Recursion and the Lexicon*

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1. A critique of biolinguistics

Current theorizing about the human language faculty, particularly about recursion, is dominated by the biolinguistics perspective. This perspective has been part of the generative enterprise since its inception and can be summarized as follows: The core of language is individual-psychological and may ultimately be explained in terms of human biology. A classical formulation of this program was Lenneberg (1967) and it was revitalized recently by Jenkins (2000) and particularly by Hauser, Chomsky and Fitch (2002) (henceforth: HCF). According to HCF, recursion (in the form of Merge) is the core of the human language faculty biologically conceived.

   The biological perspective is far from self-evidently correct and, in fact, goes against a long tradition that emphasized the cultural, conventional nature of language. This tradition goes back at least to Aristotle's *De Interpretatione* and became the core idea about language since the late Enlightenment and Romanticism, thanks to the influence of Herder, Von Humboldt and others. Most early 20th-century views were offshoots of the great conceptions formulated around the turn of the 18th century. Thus, Ferdinand de Saussure followed German Romanticism in this respect, as did the great American structuralists Franz Boas and Edward Sapir. Saussure was also influenced by one of the founding fathers of sociology, Émile Durkheim, who argued that certain social facts could not be reduced to individual psychology or biology.[1] Also philosophers like Wittgenstein and Popper followed the European tradition, the former with his emphasis on the public and language game-dependent nature of linguistic rules, the latter by stipulating that language belongs to his (pseudo-technical) conception of supra-individual human culture known as "world 3" (Popper 1972).

   None of these conceptions excludes a biological basis for language, for the trivial reason that *all* human culture and activity has a biological basis. Sapir (1921: 3), for instance, adheres to the cultural view of language: "[…] walking is an inherent, biological function of man" but "[…] speech is a non-instinctive, acquired, "cultural" function" (1921: 4). Clearly, however, this does not exclude biology for Sapir:

> Physiologically, speech is an overlaid function, or to be more precise, a group of overlaid functions. It gets what service it can out of organs and functions, nervous and muscular, that have come into being and are maintained for very different ends than its own.

Biological structures given a new, "overlaid" function, this comes close to what biologists Gould and Vrba (1982) call "exaptation". I will argue, however, that culture involves particular forms of exaptation, namely those based on human agency.

[1] See Durkheim (1982)

In the meantime, nobody really denies the non-biological, cultural aspects of language. In the framework of HCF, the biological core of language is separated from the rest by making an idealizing distinction between the faculty of language in the narrow sense (FLN) and the faculty of language in the broad sense (FLB). It is probably assumed that FLN is purely biological, while culture enters FLB. The essence of FLN, it is assumed, is recursive Merge.

Suppose, counter to what I will ultimately conclude, that recursive Merge is the biological essence of language. Then an immediate further question arises, namely whether recursive Merge is, functionally speaking, unique to language in any sense. Interestingly, in both HCF and Chomsky (2007) it is considered that recursive Merge is, ultimately, not language-specific:

> The conclusion that Merge falls within UG holds whether such recursive generation is unique to FL or is appropriated from other systems. If the latter, there still must be a genetic instruction to use Merge to form structured linguistic expressions satisfying the interface conditions. Nonetheless, it is interesting to ask whether this operation is language-specific. We know that it is not. The classic illustration is "the mathematical capacity," which troubled Alfred Russel Wallace 125 years ago because it "is wholly unexplained by the theory of natural selection, and must be due to some altogether distinct cause," if only because it remained unused. One possibility is that it is derivative from language.

This passage is worth reading twice because it considerably weakens the biolinguistics thesis: neither in its origins nor in its ultimate applications is Merge necessarily language-specific. At best, there is "a genetic instruction" to give Merge a linguistic function and perhaps the linguistic application has a certain genealogical priority over other applications such as in mathematics. The view cited comes close to what was called the Thesis of Radical Autonomy in Koster (1987, 1988, 1989): the computational core of language has no intrinsic linguistic function and its functional dedication to language is based on a purely human invention, namely the invention of words (or rather lexical items, including both words and morphemes). The main difference between Chomsky's view and my own is that Chomsky emphasizes "internal" functional dedication by a (so far undiscovered) "genetic instruction," while I emphasize "external" functional dedication by invented words. Obviously, words do not belong to biology but to human cultural traditions, which presuppose individual psychology and biology but also have an existence external to the individual. It would be somewhat pretentious to assume that the end of my life would be the end of Dutch!

Although Chomsky has usually distanced himself from naïve sociobiology (or evolutionary psychology), I believe that his emphasis on the (unknown) genetic instruction and his ignoring of culturally determined functionality brings his ideas closer to sociobiology than I consider desirable. I cannot do full justice to the topic here, but in general it seems to me that seeing cultural transparency in biological structures leads to views that Gould and Lewontin (1979) characterized as "panglossian", after Dr. Pangloss in Voltaire's *Candide*, who praised the human nose as a structure designed to support glasses.

The panglossian view of language is confirmed by Chomsky's long-standing tendency to see FLN as an organ, like the liver, the heart or the kidneys. This cannot be quite right,

because there is a fundamental difference between how organs acquire their functionality in the body and how recursive Merge (or the capacity underlying it) receives its function in language. The difference is best described in terms of the distinction John Searle (1995: 20) makes between agentive and non-agentive functionality. Cultural functionality involves human decisions and is therefore agentive, for instance when we use a stone as a paper weight. The functionality of the heart and other organs, in contrast, is assigned in a very different way, namely completely independent of human interference. It is essentially a genetically driven, fully automatized biological process.

So, what kind of functionality is involved in the human language faculty? How does recursive Merge get its function? The capacity at issue would remain completely dormant and linguistically functionless without the purely human invention mentioned, i.e., the invention of lexical items. Lexical items belong to a culture and, as such, are external to the individual. More importantly, lexical items are invented artifacts and therefore involve an undeniable element of human agency. Since recursive Merge only has linguistic functionality thanks to this human invention, the capacity in question is not properly characterized as a language organ but, not unlike a paper weight, something that receives its functionality the agentive way. In other words, language, even in the narrowest sense, is more properly characterized as a technology than as some organ-like part of human biology. I just follow Sapir and the tradition in this respect and consider the fully biological interpretation of FLN an error.

What about poverty-of-the-stimulus arguments, one might object. I consider poverty-of-the stimulus arguments completely irrelevant for the issues at hand, because poverty-of-the-stimulus arguments are about innateness, not about the nature of functional dedication. Clearly, the fact that we learn so much in such a short time, on the basis of so little evidence ("Plato's problem") shows that something is innate (cf. Chomsky 1986). That much of the Chomskyan view stands unchallenged, as far as I am concerned. However, the arguments in question show at best that the capacity for recursive Merge is innate, not whether this capacity is functionally dedicated to language in the manner of organs or by applying it thanks to human invention.

Innateness considerations only apply to the components of language as such, not to what makes these components part of language, namely their culturally mediated combination into a linguistically functional whole. As emphasized by Saussure, the essence of language is the bridge function between publicly accessible and supported signs and the corresponding elements of our conceptual-intentional world, between external *signifiants* and internal *signifiés* (Saussure 1916). None of the components of language is in its own right, in abstraction from the relevant functional combination, linguistic in any sense. Thus, many innateness issues have been discussed in relation to the sounds of speech (for instance, as in Mehler *et al*. 1988) or even similar elements of sign language (Petitto 2005). It is very well possible, and even likely, that rapid and smooth access to such elements evolved to facilitate its use in language. But note that there is nothing inherently linguistic about speech sound. Speech is not even a necessary condition for language, as in many cases the public aspect of language is not represented by speech sounds (or signs) but by written words or print. What is necessary for language is an external, publicly accessible medium. Speech happens to be such a medium, but not a necessary one.

The word that comes to mind in connection with speech is "facilitation". Obviously, speech is facilitated in ways that writing is not. Similarly, it is very well possible (and even likely) that rapid and smooth access to the recursive mechanisms underlying grammar were also facilitated by evolution. But once more, this is irrelevant for the question whether language is a biological phenomenon or a form of technology. Riding a bike or playing the piano is a cultural function, based on technologies, but largely exploiting genetically determined aspects of our biology. The same is, trivially, true about language, the only difference being that the components of language are probably more facilitated by evolution than the physical en biological elements underlying biking and piano playing.

A related issue is whether language should be seen as E-language or I-language, as something external or internal to the human mind (see Chomsky 1986). It seems to me that this is a false dichotomy, as language, even in the narrowest sense, has both external, public aspects en internal aspects.[2] The idea of a narrow language faculty (FLN, recursive Merge) as I-language does not make sense because there is nothing about recursive Merge *per se* that makes it linguistic. It is only in combination with external, invented cultural objects -lexical elements- that our capacities for recursion have any linguistic relevance at all. In some sense, then, words are closer to the essence of language than syntax, which is a matter independent of the fact that syntactic theories are often more profound that theories about words.

More generally, FCH seem to discuss language as if they were discussing fish without taking into account that fish swim in water. One crucial difference between humans and apes is that we live in symbiosis with an *external*, supra-individual and shared symbolic culture. Mentally speaking, humans can only be understood as symbionts with a shared culture.[3] This culture is a record, among other things, of earlier successful agentive assignments of functionality, language among them. This external culture is, no doubt, possible thanks to internal developments of our brains in comparison to other primates, but it has led to an entirely different organism that is not properly understood within the confinements of primate biology.

Summarizing so far, we can say that culturally invented, not biologically given, words are the primary carriers of linguistic functionality. Words are not individual properties of organisms but belong to a shared culture, which has an existence external to the individual. Linguistics is the study of the unique technology embodied by our words, including the internal factors that make possible the complex properties of our most important cultural objects. Recursion is a case in point.

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[2] See also Muysken (2002)

[3] For the idea of humans as symbionts, see Donald (1991). For related reasons, I am skeptical about the notion mind/brain. The brain is an individual biological part of humans, while for the mind, being a symbiotic structure, no sharp distinction can be made between the individual and the supra-individual.

2. A critique of Merge

This year, it is 50 years ago that Chomsky's *Syntactic Structures* appeared and started having its revolutionary impact on linguistics, making the field the intellectual adventure it has been until the present day. In retrospect, however, it must be said that the view expounded on syntax in this seminal little book was based on an error, ironically precisely where it deviated from a linguistic tradition of more than 2000 years. According to Egli and Egli-Gerber (1992), it is one of the oldest insights of linguistics (at least since the Stoics) that syntax realizes the combinatorial properties of *words*. Since the 19th century, German linguists and others studied combinatorial properties of words under the label "Rektion" (cf. "government") and the various 20th-century structuralists were often discussing matters in terms of the "valency" of words.[4] *Syntactic Structures* deviated from this tradition by introducing a form of syntax that was no longer word-oriented, but largely independent of words. This new approach was borrowed from the theory of formal systems, in which complex expressions are generated with the terminals ("words") as elements of an alphabet, without internal properties.[5] I consider this approach to the syntax of natural language fundamentally flawed.

At the time, *Aspects of the Theory of Syntax* (Chomsky 1965) was often seen as the next step forward, but in retrospect it can be said that it was a correction of the mistaken view of *Syntactic Structures* and the first step of a gradual return to more traditional insights, particularly the view that the lexicon plays a crucial role in natural language syntax. *Aspects* added a lexicon to generative grammar, with selection restrictions and subcategorization frames. Subcategorization frames are nothing other than more or less explicit versions of the combinatorial properties of words, which were seen as the core of syntax since Antiquity ("valency", etc.). The addition of a lexicon with said properties clearly revealed what was wrong with a grammar based on lexicon-independent rules: the same information was stated twice in the grammar, once in the subcategorzation frame (1a) and once in the possible outputs of phrase structure rules (as in 1b):

(1)   a.   *see*: [+V, --NP]
        b.   [$_{VP}$ [$_V$ *see*] NP]

In other words, a redundancy problem was introduced in grammar, as was clearly realized by Chomsky right away and formulated not too long ago as follows (1981, 31):

> Thus information concerning the class of subcategorization frames is in effect given twice in the grammar: once -implicitly- in the lexicon, as a property of the class of lexical items in its totality; and once -this time directly- by the rules of the categorical component.

In Chomsky (1970), X-bar theory was introduced as a response to the redundancy problem (and also as a response to the well-known endocentricity problem, which I will ignore here).

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[4] See, for instance, Tesnière (1959).

[5] See Tomalin (2002).

However, X-bar theory was nothing really new but one of the structuralist formulations of valency properties (in this case going back to Harris 1951), in line with the tradition since Antiquity to see grammar as a theory about the combinatorial properties of words.

Thanks to Emonds's idea of structure-preservingness (1970), the revolutionary nature of generative grammar came even more under fire: if the outputs of transformations have exactly the same form as the outputs of phrase structure rules, why would one need transformations in the first place? If the kind of structure generated by PS-rules is all there is, everything could be reduced to X-bar theory (a theory of lexical properties) and therefore to a form of grammar completely compatible with the tradition. In the 1970s, many syntacticians came to that kind of conclusion in one way or another, leading to more or less transformation-free variants of generative grammar (Brame 1978, Bresnan 2001, HPSG, Koster 1978, 1987). Mainstream generative grammar, however, insisted on the transformational residue "move alpha", which eventually disappeared but lives on in current minimalist theories as "internal Merge". I have argued elsewhere why I do not find this ongoing derivational tradition convincing (see, for instance, Koster 2007). Although I do not see X-bar theory as formulated in the 1970s and 1980s as the last word, I find the leading idea basically correct, namely that syntactic structures are projected from lexical items. Given a word, its possible syntactic environments are predictable, which can be seen as a reflection of the tacit knowledge of the native speaker of a language.

Lexicon-independent theories of sentence generation inevitably lead to the redundancy problem, indicating that something is wrong. Within the minimalist framework, lexicon-independent sentence generation made a come-back in the form of the operation Merge. Merge differs from phrase structure rules but partially runs into the same problems: it combines lexical elements that are not dummies but that, even before Merge has applied, have full-fledged combinatorial properties that fully specify the hierarchical configurations that are redundantly generated once more by Merge.

Even if Merge interacts with independent information at the interfaces, the fact remains that this interface information is partially the same as what is introduced by Merge, so that the redundancy problem fails to disappear. In fact, theories based on Merge can hardly be evaluated because it is almost never made explicit what happened to combinatorial lexical information.[6] It can certainly not be reduced to semantics, because it is generally agreed upon that c-selection cannot be reduced to s-selection (see, for instance, Odijk 1997).

Although these considerations strongly argue against Merge as a sentence-generation device, it is still possible that Merge is a more abstract background mechanism, accounting for certain properties that all projectable lexical frames have in common. In this view, recursive Merge would be a non-linguistic, functionless capacity, which is assigned a function by its application in the combinatorial frames of words. This approach would be conceptually less problematic than the standard approach, but it runs into the empirical problem that the creation of hierarchical structure and the combination of the properties of elements does not

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[6] A positive exception is Adger (2003), but his treatment of subcategorization of verbs as the elimination of N-features (for objects) leaves the impression that bare phrase structure plus this kind of feature elimination is a notational variant of X-bar theory.

run exactly parallel in natural language. Traditional phrase structure rules created hierarchical structures but left the combination of properties to other mechanisms, such as the amalgamation rules of Katz and Fodor (1963) and construal rules of Chomsky (1981). To the extent that Merge combines these two functions, it runs into new empirical problems, for instance with idioms, which often have normal hierarchical structure but not the standard combination of properties as found in normal compositionality. Therefore, although I am sympathetic to the idea that recursion is part of an unapplied, non-linguistic background capacity, I believe that Merge does not quite fit the bill. The theory we are looking for separates the account of hierarchical structure (primary computation) from the varying ways of combining properties that exploit this hierarchical structure (secondary computation).

3. Concluding remarks

So far, I have distanced myself from current biolinguistics, from notions such as I-language and from the idea that sentences are directly generated by Merge. The conclusion of the first section was that language, no matter how narrowly construed, has an inalienable *external* element. There is not the slightest reason to call our capacity for Merge or any other biological capacity "linguistic". The essence of language is not in our biology but in the technology we have developed to *apply* our biology, possibly including our capacity for recursion. The technology in question mediates between our inner, conceptual-intentional world and the external, public world we share with others. The core of our linguistic technology has been the invention of words. Particularly with respect to their spoken form, the invention of words is probably facilitated by our genetic endowment, but this does not seem to be the case at all for written words, which are equally valid, and often even the most frequently used interface elements. It is even possible that the "instinct" to connect inner forms with outer signs is based on a genetic instruction, but this should be a matter not of stipulation but of discovery.

Since words and lexicons are cultural objects, their properties, including recursion, are properties of our culture as well. Even if our capacity for recursion is innate, its application to cultural objects was the result of invention, and therefore a matter of agentive functionality. Agentive assignment of functionality can be a conscious process but does not need to be. More generally, linguistics (narrow or not) cannot be reduced to biology, whereas biology itself cannot be reduced to physics. The reason, in both cases, is that there is no intrinsic connection between form and function. That an existing physical form can be given a function is a matter of good luck and of what happens to work in an infinite and unpredictable set of ever changing contexts. The non-agentive function assignments are what Jacob (1982) called a matter of "tinkering", which he sees as the most typical aspect of biological evolution. Due to its accidental nature, successful tinkering cannot be preserved as a matter of physical law and therefore required something new and unknown before the emergence of life: a memory in the form of DNA.

Humans are constrained but not determined by their biology. Thanks to our capacity of agentive function assignment -also- in ever changing contexts, we are able to give an infinite

and unpredictable number of applications to our innate biological structures. We have a strong creative impulse in this respect and it liberates us from our biology to some extent, even in spectacular ways sometimes. Just as successful non-agentive functionality is preserved via DNA, successful agentive function assignment is preserved in another innovative memory structure, our cultural record. Words and their properties are the most important elements of our non-individual cultural memory, giving infinite potential to otherwise meaningless structures of our brain.

Bibliography

Adger, David (2003). *Core Syntax: A Minimalist Approach*. Oxford: Oxford University Press.

Brame, Michael (1978*). Base Generated Syntax*. Seattle: Noit Amrofer.

Bresnan, Joan (2001). *Lexical-Functional Syntax*. Malden, Mass.: Blackwell.

Chomsky, Noam (1957). *Syntactic Structures*. The Hague: Mouton.

Chomsky, Noam (1965). *Aspects of the Theory of Syntax*. Cambridge, Mass.: MIT Press.

Chomsky, Noam (1970). Remarks on Nominalization. In R Jacobs & P Rosenbaum, (eds.), *Readings in English Transformational Grammar*. Waltham, Mass.: Ginn and Company: 184-221.

Chomsky, Noam (1981). *Lectures on Government and Binding*. Dordrecht: Foris.

Chomsky, Noam (1986). *Knowledge of Language*. New York: Praeger.

Chomsky, Noam (2007). Approaching UG from Below. In Uli Sauerland and Hans-Martin Gärtner, (eds.), *Interfaces + Recursion = Language?* Berlin: Mouton de Gruyter: 1-29.

Donald, Merlin (1991). *Origins of The Modern Mind*. Cambridge, Mass.: Harvard University Press.

Durkheim, Émile (1982). What is a Social Fact? In Émile Durkheim, *The Rules of the Sociological Method.* Edited by Steven Lukes; translated from the French original (1895) by W.D. Halls. New York: Free Press: 50-59.

Egli, Urs & Renata Egli-Gerber (1992). Sprachsysteme: logische und historische Grundlagen der erweiterten Phrasenstrukturgrammatik. Konstanz: Fachgruppe Sprachwissenschaft Universität Konstanz. *Arbeitspapier* 28.

Emonds, Jospeh (1970). Root and Structure Preserving Transformations. PhD Dissertation. Cambridge, Mass : MIT.

Gould, Stephen Jay and Richard Lewontin (1979). The Spandrels of San Marco and the Panglossion Paradigm: a Critique of the Adaptationist Programme. *Proceedings of the Royal Society of London*. B 205 (1161): 581–598.

Gould, Stephen Jay and Elisabeth Vrba (1982). Exaptation A Missing Term in the Science of Form. *Paleobiology* 8: 4-15.

Harris, Zellig (1951). *Methods in Structural Linguistics*. Chicago: University of Chicago Press.

Hauser, Marc D., Noam Chomsky, & Tecumseh W. Fitch (2002). The Faculty of Language: What Is It, Who Has It, and How Did It Evolve? *Science* 298: 1569-1579.

Jacob, François (1982). *The Possible and the Actual*. New York: Pantheon Books.

Jenkins, Lyle (2000). *Biolinguistics*. Cambridge., Mass.: MIT Press.

Katz, Jerrold J. en Jerry. A. Fodor (1963). The Structure of a Semantic Theory. *Language* 39: 170-210.

Koster, Jan (1978). *Locality Principles in Syntax*. Dordrecht: Foris.

Koster, Jan (1987). *Domains and Dynasties: The Radical Autonomy of Syntax*. Dordrecht: Foris.

Koster, Jan (1988). *Doelloze Structuren*. Inaugural Lecture University of Groningen. Dordrecht: Foris.

Koster, Jan (1989). How Natural is Natural Language? In J.E. Fenstad *et al*., (eds.), *Logic, Methodology, and Philosophy of Science VIII*. Amsterdam: Elsevier: 591-606.

Koster, Jan (2007). Structure-Preservingness, Internal Merge, and the Strict Locality of Triads. In Simin Karimi, Vida Samiian, & Wendy K. Wilkins, (eds.), *Phrasal and Clausal Architecture: Syntactic Derivation and Interpretation*. Amsterdam/Philadelphia: John Benjamins: 188-205.

Lenneberg, Eric (1967). *Biological Foundations of Language*. New York: John Wiley & Sons, Inc.

Mehler, Jacques, P. Jusczyk, G. Lambertz, N. Halsted, J. Bertoncini, & C. Amiel-Tison (1988). A Precursor of Language Acquisition in Young Infants. *Cognition* 29: 143-178.

Muysken, Pieter (2002). *Waar is de Taalwetenschap?* Inaugural Lecture. Nijmegen: Radboud University.

Odijk, Jan (1997). C-selection and S-selection. *Linguistic Inquiry* 28: 365-372.

Petitto, Laura-Ann (2005). How the Brain Begets Language: On the Neural Tissue underlying Human Language Acquisition. In James McGilvray, (ed.), *The Cambridge Companion to Chomsky*. Cambridge: Cambridge University Press: 84-101.

Popper, Karl R. (1972). Epistemology Without a Knowing Subject. In Karl R. Popper, *Objective Knowledge: An Evolutionary Approach*. Oxford: Oxford University Press: 106-152.

Sapir, Edward (1921). *Language: An Introduction to the Study of Speech*. New York: Harcourt, Brace & World.

Saussure, Ferdinand de (1916). *Cours de linguistique générale*. C. Bally & A. Sechehaye, (eds.). Lausanne and Paris: Payot.

Searle, John R. (1995). *The Construction of Social Reality*. London, etc.: Penguin Books.

Tesnière, Lucien (1959). *Élements de syntaxe structurale*. Paris: Editions Klincksieck.

Tomalin, Marcus (2002).The Formal Origins of Syntactic Theory. *Lingua* 112: 827–848.

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