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Cognitive and functional factors in the evolution of grammar

FREDERICK J. NEWMEYER

Department of Linguistics, University of Washington, Seattle, WA 98195-4340, USA. E-mail: fjn@u.washington.edu

The purpose of this paper is to raise the question of the relative roles of cognitive and functional factors in the evolution of grammar. The conclusion is that they have both played important roles, although unbalanced ones. Human language originated with the linking of conceptual structures and the vocal output system. In other words, cognitive factors were the first to shape grammar. But with the passage of time, the needs of communication came to play an ever-more important role in grammar. Human language today hence reflects the influence of both types of factors.

Introduction

The structural properties of human languages, their 'grammars', are at one and the same time the most uniquely human of all human attributes and the most difficult one for which to provide an evolutionary account. These two facts are intimately related. The central components of grammar, namely, syntax and phonology, have no evident homologues in the communicative behaviour of any species remotely related to our own. This is particularly true of our closest relatives, the great apes, whose rudimentary vocalizations have no structural properties that have ever been identified. And unfortunately there are no archaeological digs turning up specimens of the language of 100,000 years ago. While the fossil record has given us a reasonably clear picture of the evolution of the vocal tract, grammatical structure, needless to say, is not preserved in geological strata.

Given such limitations, our best hope for understanding how grammar evolved would seem to be to investigate it in terms of its contemporary structure and function and to extrapolate backwards in time by proposing plausible accounts of how that structure and function may have arisen in the species. But here as well we encounter

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a perplexing problem. Languages (and hence the grammars that characterize them) are used for (at least) two very different purposes. One is for cognition, that is for the representation of meaning and the process of thinking, which draws upon those meanings. The other essential application of language is as the primary agent of interaction among members of our species. While one might reasonably take the position that verbal interaction involves, to a certain extent, the transfer of 'knowledge' from one person to another, that is not one of its necessary features. Indeed, it has been shown that a sizeable percentage of vocal interaction is primarily social in character, rather than involving an exchange of (propositional) information.[1,2]

Clearly, a system 'ideally' designed for knowledge representation is not necessarily a system that is 'ideally' designed for verbal interaction. On the one hand, the former admits to a complexity not found in the latter. That is, introspection tells us that we are capable of forming in our heads complex concepts that we could never have the ability (nor, often, the desire) to communicate to another individual. On the other hand, verbal interaction is subject to constraints of real time that are not found in the simple representation of knowledge. In language production, every word has to be identified from an ensemble of more than 50,000 stored forms in less than a third of a second and assembled into a structure that correctly represents the meaning intended by the speaker. The hearer has to perform the same process in reverse and rarely makes mistakes in assigning the correct grammatical structure to the incoming flow of speech. In other words, it is in our interest for grammars to allow verbal interaction to be fast.

The purpose of this paper, then, is to puzzle out different contributions of cognition-aiding factors and vocal interaction-aiding factors in the origins and evolution of grammar. In keeping with standard practice among linguists – albeit a practice that has often created a bit of confusion among non-linguists – I will refer to the latter factors as 'functional' ones. This usage has arisen as a result of the belief of a large number of linguists that the primary 'function' of language is communication (rather than knowledge representation). Hence a 'functional explanation', for many linguists, is one that is based on enabling more efficient communication among speakers and hearers. In the remainder of this paper, then, a factor will be said to be 'cognitive' if it is based on representations of meaning or thoughts, and a factor will be said to be 'functional' if it is based on pressure for (more) efficient use of language among members of the species. I will argue that both played a role in evolution, but an imbalanced one. Natural language grammars at their onset reflected factors that I am calling 'cognitive'. Functional pressure exerted itself only after the basic structure of grammar was in place. Furthermore, those factors based in cognition are reflected in the genetically-transmitted aspect of grammars (or 'Universal Grammar', as it is often called), while communicative factors are primarily historical and have become more and more manifest with the passage of time.

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On the functional grounding of grammar

There are numerous ways that grammars seem to reflect communicative function. At the same time, grammars appear – at least in part – to be poorly designed from the perspective of cognition. These two points are developed in the next subsections.

Grammar as a response to functional pressure

At first blush, the structure of language seems good for communication and at same time not particularly well designed for the representation of meaning or thought. In fact, for mainstream functional linguists, the communicative underpinnings of language are so obvious that there is no issue at all. To take a typical case, Charles Li, for example, simply defines the question of language evolution as one that involves the evolution of communicative behaviour, pure and simple:

> The study of the origin of language, however, concerns the evolution of the communicative behavior of our hominid ancestors toward the emergence of language. (Ref. 3, p. 218)

Li cannot even imagine what it might mean to take the position that grammar is rooted in cognition:

> Scholars who recognize the merit of functional linguistics agree that language emerged evolutionarily first and foremost as a vehicle of human communication, *not* as an instrument of thought. The claim of language as an instrument of thought is an intuitive and a priori claim that defies scientific verification. (Ref. 4, p. 87; emphasis in original)

To be sure, there are many ways that functional factors do seem to have shaped language. I consider the evidence to be overwhelming that several external functional pressures have left their mark on grammars. In the remainder of this section I will briefly illustrate three of them: the pressure to process sentences rapidly, the pressure for form and meaning to be in alignment ('iconic motivation' for grammatical structure), and pressure for information to be conveyed in an orderly manner ('discourse pressure' on grammatical structure).

Of these three pressures, perhaps the most important is the pressure to process sentences rapidly. Consider one way that grammars have adapted themselves to facilitate speed of processing. Cross-linguistic generalizations about language structure reflect the fact that it is in the language user's interest to recognize the major grammatical elements of the sentence as rapidly as possible. For example, one of the most longstanding typological generalizations in syntax[5] is that languages in which the verb precedes the object tend to have prepositions and that

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languages in which the verb follows the object tend to have postpositions (i.e. preposition-like elements that follow the noun that they are associated with). There are four logical possibilities, illustrated in (1a–d): verb-object (VO) and prepositional (1a); object-verb (OV) and postpositional (1b); VO and postpositional (1c); and OV and prepositional (1d):[6]

(1a) (VO and preposition-object – English)
I sliced the cheese with a knife.

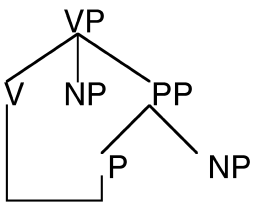
(1b) (OV and object-postposition – Japanese)
Taroo-ga Hanako-ni sono tegami-oyon-da
Taroo-SUBJ Hanako-IDO that letter-DOread-PAST
'Taroo read that letter to Hanako.'

(1c) (VO and object-postposition– Hungarian)[7]
_____ kidugtaa fejét a dunyha alól
(someone) thrust the head the quilt from under
'Someone thrust his/her head out from under the quilt'

(1d) (OV and preposition-object – Amharic)
aster w′nb′r-u-n l′ setiyy′ was′t't′′c&iw
Aster chair-the-DO to woman the gave
'Aster gave the chair to the woman'

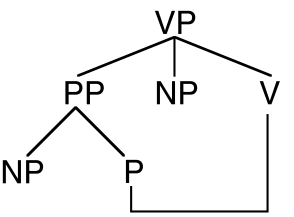
Languages such as English and Japanese are very common – perhaps 80% or more of all languages behave like them. On the other hand, languages such as Hungarian and Amharic are rather rare. Why should this be? Consider the relevant parts of the structures of the four language types, depicted in (2a–d):

(2a)



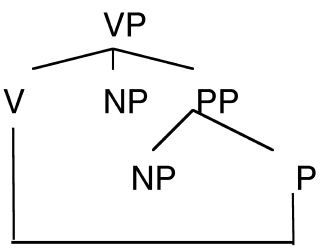
VO and prepositional (common)

(2b)



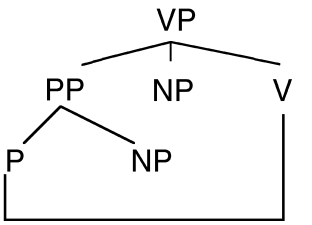
OV and postpositional (common)

(2c)



VO and postpositional (rare)

(2d)



OV and prepositional (rare)

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As noted in (Ref. 8), in (2a) and (2b), the two common structures, the length of time that it takes the hearer to identify all of the parts of the VP is rather short, in that it is simply a function of the distance between V and P. All that lies between these two elements is the object NP. But in (2c) and (2d), the uncommon structures, the identification time is longer, since the object of the preposition lies between V and P as well. The reasonable conclusion, then, is that the typological generalization about the correlation between verb-object order and adposition type reflects the preference of language users to process input rapidly.

Iconic motivation for grammatical structure is a theme in much functionalist writing. For our purposes this means that the form, length, complexity, or interrelationship of elements in a linguistic representation reflects the form, length, complexity or interrelationship of elements in the concept that that representation encodes. For example, it is well known that syntactic units tend also to be conceptual units. In his classic studies of the effects of iconicity in syntax, Haiman[9,10] points to a multitude of cases where grammatical distance and conceptual distance are correlated. Consider, for example, the following well-known pair of examples:

(4a) John caused Bill to die by inadvertently buying him a ticket on a plane that ended up crashing.
(4b) ?John killed Bill by inadvertently buying him a ticket on a plane that ended up crashing.

The oddness of (4b) results from the fact that causatives that are single words (e.g. *kill*) tend to convey a more direct causation than periphrastic causatives (e.g. *cause to die*). So, where cause and result are formally separated, conceptual distance is greater than when they are not. Haiman also points to the distinction between alienable possession (e.g. *Mary's book*) and inalienable possession (e. g. *Mary's heart*). In no language is the grammatical distance (measured in terms of the amount of structure) between the possessor and the possessed greater for inalienable possession than for alienable possession.

The third type of usage-based explanation appeals to the flow of information in discourse. Such explanations start from fact that language used to communicate and communication involves the conveying of information. Therefore, it is argued, the nature of information flow should leave and has left its mark on grammatical structure. The communication of information has been appealed to, for example, in order to explain the ordering of the major elements within a clause. There are three ways to say: 'Daddy has brought a Christmas tree' in Russian, a typical so-called 'free word-order' language:

(5a) Pápa prinyós yólku. (Daddy – bought – a Christmas tree)

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(5b) Yólku prinyós pápa. (A Christmas tree – bought – Daddy)
(5c) Yólku pápa prinyós. (A Christmas tree – Daddy – bought)

Each sentence is interpreted with the initial element representing old information and the final element representing new information. A common functionalist claim is that discourse principle of Communicative Dynamism governs the ordering. The passage of time from past to present to future is mirrored iconically in discourse by the ordering of old information before new information (see, for example, Ref. 11).

Some cognitively-unsuited aspects of grammars

Not only do grammars in certain respects seem well designed functionally, but there are also a number of ways that they seem extremely poorly designed for the representation of meaning or thought. Hurford has catalogued them in an important paper.[12] Most importantly, since we do use language to communicate, grammatical structure necessarily has phonological properties as well as syntactic ones. Indeed, the classic definition of a grammar is that it is a system that relates sound to meaning. Yet, aside from the relatively rare cases where one might talk to oneself out loud, phonology has no role at all to play in cognitive processes such as thought and reasoning. Likewise, language is replete with morphological complexity, which serves no obvious cognitive function. For example, in English a concept can be represented by a stand-alone word (*book*), by a prefix (***un***able), or by a suffix (*king***dom**); indeed a single word can contain all three (*under-talent-ed*). If language evolved solely in the service of cognition, it is hard to imagine why it would manifest morphological complexity.

Hurford points to several other ways that grammars make distinctions that serve no evident cognitive function. For example, virtually all languages distinguish in their grammars between the grammatical relation 'Subject' and the grammatical relation 'Direct Object'. These grammatical notions conflate a relatively large number of semantic ones. For example, a subject in English can be the agent of an action (6a), the patient of an action (6b), an instrument (6c), an experiencer (6d), a recipient (6e), a location (6f), and much more. The same point could be made about direct objects. This conflation of a large number of semantic roles into a couple of grammatical ones seems rather perplexing if language arose primarily to represent meanings.

(6a) *Mary* threw the ball.
(6b) *The ball* was thrown by Mary.
(6c) *The knife* cut the butter.
(6d) *John* enjoyed the play.
(6e) *Mary* received a letter.

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(6f) *Chicago* is an interesting city.

Hurford also notes that all languages contain what he calls 'quirky mismatches', that is, they express parallel semantic notions in quite different grammatical ways. Hence past and present tense in English are encoded by suffixes (*Mary work***s** for the Parks Department, Mary work**ed** for the Parks Department), but future tense by a modal verb (*Mary* **will** work for the Parks Department). Along the same lines, markers of clause boundaries such as complementizers serve no obvious role (7), nor does the fact that an element can be 'displaced' from other elements with which it is associated cognitively (8):

(7) John thinks [*that* it is time to leave].
(8) *Who* is John going to the game with? (*Who* is understood as the object of *with*)

Finally, Hurford points to the phenomenon of grammatical agreement as one which serves no cognitive function. So in Spanish, the article and the adjective must agree in gender and number with the noun that they modify – a puzzling fact from the perspective of a cognitive account of the origins of grammar:

(9a) *el* libr*o* roj*o*, *los* libr*os* roj*os*
(9b) *la* ventan*a* roj*a*, *las* ventan*as* roj*as*

We will return to examples such as these later.

Grammar as a reflection of cognitive processes

The core of my argument for the importance of cognitive factors is based on the many ways that grammars seem overdesigned for efficient communication and at the same time well designed from the standpoint of cognition. These are summarized in (10):

(10) Factors supporting an origin of grammar in cognition:
(10a) The importance of full argument structure
(10b) The possibility of recursion
(10c) The rampant structural ambiguity that grammars allow
(10d) The possibility of communicatively useless sentences
(10e) The closer relation of grammatical categories to cognitive categories than to communicative ones
(10f) The existence of covert levels of grammatical structure representing aspects of meaning

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The importance of full argument structure

An interesting fact about actual utterances produced by language users is that they rarely contain a subject, a verb, and an object, where the subject and the object (the 'arguments' of the sentence) are full lexical items. Most utterances consist of a verb with one full argument, which is either the subject of an intransitive verb or the object of a transitive verb. Other arguments are either reduced to pronomimal or affix status or omitted entirely (the latter in languages such as Spanish and Chinese, which allow the wholesale omission of arguments). One's first thought might be that this fact presents another piece of evidence against the idea of the origin of grammar in cognition. That is, while conceptual representations of events embody fully-specified arguments, actual speech (and therefore possibly the grammars that underlie it) appear not to.

However, when one looks at things more closely, we see that grammars are in fact 'propositional', that is they consist of structures specified by formal rules that take the sentence to be the basic unit of grammar, where sentences are in a rough mapping with propositions, verbs with predicates, and noun phrases with logical arguments.

We begin with some typological evidence. Since Greenberg[5] it has been customary to divide languages into their basic ordering of subject (S), verb (V), and object (O). From this ordering, certain predictions tend to follow. For example, SOV languages (as we have seen) are more likely to have postpositions than prepositions. But since very few utterances in natural language actually have the full subject, verb, and object, one might predict that ordering of full subject, verb, and object should be irrelevant to typology. But that prediction is false, as a look at French indicates. French is SVO when the object is lexical, but SOV when the object is pronominal:

(11a) Marie voit Jean.
(11b) Marie le voit.

Text counts show that sentences like (11b) are vastly more likely to be uttered than those like (11a). But French is archetypically an VO language in its typological behaviour. In other words, in this case actual language use is irrelevant. What is important is the ordering of elements in sentences with full propositional and lexical structure, rare as they are in actual discourse. The reason is that it is this full structure that is called upon in speech production. According to Levelt,[13] a central part of planning a speech act involves retrieving lexical information, what he calls 'lemmas' – essentially predicates and their argument structure. In other words, for transitive verbs like *hit*, *know*, *eat* and so on, the speaker has a mental representation of the full argument structure of the sentence:

> Lemma structure plays a central role in the generation of surface structure. In

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> particular, the main verb dictates what arguments have to be checked in the message, and which grammatical functions will be assigned to them. (Ref. 13, p. 244)

The 'formulator', the formulating component of speech production, takes this information as input. Because of that, sentences with full argument structure are psychologically more basic than others, even though efficient discourse packaging keeps them from being used very often. But for typological purposes, it does not matter that fully elaborated sentences are rarely actually used. It is the most frequently used canonical ordering of subject, verb and object that drives typology, not the most frequently used utterance type in general. The speaker of French might rarely utter sentences like (11a), but he or she does so more far more often than those like (12):

(12) *Marie Jean voit.

And because of that, French behaves typologically like a VO language, not like an OV language. In other words, grammars reflect the full argument structure that characterizes cognition, even though there is no communicative reason for them to do so

The way that sentence fragments are processed also points to the centrality of fully specified grammatical representations, as work such as that of Pope[14] and Morgan[15] reveals. Consider some possible answers to the question in (13):

(13) Who does $John_i$ want to shave?

Those in (14a–c) are possible, but not those in (14d and e):

(14a) $Himself_i$
(14b Him_j
(14c) Me
(14d) *Myself
(14e) *Him_i

The generalization is that the possible pronoun corresponds to the one usable in full sentences, with all arguments expressed:

(15a) $John_i$ wants to shave $himself_i$.
(15b) $John_i$ wants to shave him_j.
(15c) $John_i$ wants to shave me.
(15d) * $John_i$ wants to shave myself.
(15e) * $John_i$ wants to shave him_i.

In other words, whatever one might do in actual speech, one's cognitive representation embodies all the arguments and the principles for assigning the

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proper pronominal form to the direct object. These are ingredients of cognition, not communication.

The possibility of recursion

Every language on earth allows for the possibility of recursion, that is, sentences embedded inside of sentences inside of sentences, ad infinitum. For example, in principle, there is no limit to the number of times that another subordinate clause can be added in sentences like the following:

(16) Mary thought that John said that Sue insisted that Paul believed that …

Is recursion necessary for communication? Apparently, it is not. We virtually never have any reason to utter complex sentences like (16). And the desired message conveyed by simpler sentences with recursion like (17a) can easily be communicated by a sentence like (17b), employing juxtaposition of two clauses:

(17a) Mary thought that John would leave.
(17b) Here is what Mary thought. John was going to leave.

Actually, everyday communication makes use of surprisingly little recursion. Givón[16] and many others have suggested that the use of subordinate clauses increases dramatically with literacy. The major study along these lines is Kalmár,[17] which maintains that Samoyed, Bushman, Seneca, and various Australian languages rarely employ subordination. According to Kalmár:

> It is quite likely that the number of subordinate clause types grew as narrative developed and accelerated with the advent of writing. Typical is the development of subordination in Greek, which hardly existed in Homer but was well developed in the classics (Goodwin 1912). (Ref 17, p. 159)

Mithun[18] carried out text counts on a number of languages with respect to the amount of subordination that one finds in discourses carried out in those language. All languages manifest some subordination, but there is a strong correlation between its rare use and the pre-literate status of their speakers.

It is important to stress that there exists no language for which subordination is literally impossible. In fact, as societies 'modernize', the use of subordination becomes more frequent. For example, Kalmár[17] observes that Inukitut is now developing subordinate clauses. The fact that every language allows the possibility of recursion suggests that it is a genuine design feature of language, there from the beginning. Why would this be the case? The obvious answer is that human thought has recursive properties, even if the manifestation of the

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expression of that thought in communication does not necessarily draw on those properties. As noted by Pinker and Jackendoff:[19]

> Indeed, the only reason language *needs* to be recursive is because its purpose is to express recursive *thoughts*. If there weren't any recursive thoughts, the means of expression wouldn't need recursion either. (emphasis in original)

Grammarians have long stressed the importance of recursion as a distinguishing feature of human language.[20,21] Charles Li, again taking the mainstream functionalist viewpoint, attempts to deflect its importance by raising the question of whether it can be found in other species:

> In order to determine whether or not the recursive property is a unique defining feature of human language, we must find out if there is a theoretical possibility that certain animal communicative signals could also be described with a re-writing system that is recursive. (Ref. 3, p. 211)

Li suggests that the vocalizations of humpback whales can be described by means of a recursive system. I have no idea if he is right or wrong about such creatures, but it hardly matters to the point under consideration, namely that recursion is not necessary for communication, while at the same time pointing to an origin of grammar in cognition.[22]

The rampant structural ambiguity that grammars allow

I do not think that it is controversial that the more ambiguity a communication system allows, the less efficient it is. By that criterion, human grammars are horribly designed for communication. Virtually any sentence imaginable is loaded with potential ambiguity. For example, sentence (18) was calculated by Martin *et al.*[23] to have 455 parses:

> (18) List the sales of products produced in 1973 with the products produced in 1972.

Of course, we have found ways to deal with this problem in actual language use. For that reason, humans have developed complex systems of inference and implicature, conveyed meanings, and so on. Hence, in actual conversation, real ambiguity is normally a minor problem. But our concern here is the design of grammars and whether they are well shaped for communicative purposes. Based on the ambiguity that they permit, the conclusion has to be that they are not well shaped.

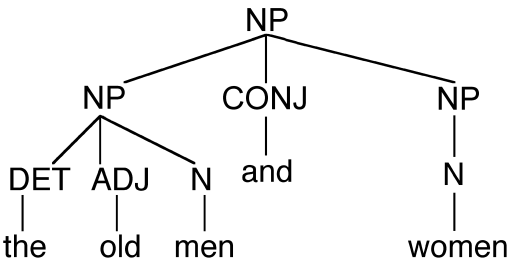
If we focus on cognitive representations instead of on communication, however, structural ambiguity is a much less serious problem. The reason is that many (communicatively) ambiguous sentences are disambiguated by their structures. Consider for example the following ambiguous phrase:

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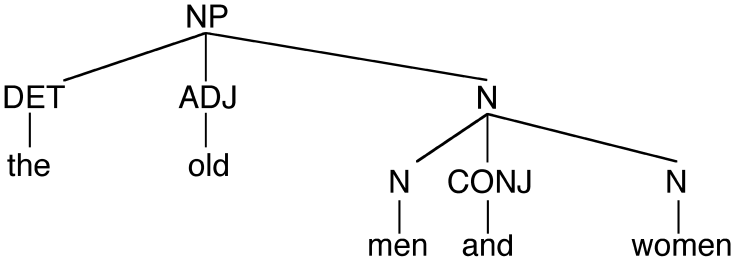
(19) The old men and women (applied for senior citizen discounts).

In actual speech, the scope of 'old' could be simply 'men' or be 'men and women' understood collectively. But this phrase is disambiguated in terms of its structural (i.e. cognitive) representation. The former representation is as in (20a), the latter as in (20b):

(20a)



(20b)



From the point of view of language use, the possibility of dual (i.e. ambiguous) representations for the same sequence of words is not communicatively desirable. But since the different meanings are represented differently from the cognitive standpoint, we must conclude that, in this respect, grammars seem well adapted to cognition.

The possibility of communicatively useless sentences

A central fact about language that it allows us say anything that we can conceptualize, regardless of whether we would actually have any need, desire, or likelihood to convey the information conceptualized. No more effort is required to say an obviously false sentence (21a) or an obviously true one (21b) than one that might be genuinely communicatively relevant (21c):

(21a) Tomorrow will not follow today.
(21b) Tomorrow will follow today.
(21c) Tomorrow will be rainier than today.

Along the same lines, we have no more trouble uttering pure nonsense sentences

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like the celebrated (22a) than grammatically parallel ones that contain an easily accessible semantic content (22b):

(22a) Colourless green ideas sleep furiously.
(22b) Revolutionary new ideas appear infrequently.

Any speaker of English knows that (22a) is absurd and knows why it is absurd. That is, we assign to it a conceptual representation that registers the incompatibility of being simultaneously 'colourless' and 'green', the impossibility of ideas have (literal) colour, the incongruity of sleeping in a furious manner, and so on. But none of that prevents our being able to utter (22a) with the same facility as (22b). In other words, communicatively useless sentences provide another example of how language is 'overdesigned' for communication.

The closer relation of grammatical categories to cognitive categories than to communicative ones

The classic (albeit oversimplified) conception of a grammar is that it is composed of different levels, each higher level containing a sequence of units at a lower level. In other words, the classic picture is something like the following:

(23) SENTENCES
|
which are composed of a sequence of GRAMMATICAL CATEGORIES (i.e. word units)
|
which are composed of a sequence of MORPHEMES[24]
|
which are composed of a sequence of SOUNDS

For example, sentence (24a) can be represented in terms of its component words as in (24b), its component morphemes as in (24c), and its component sounds, as in (24d):[25]

(24a) The colourful paintings seemed to be original.
(24b) $_{D}$[the] – $_{A}$[colourful] – $_{N}$[paintings] -$_{V}$[seemed] – $_{C}$[to] – $_{V}$[be] – $_{A}$[original]
(24c) the – colour -ful – paint – ing – s -seem – ed – to – be – origin – al
(24d) [D′k′l′rf′lpeyntINzsiymdtuwbe′rIdg′n′l]

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The units at each level tend to be more pertinent to meaning than to discourse.[26] We have already seen that such is the case with respect to sentences. As far as grammatical categories are concerned, a tradition going back to the ancient Greeks holds that each category admits to a notional definition (for a modern version of this view, see Ref. 27). Consider, for example, the classic definition of a 'noun' as a 'person, place, thing, or idea'. There are, in fact, syntactic categories that represent discourse constructs, as in the following example from Somali, where 'FOC' denotes the category of 'focus marker', realized in this language as the word *baa*. That is, any word that precedes *baa* is understood as information focused on by the speaker.

(25) Cali baa sheegay in Muuse yimid (Somali)
Cali FOC said that Muuse came
'CALI said that Muuse has come'

However, categories that denote aspects of the discourse setting of the utterance are a great deal rarer than those that denote aspects of the cognitive meaning of the sentence.

The same point can be made with respect to morphemes – indeed, the classical definition of a morpheme is that it is a basic unit of meaning. While this view is oversimplified, it is not far from being correct. Most units of word formation have an identifiable semantic content.[28] Again, there are morphemes whose role is a discourse-oriented one, such as the topic-marker *wa* in Japanese, illustrated in (26), but these are vastly rarer than morphemes that are semantically-characterizable.

(26) John-wa Mary-oaisi-te i-ru (Japanese)
John-theme Mary-obj lov-ing is
'John loves Mary'

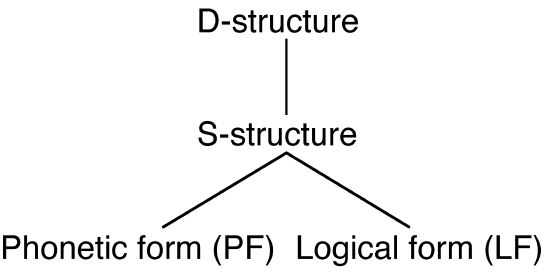
To summarize, the properties of the basic grammatical building blocks of a sentence suggest that in an important respect, grammar is better designed for cognition than for communication.

The existence of covert levels of grammatical structure representing aspects of meaning[29]

Let us consider the architecture of the grammatical model in the mainstream Principles-and-Parameters approach to syntax.[30,31] It can be depicted as in (27). In a nutshell, the level of D-structure is mapped onto the level of S-structure and S-structure onto the level of LF by a series of grammatical rules:

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(27)



Each of these three levels appears to have a characteristic (though not exclusive) function, as far as the linkage between form and content is concerned. D-structure is the pure representation of predicate-argument structure. LF represents quantification structure, that is the relations between quantifiers and the variables that they bind. For example, at LF the quantifiers *everyone* and *who*, whose surface syntax is very different, have parallel representations:

(28) S-structure:
(28a) Whoi did Mary love ei
(28b) Mary loved everyone
Logical form:
(28c) Whoi [Mary love ei]
(28d) Everyonei [Mary love ei]

S-structure is the level most germane to the syntactic representation of discourse constructs and to the grammatical instantiation of the needs of sentence processing. So notice that two of the three syntactic levels encode cognitive aspects of grammar, rather than communicative aspects. If this picture is right, it suggests that cognitive relations are at the heart of grammar in a way that communicative aspects are not. After all, the fact that the levels of DS and LF are covert and, therefore, 'unlearnable' by direct evidence suggests that they reflect our genetic preprogramming and were therefore in place at the origin of language.

Cognition, functional pressure, and the origins of language

Consider the point to which our investigations have led us. On the one hand, we have just seen six important design features of language that pertain little – if at all – to communication. Importantly, none of them are 'learnable' in the ordinary sense of the word, suggesting that they were there from the dawn of human language itself. On the other hand, those aspects of language that seem designed to better aid communication, are historical. That is, unlike predicate-argument

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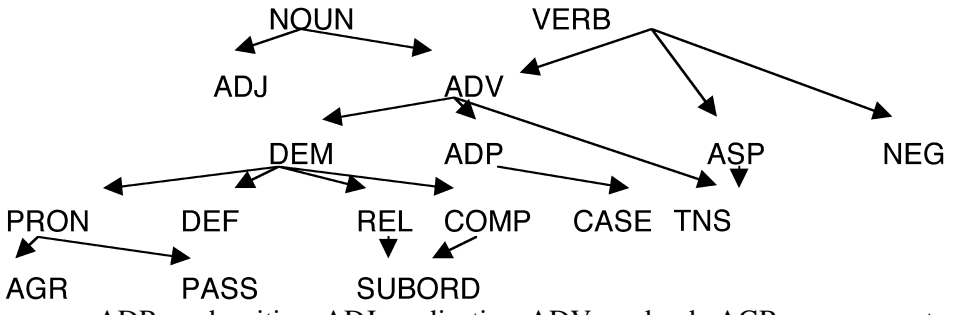
structure and so on, we can see how they developed over time. For example, take a communicative aspect of language par excellence, namely discourse markers. These are expressions like the following:

(29) then, I mean, y'know, like, indeed, actually, in fact, well, …

According to Schiffrin[32] they are essential to the makings of a coherent discourse. But as Traugott and Dasher[33] have recently pointed out, they invariably arise from something else, most typically out of conceptual meanings and uses constrained to the argument structure of the clause. This is a curious fact: while central to communication, they are at the same time derivative historically. Well, if vocal communication itself is derivative, it all makes sense. Nouns and verbs trace back to nouns and verbs, because they were there from the start. The derivative nature of discourse markers points to a time when we had structured conceptual representations, but they had not yet been co-opted for communication.

It is not just discourse markers that seem derivative, evolutionarily speaking. By and large elements that convey grammatical meaning and those that supply the clause with aspectual modalities, nuances of quantification and reference, and so on invariably derive from something else, and ultimately from nouns and verbs. Heine and Kuteva[34] have illustrated the most common pathways by which such elements arise, as in (30):

(30)



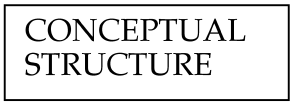
ADP = adposition; ADJ = adjective; ADV = adverb; AGR = agreement; ASP = aspect; COMP = complementizer; DEF = definite marker; DEM = demonstrative; NEG = negation; PASS = passive; PRON = pronoun; REL = relative clause marker; SUBORD = subordination marker; TNS = tense

Heine and Kuteva draw the reasonable conclusion that in the earliest form of human language there were only two types of linguistic entities, one denoting thing-like time-stable entities – nouns in other words – the other denoting actions, activities, and events – verbs in other words. While they themselves do not go on to suggest these facts point to a pre-communicative stage for language, the conclusion seems like a reasonable one.

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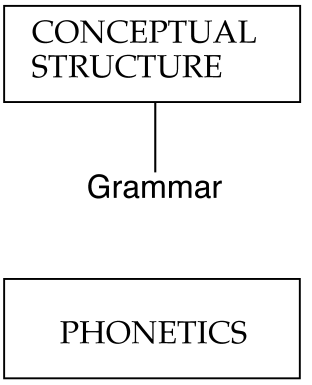
There is another reason to posit that cognition left its mark on language before communication. We have learned that the conceptual abilities of the higher apes are surprisingly sophisticated. Each passing year leads to new discoveries about their capacity for problem solving, social interaction, and so on. However, their communicative abilities are remarkably primitive. There is very little calling on their conceptual structures in communicative settings. These facts, taken together, suggest a three-stage process in language evolution. First, there existed a level of conceptual structure:

(31)



Secondly, the level became linked to the vocal output channel, creating for the first time a grammar that is independent of the combinatorial possibilities of conceptual structure per se and making possible the conveying of thought – in other words, communication, as in (32):

(32)

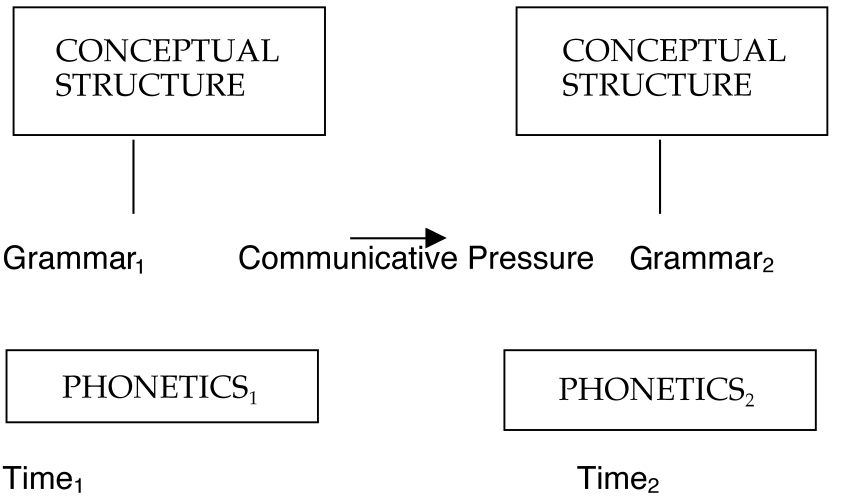


However, once grammars started to be drawn upon for real-time purposes, the constraints of real-time use begin to affect their properties. The development of phonological systems is perhaps the most obvious example. Grammars over time began to be shaped to facilitate processing in various ways. This is most evident in their shaping to allow the more rapid expression of frequently used meaningful elements than of those less frequently used ones. As a result, it is auxiliaries and negative elements that tend to contract in English, rather than full lexical nouns and verbs. Many languages developed affixes for the most commonly used concepts, such as negation, causation, comparison, and so on, but rarely for more complex infrequent concepts. The dozens of different semantic roles expressible became packaged into a small number of grammatical relations such as 'Subject' and 'Direct Object'. Displacements, such as is illustrated in (8), arose to focus or

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to downplay the importance of constituents for the discourse, driven by communicative considerations. (33) represents the historical process I am describing:

(33)



Conclusion

This paper began by raising the question of the relative roles of cognitive and functional factors in the evolution of grammar. The conclusion is that they have both played important roles, although unbalanced ones. Human language was jump-started by the linking of conceptual structures and the vocal output system. In other words, cognitive factors were the first to shape grammars. But with the passage of time, the exigencies of communication came to play an ever-more important role in grammar. Human language today hence reflects the influence of both types of factors.

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6. Other abbreviations used in examples (1) and (2) are the following: SUBJ = subject; IDO = indirect object; DO = direct object; VP = verb phrase; V = verb; NP = noun phrase; PP = prepositional phrase.
7. In Hungarian, the subject is often omitted if its reference is indefinite, as in this example.
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22. In any event, we do not have humpback whales for ancestors.
23. W. A. Martin, K. W. Church and R. S. Patel (1987) Preliminary analysis of the breadth-first parsing algorithm: theoretical and experimental

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results. In L. Bolc (ed), *Natural Language Parsing Systems* (Berlin: Springer Verlag), pp. 267–328.

24. A morpheme is a unit of word formation, that is a subcomponent of a word that (typically) enters into the formation of many words.
25. The abbreviations are as follows: D = determiner (i.e. article); A = adjective; N = noun; V = verb; C = complementizer (i.e. marker of subordination).
26. Ignoring the phonological level, that is. Nobody would claim that sounds are units of either meaning or discourse.
27. R. W. Langacker (1987) Nouns and verbs. *Language*, **63**, 53–94.
28. Some interesting exceptions in English are the morphemes 'cran' and 'ert' in the words *cranberry* and *inert* respectively, and Latin-derived elements such as 'ceive' in *perceive*, *receive*, *deceive*, *conceive*, etc.
29. The material in this section is considerably more controversial than that in the previous ones, given that not all grammarians accept the existence of covert levels of structure.
30. N. Chomsky (1981) *Lectures on Government and Binding* (Dordrecht: Foris).
31. The reader with a background in linguistics will note that the picture presented here represents the earlier Government-Binding instantiation, rather than the later Minimalist Program instantiation, of Principles-and-Parameters syntax. For our purposes in this section, the former is easier to present than the latter and allows the same basic point to be made.
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About the Author

Frederick J. Newmeyer has taught at the University of Washington in Seattle since 1969. He was Secretary-Treasurer of the Linguistic Society of America from 1989 to 1993 and its President in 2002. He specializes in syntax and the history of linguistics and has, as his current research programme, the attempt to synthesize the results of formal and functional linguistics. Newmeyer is the author of several books, including *Linguistic Theory in America*, *Grammatical Theory: Its Limits and its Possibilities*, and *Language Form and Language Function*.

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