). In this regard, this volume departs from [Dahl \(2004: 37\)](#) who claims that “we should keep complexity apart from other notions such as “cost” and “difficulty”, which must always be related to a user or an agent.” Instead, the approach proposed by the chapters in this volume is one that tries to access complexity based on external and internal properties of the form, how such form maps onto meaning and how computation of form and meaning affects learning.

#### 4. The chapters in this volume

This volume, which grows out of two years of collaborative work between the participants, brings together twelve papers that discuss complexity from various perspectives including typology, sociolinguistics, language change, processing, language acquisition by typically developing children, as well as children with Specific Language Impairment or High Functioning Autism. The aim of this interdisciplinary dialogue is to gain better understanding of linguistic complexity, a multifaceted phenomenon. I would like to thank all the contributors for taking part in this enterprise. I'm also grateful to all the anonymous reviewers for the evaluation of the papers.

**Margreet Dorleijn** investigates the paradox of code switching from the speaker's perspective. Studies of code switching show that the phenomenon is constrained by a complex interaction between linguistic rules as well as the speaker's language use in different discourse contexts. These factors arguably make code switching a complex phenomenon, as suggested by psycholinguistic experiments on production and comprehension. Yet, speakers perceive code switching as the ‘most comfortable’ way of speaking. We therefore reach the paradox that while a linguistic phenomenon may appear extremely complex in terms of its formal description, it is not necessarily perceived as such by speakers and vice versa. Dorleijn addresses this paradox based on bilingual Dutch-Turkish digital data. The analysis of the data suggests that structural, sociopsychological, and conversational factors combine to make code switching an efficient way of communication for its users, hence their perception of the phenomenon despite the complex sociolinguistic context in which it occurs and the cognitive resources that it requires.

**Umberto Ansaldo** also addresses the relation between sociolinguistic typology and linguistic complexity. Based on a survey of four sociolinguistic dimensions of Creole complexity across fifty Creole varieties, he shows that creole languages appear extremely complex once one considers the social perspective, that is, the degree of multilingualism that characterizes creole societies, the complexity of registers that speakers negotiate on a daily basis, and their competence in code switching. Given the complex social matrix and intense contact setting in which creoles emerge, one could expect creole creators to engage in linguistic complexification rather than simplification, contrary to what is often claimed in the literature (cf. [Aboh and Smith, 2009](#); [Aboh, 2015](#) for discussion). Indeed, Ansaldo's conclusions cast doubts on the often assumed (but still undemonstrated) correlation between creole grammars and simplicity. He therefore revisits the notion of simplification in Creole genesis and offers a different perspective in which a complex ecology may correlate with linguistic complexity.

The question of linguistic complexification also arises in the context of planned languages. As **Federico Gobbo** remarks, it is often assumed that planned languages such as Esperanto are less complex because they exhibit a high degree of morphological regularity that makes them apparently highly transparent. The received wisdom is that such morphological traits can help learners acquire the basics of the planned language more easily as compared to natural languages. Yet, Gobbo argues that one must consider the sociolinguistic status of these languages in order to assess the learnability problem. It is shown, for instance, that while Esperanto exhibits a rather regular morphology with almost no allomorphy this is not the case with non-auxiliary languages (e.g., fictional languages, secret languages), which may display rather intricate morphology, thus mimicking natural languages. Notwithstanding these differences, Gobbo shows that an apparent simple morphology does not imply easy acquisition. Other factors facilitating acquisition, such as, the linguistic repertoire of the learner, her attitude and motivation may depend on the facilities provided by the community of practice surrounding the language. He therefore concludes that “a language without support by the community will not be easy to learn, regardless of the structural traits of the language itself”.

**Jenny Audring** tackles the question of linguistic complexity from a theoretical perspective. She proposes a formal metrics of complexity based on a typological study of grammatical gender. Grammatical gender involves intricate relations between semantics, morphology, phonology, and syntax, and appears one of the most complex linguistic phenomena. Yet, not all gender systems are equally complex. Likewise, Audring shows that there is no one-to-one correlation between overt morphological exponence and complexity. Under her metrics, some dimensions of complexity may increase in contexts where the exponent is not expressed. Accordingly, studies that exclusively focus on presence versus absence of morphology may be misleading. This chapter further provides a descriptive basis for the assessment of difficulty in acquisition and processing, thus avoiding the common misconception that what appears more complex on the surface should also be more difficult to acquire.

**Klaas Seinhorst** investigates two measures of complexity, feature economy and logical complexity, and compares them as predictors for ease of learning in the acquisition of a small set of signs that is conceived of as analogue of plosive inventories in

spoken languages. In terms of feature economy, languages tend to maximally combine their phonological features. This would mean that more economical inventories are easier to learn, and because they are easier to learn they would also tend to be cross-linguistically frequent. Logical complexity on the other hand predicts that logically simple data sets are easier to learn. Seinhorst's study shows that participants learned data sets that varied in feature economy and logical complexity, but the results indicate that ease of learning is best predicted by logical complexity, and that learners unintentionally reduce the cumulative complexity of the data set. In other words, logically simple datasets are easier to learn. These results clearly show that the study of linguistic complexity must focus on the mapping of form onto meaning and how learners get to acquire this knowledge, rather than focusing uniquely on surface forms.

In evaluating form-meaning computation, **Jakub Szymanik and Camilo Thorne** investigate the distribution and semantic complexity of quantifiers, using large-scale English and German corpora. In a way similar to Seinhorst, they propose that the semantic complexity of a quantifier can be determined based on the amount of computational resources necessary to decide whether the quantifier sentence is true in a defined context. The rationale here is that speakers and learners have limited cognitive resources (e.g., working memory), and may thus be biased toward quantifiers that are easy to compute (e.g., because they involve little or no working memory). In line with Seinhorst's conclusions and as predicted by the theory, their study shows that corpora distributions are significantly skewed towards quantifiers that can be said to involve lower complexity.

The interaction between form-meaning mapping and its related processing cost is also the topic of the chapter by **Jelke Bloem, Arjen Versloot, and Fred Weerman** which focuses on verb clusters in Dutch. This language allows word order variation in verb clusters with no obvious meaning difference. According to the authors, such orders are of equal syntactic and morphological complexity even though they show a different distribution. It is therefore proposed that such a variation in distribution can serve as empirical evidence for investigating how verb cluster ordering variation relates to processing, as well as which order requires more processing and can be said to be more complex. Bloem, Versloot, and Weerman conducted a large-scale corpus study in order to find out which factors affect word order variation in verb clusters and what these factors have in common. The study suggests that: "a variety of factors that are related to verbal cluster word order can also be related to the processing complexity of the cluster's context". The study further shows that more frequent orders are also easier to process. This is in accordance with Seinhorst's findings.

Focusing on the issue of the relation between frequency of distribution of word order patterns and complexity, **Hedde Zeijlstra and Denise Goddard** tackle the question of to what extent the VO order commonly assumed to be typical of creoles is a sign of simplification. An interesting case in regard to this question is Berbice Dutch, a now extinct creole, which displays VO order even though its most relevant source languages Dutch and Ijo (Kalabari) exhibit OV patterns. A common assumption is that VO order being the default option it is less complex than marked orders such as OV. Under this view, the emergence of Berbice Dutch VO could be analyzed as a reduction of the complexity of a creole language in comparison to its source languages. In their chapter, Zeijlstra and Goddard demonstrate that the emergence of Berbice Dutch VO can be accounted for based on common assumptions about first and second language acquisition. Indeed, close inspection shows that Berbice Dutch VO results from the fact that Kalabari speakers did not analyze Dutch as a Verb Second (V2) language. This has led the learners to the hypothesis that SVO orders resulting from V2 are plain VO orders. The chapter further shows that such a reanalysis of OV + V2 structures as VO structures was facilitated by the existence of so-called VO leakages in 16th and 17th century Dutch. This discussion therefore indicates that notions such as 'marked order' or 'transparent morphology' which are assumed to be prevalent in creole languages because they are less complex is misleading.

In this regard, **Jan Don** argues that 'transparency' is not part of the design of language and should therefore not be taken into account in the evaluation of complexity. As Don argues, "the mapping between the (morpho-)syntax and the phonology in natural languages is characterized by mismatches between structure and form. The grammar has different means that allow for such mismatches. Consequently, the idea that a transparent mapping is somehow 'optimal' is, at least from the perspective of the grammar, misguided". Given this, the question arises how to account for apparent cases of transparent systems (e.g., Esperanto, Gobbo this volume, or creole languages, **Leufkens, 2013**). In addressing the case of creoles, **Don** proposes that their tendency to be transparent in certain domains could be an effect of second language acquisition, namely, the Mutual Exclusivity Principle which stipulates that forms that have been assigned a meaning by the language learner, will not be used in different meanings, and references that have a particular form will not be expressed by another form. Such a principle would generate linguistic transparency if the acquisition context allows it. This effect, Don submits, will be greater in second language acquisition than in first language acquisition. Since second language acquisition played an important role in the emergence of creoles, this could explain the transparency tendency observed in some areas of these languages. A main conclusion of this chapter therefore is that transparency need not be taken into account in evaluating complexity. Once again, a key factor seems to be the computation of form-meaning mapping.

This question is also central to the study by **Sanne Berends, Aafke Hulk, and Petra Sleeman**. In this corpus-based study, the authors investigate the role of complexity in the acquisition of Dutch and French pronouns *er* and *en*, respectively. The authors assume Jakubowicz' (2005) Derivational Complexity Metric which stipulates that base-generation of an item or constituent is less costly than applying movement to that element: External Merge is more economical than Internal Merge. Likewise, the more steps of movement a derivation involves, the costlier it is. Though the evaluation of such a metric appears difficult when considering the target language only, these authors show that careful analysis of the child data is promising. The analysis is based on a limited number of children, nevertheless this chapter indicates that different Merge operations relate to different complexity degree and that less complex structures tend to

occur before more complex ones in child acquisition. Accordingly, the correlation between less complex and ease of acquisition seems to hold in these cases.

**Judith Rispens & Vicente Soto de Amesti** investigate processing of syntactic complexity focusing on subject-verb agreement. The following examples, for instance, show that a number of constituents may appear between the subject and the verb in many languages. While *often* in (11a) is an adjunct of the VP, the relative clause *that we wanted to talk to*, modifies the noun phrase in subject position.

- (13) a. The girl/s (often) reads/read the book.  
 b. The girl/s (that we wanted to talk to) is/are coming.

In both cases, however, number specification of the subject noun phrase must be stored in memory until the speaker/hearer reaches the relevant verb. A question that one may therefore ask is whether increasing the number of intervening constituents between the subject and the verb may affect agreement processing (thus increasing the complexity of the sentence). A related question that also comes to mind is whether the type of the intervening constituent may also come into play. Event-related potentials (ERPs) were measured to investigate the neural correlates of agreement processing. In this experiment, participants read grammatical sentences as well as ungrammatical sentences violating subject-verb agreement. The ungrammatical sentences elicited posterior negativities in the 350–500 ms time window, but no effects of distance or type of constituents were found in this time window. Likewise, a P600 effect was observed in response to the agreement violations. While the type of constituent seem not to play a role, it appears that linear distance between the subject and the verb influenced the P600 effect since sentences with two constituents elicited more positive going waveforms than sentences with no intervening constituent between the subject and the verb. These results are in line with psycholinguistic accounts that integration of additional linguistic elements makes it more complex to process subject-verb agreement relationship, regardless of the presence of additional number features.

**Jeannette Schaeffer's** chapter investigates object scrambling in Dutch in correlation with syntactic complexity in three Dutch-speaking groups of children between the ages of 6 and 14: children with Specific Language Impairment (SLI), children with High Functioning Autism (HFA) and Typically Developing children (TD). Her results suggest that children with SLI fail to scramble due to syntactic aspects of object placement, while children with HFA leave referential direct objects unscrambled due to difficulties in integrating the different components of direct object scrambling. These results further reveal the relevant components of direct object scrambling and their role in linguistic complexity. Indeed, this study indicates that direct object scrambling is complex because it relates to different interfaces: the interface of grammar (including (morpho)syntax and semantics) and pragmatics. As Schaeffer shows, “the more interaction between language components the phenomenon involves, the more complex it is”.

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