Ceaseless, unpredictable creativity*

Language as Technology

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1. Introduction

In this article, I will present a skeptical view of biolinguistics and linguistic internalism as currently conceived and advocate a return to the traditional idea that language is primarily a cultural phenomenon, even if firmly rooted in our biology. During the first half of the 20th century, according to the most common theories of language of those days, it was essentially a system of signs or symbols and sometimes also of rules. Such objects were seen as external to the individual human mind and as belonging to our socio-cultural reality. Language, in this view, is a set of invented tools that enables us to give public expression to our inner feelings and thoughts. The classical expression of these ideas is Ferdinand de Saussure's conception of systems of signs in which signs have an external aspect (*signifiant*) and a conceptual aspect (*signifié*). Crucially, such signs could not be reduced to individual psychology, which was in accordance with Émile Durkheim's insight that methodological individualism would not do for certain social and cultural facts (Durkheim 1982 [1885]).[1] Related ideas are Ernst Cassirer's view of language as a system of symbolic forms, the insistence of Ludwig Wittgenstein on the public nature of rules and Karl Popper's claim that language is part of his supra-individual World 3.[2] The near consensus of those days, then, could be characterized, in current terminology, as "externalist".

Most of the time, adherents of this externalist view in no way denied the internal aspects of language or its being rooted in human biology. In fact, it is a truism that cultural objects are external to individual minds but are only what they are thanks to the *combination* of external object and mind-internal interpretation. As Rose *et al.* (1984, 282) put it: "The biological and the social are neither separable, nor antithetical, nor alternatives, but complementary."

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* The title of this article was inspired by Kauffman (2007).

Another aspect of the externalist consensus was the idea, going back to Herder, Von Humboldt and other early Romantics, that language plays a dominant role in determining the common culture of those who speak the language. Saussure's famous dictum that "*le signe linguistique est arbitraire*" not only has the uninteresting meaning that the same concept is expressed by English *tree* and French *arbre* but also the much more interesting implication that different languages differ in the way they divide our -possibly innate- conceptual "space." Thus, English has separate words for "blue" and "green," while other languages have only one word here. In other words, linguistic signs are conventional in two ways: in the arbitrary selection of their sound form (or visually-based equivalent) and in the way they organize our conceptual reality. Everyone who has ever translated a text is aware of this fact, even upon minimal reflection. The problems involved increase with cultural distance between languages.

The fact that language is thoroughly conventional (and often diverse), firmly places it in human culture, no matter on which individual-psychological and biological foundations it might also rest. Language, then, was seen as crucially involving external tools and as something cultural. In the United States, the cultural view of language, traceable to the same German-Romantic roots, was advocated by Franz Boas and his school. Of Boas's many well-known students, Edward Sapir was by far the most prominent linguist.[3]

For many linguists these days, the Boas school is ignored because of its alleged tendency towards cultural relativism, particularly as found in the more extreme interpretations of the Sapir-Whorf hypothesis. Somehow, the cultural view of language is often seen as at variance with the idea of linguistic universals, which is seen as better served by a non-cultural, biologically-based view of language. However, there is no contradiction between a culturally-based view of language and the idea of universals. The issue of universalism vs. relativism is independent of the question whether language is primarily a cultural or a biological phenomenon. Cultural conventionalism can be based on an "anything goes" philosophy, like behaviorism, or on the idea that cultural conventions are chosen from a narrowly constrained "biological" hypothesis space. The latter view is equivalent to the "universal toolkit" view discussed by Fitch *et al.* (2005, 203-204). The example they give is vowel systems: by convention, different languages have different vowel systems, but individual systems are selections from a limited, universal set of possibilities. Clearly, cultural conventions are constrained by our biology. To what degree is an empirical issue and a matter of debate. Also within the Boas school itself, a number of different views were expressed over time (see Degler 1991).

An interesting version of the cultural view is the one that was formulated by Sapir (1921: 3): "[…] 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.

Although "speech" is not the most suitable aspect of language to illustrate things further, it seems to me that Sapir's view is basically correct: nothing biological is intrinsically linguistic. This goes against the currently popular forms of "biolinguistics", according to which the faculty of language can be construed in a narrow enough sense so that it falls entirely within biology. What I have in mind is the faculty of language in the narrow sense (FLN) as described by Hauser, Chomsky and Fitch (2002).[4]

Not only Sapir, but also his European colleague Otto Jespersen saw language primarily as a cultural phenomenon. Jespersen is an interesting example because he has been mentioned by Chomsky as a precursor of the "internalist" view of language that is so intimately connected with current biolinguistics (see, for instance, Chomsky 1986, 32). According to Jespersen, languages are man-made, cultural phenomena and artificial rather than natural in most respects. Jespersen took constructed international auxiliary languages, like Esperanto, very seriously and considered them on a par with natural languages. He even went so far as inventing such a language himself. In the presentation of his language Novial, he makes the following comments (Jespersen 1928):

> People who hear about constructed languages will often say that such a language must be as lifeless as a dead herring, and that we may just as well think of setting up an homunculus made in a chemical retort and claiming for it the qualities of a living human being. Languages are not organisms, and their "life" is not to be compared with that of animals or plants. Forty years ago Schuchardt was able to make short work of this objection by showing how much in the so-called natural languages was really artificial, that is, due to conscious endeavours and conscious selection, and yet was just as capable of "living" as anything else.

What the examples of Sapir and Jespersen show is that it is possible to have a primarily cultural view of language without denying its biological or mind-internal foundations. In the cultural view, language is not the product of a language organ comparable to the heart but is the fruit of human agency. Accordingly, I would like to argue in this article that "biolinguistics" as currently conceived is a problematic notion and that language is better characterized as *applied* biology, i.e., as a technology to create cultural products that serve as a bridge between our inner life and an external, shared symbolic world. Language, no matter how narrowly construed, only deserves that name if it has *both* internal-individual and

external, supra-individual aspects. Eventually, I will conclude that not only the narrow, biological reconstruction of the notion "language" is untenable, but also the strong "internalist" paradigm on which it is based. I will further conclude that only the lexicalist conception of generative grammar (as developed roughly during the period 1970-1990) is compatible with what I see as the correct, cultural conception of language. Recent minimalist deviations from lexicalism are a step in the wrong direction and reminiscent of the flawed pre-lexicalist forms of generative grammar popular in the period 1955-1970.

2. Language: external or internal?

It has been a prominent aspect of the forms of generative grammar emerging in the 1950s that the traditional word-based grammar and externalist paradigm was replaced by a syntax-based, internalist paradigm. According to Chomsky (1986, 19), the Saussurian views of language relegated syntax to "parole", where it was often left in limbo. It is true that Saussurian linguistics, although it was at the origin of phonology, contributed little to syntax. But from this fact, it does not immediately follow that the relative stagnation was due to a word-based view instead of a syntax-based view. At least since the Stoics, syntax has been seen as the realization of the properties of words.[5] So, nothing in a word-centered view of language precludes development of a syntactic component. It can even be argued, as I will do later on, that the kind of syntax introduced by *Syntactic Structures* (Chomsky 1957) was mistaken precisely insofar as it deviated from the word-centered tradition. In this view, as I will argue later on in this article, *Aspects* (Chomsky 1965) was not the next revolutionary step forward but a partial return to the Stoic tradition of word-centered syntax. This would culminate in the lexicalist version of generative grammar that reigned between 1970 and the early 1990s.

Together with the technical elaborations of generative grammar, a general view of language was developed known as "internalism" (see, for instance, Chomsky 2000), as opposed to the traditional views that see language primarily in terms of collections of mind-external cultural objects. It must be emphasized from the outset that this traditional externalism should not be confused with standard meaning externalism as proposed by philosophers like Putnam (1975) or Burge (1997). What I am concerned with is the traditional insight that the mental is not limited to the brain. In no way am I commited to Putnam/Burge-style externalism or any other form of semantics that seeks to develop mental content in (partial) referential terms. Implicit in what follows is that what I call "externalism" is an extension of what in said philosophical tradition is called "internalism" and "narrow mental content" (See Clark and Chalmers 1998 for discussion).

The more traditional linguistic views are said (by Chomsky) to be concerned with "E-language," while Chomsky's own concerns are with the internalist reconstruction of the concept of language referred to as "I-language." Since language, construed in a sufficiently narrow sense, is seen as a property of the human mind, a further point of interest is Chomsky's idea that such properties of the mind are in fact properties of the brain described at a certain level of abstraction. This is supposed to be not unlike 19th-century talk about "chemical valence," which was eventually leading to theories about the underlying physical mechanisms. This partial equation of mind and brain about language, expressed by the neologism mind/brain, is characteristic for the current internalist paradigm. Since theories about I-language are ultimately about the brain -a biological object- at least part of linguistics can be seen in this view as a form of theoretical biology. Hence the program referred to as biolinguistics.

Let us be somewhat more explicit about I-language. Chomsky (1986, 21) refers to Jespersen, who claimed that there is "some notion of structure" in the mind of the speaker.[6] According to Chomsky, I-language is a distinct system of the mind/brain that grows in the individual from an initial state S_0 to a stable state S_s. This growth, comparable to the growth of an organ, only involves minimal external factors, such as those that help set the parameters that distinguish the grammars of different languages. In order to counter the obvious objection that language also involves external elements, Chomsky makes a distinction between the "faculty of language in the narrow sense" (FLN) and the "faculty of language in the broad sense" (FLB). The notion of I-language particularly applies to FLN, which has recursion as its core property (Hauser *et al.*, 2002).

I believe this idealization to FLN is problematic and that, therefore, the objection to I-language still stands. More generally, I believe that no coherent notion of I-language is possible and that the partial equation of mind and brain is highly problematic. Just to avoid misunderstanding, I am not at all denying the existence of brain-internal computational structures used in language or even their innate character. Poverty-of-the-stimulus arguments sufficiently show that language involves innate structures of some kind. Given the varied pace and fashions with which our various skills and forms of knowledge are acquired, these innate structures are not general, as the behaviorists liked to see it, but specific to various degrees. As a matter of fact, these observations are rather trivial, since *all* our mental capacities are based on innate structure. My argument is not against innateness but against the idea that biological structures are transparent with respect to their cultural functions, including their role in language.

In the next section, I will argue that the point can be generalized to all form-function relations, at all levels of biology: since there is no intrinsic form-function relationship, successful

correlations can only be maintained by some kind of memory. For biological structures like our organs, form-function relations are mainly, but not exclusively, preserved by DNA. For cultural phenomena like language, form-function correlations are mostly maintained by our cultural record. A cultural record is not a property of any individual in particular but can be seen as a shared, external memory.

At this point, it is absolutely crucial for my argument to appreciate that words are man-made, public cultural objects and that nothing biological is properly called "linguistic" in abstraction from words. Since the hypothesized initial state S_0 of I-language is wordless, it has nothing to do with language, no matter how innate it is and no matter whether it will be exclusively used later on for language or not. As Otto Jespersen, quoted at the beginning of this article, recognized, human languages are called "natural" but are in fact artificial. They can be created by communities over long periods of time, like English and Dutch, or they can be designed by one or more people in a relatively short time, like Esperanto, Volapük or Novial.

Reading Hauser *et al.* (2002), one gets the impression of an argument about humans that sounds like the equivalent of a discourse about fish without ever mentioning the fact that they swim in water. Humans are different from animals in that they live in a world not just of culture (like apes to some very minimal extent) but of *symbolic* culture. This symbolic culture functions as a supra-individual, external memory. As Merlin Donald (1991) put it, humans live in *symbiosis* with this shared, external memory. The shared, external memory is not only man-made but also preserves the functions that we -as agents- have assigned to certain structures of our brain. I agree with Donald (2000) that cognitive science is bound to remain sterile if it continues the solipsistic assumption of "the myth of the isolated mind" and by being in denial about the symbiotic nature of human cognition.[7]

There is perhaps even reason for fundamental skepticism in general when talking about external vs. internal with respect to the human mind. It is far from clear how these terms should be interpreted. Like most intelligent systems, the human mind relies on structures for processing or interpretation on the one hand and on data structures stored in memory on the other hand. If we disregard the mind-external processing done by our computers, we can say that processing is done "internally," in individual brains, but data structures in memories are not private in the same sense. This is the core of the problem because nobody limits the notion "mind" to processing and interpretation. *Both* processing and stored data structures are necessary conditions for us to coherently speak about "mind." But, as Clark and Chalmers (1998, 7) put it: "Where does the mind stop and the rest of the world begin." Thus, if you want the text of the Dutch national anthem, you can ask me or look it up on the internet. I predict more successful retrieval via the internet, but that can change from one moment to the next. Our cultural memory is stored in, and distributed over brains, including my own, and

over libraries and other collections of media. The same is true for words and other linguistic expressions. It would be absurd to say that I remain within the confinements of I-language when I produce or understand a sentence exclusively with words from my own memory, but that I embark on a short excursion to E-language if I use a dictionary for one word or another in the middle of a sentence.

More generally, one can say of course that if words or the text of the Dutch national anthem are stored in my brain they are "internal" and when they are found in a dictionary or stored on some hard disk of a web server they are "external," but such a distinction would be insignificant. The more interesting distinction is between private processing and interpretation, leading to conscious understanding among other things, and the data structures interchangeably distributed over individual brains and other media. If we like to insist on the terms "internal" and "external," it would make sense perhaps to call individual processing and interpretation "internal" and memory content, including content stored in my own brain, "external." But the distinction thus construed completely undermines the partial equation of "mind" and "brain." My brain is contained within my skull, but luckily my mind does not stop at the bony borders of the brain's confinement. Unlike what makes sense for the brain, the distinction between "within the skull" and "outside the skull" is completely meaningless for the mind. The boundaries between my onboard memory content and the content found in other brains and media are fluid and ever changing. Since the mind is not limited the same way the brain is, it is questionable whether talk about the mind is talk about the brain at some level of abstraction. I therefore reject the notion mind/brain.[8]

If my reconstruction of the notions "internal" and "external" is correct, the distinction between I-language and E-language also loses its significance. Under any meaningful definition, a language minimally contains words. Words are man-made cultural objects (no matter how many biological constraints there are on possible words) and they do not belong to any particular individual but are external in the sense that they are stored in media, in the memory parts of brains, in dictionaries and other books, etc. In that sense, words are E-elements that belong to a speech community. If I die, the Dutch language will in all likelihood survive.

Of course, a language can only exist thanks to individual capacities for processing and interpretation, but that is true for all cultural phenomena. A painting by Rembrandt is only a painting for humans, not for cats and dogs, and it involves innate and unconscious forms of processing, like the ability to interpret two-dimensional images as representations of things three-dimensional. But that should not lead us into making a distinction between E-paintings and I-paintings or paintings in the broad sense and paintings in the narrow sense. All cultural objects exploit our abstract cognitive capacities, but at the neurobiological level, in

abstraction of our common culture, these capacities do not assign labels like "painting" or "linguistic expression." There certainly are biological aspects to what makes painting or language possible, but both painting and language only exist if another necessary condition is fulfilled, namely the presence of a man-made, external and supra-individual cultural environment.

It is crucial for my argument that words are supra-individual, external elements of our shared cultural record. If words would have a strictly individual, internal counterpart, the internalist view of language could perhaps be saved in some weak sense. Although there have been attempts to see words as labels for a fixed and universal repertoire of concepts or feature complexes, such attempts are ill-advised.[9] As we have seen in our brief discussion of Saussure, words do not form a nomenclature for fixed concepts but divide up conceptual reality in many different ways, no doubt following biological constraints but ultimately with conventions that differ from language to language. Thus, not only in their sound form but also in their modes of significance most words thoroughly involve conventions. Conventions do not belong to our biology, but, once more, to our external, shared cultural record. I will return to meaning externalism (again, to be distinguished from Putnam/Burge-style externalism) in section 4.

3. Form, function and reductionism

Other than what is found in physics and chemistry, biology and human culture are characterized by rich patterns of form-function correlations. In considering form-function patterns, it is important to realize that there is no such a thing as an intrinsic function of a physical structure. Functionality is a relational concept: a functional structure is always functional with respect to something *external* to that structure. The emergence of form-function relationships in nature is an opportunistic process, as it is heavily constrained but not determined by physical law. In the terminology of Jacob (1982), it is a form of "tinkering." As was realized by Darwin, evolution assigns functions not only to available material without previous function, but also to structures that were originally adapted to some other function. In the latter case, biologists used to speak about "pre-adaptation," now more commonly referred to as "exaptation" (after Gould and Vrba 1982). A famous example are the wings of birds, currently adapted to flight but originally evolved as flaps for thermoregulation.

Evolutionary adaptation creates the false, Panglossian illusion that structures are functionally transparent. The many exaptations in the history of life dramatically illustrate that there is never an intrinsic relation between form and function. Even if structures are magnificently

adapted to function A, the very same structures can be used for function B under an appropriate change of external conditions. Consider a clear and spectacular example of adaptation: the various teeth forms found in mammals. Carnivores often have huge canines compared to the modest counterparts of herbivores. A biologist can tell from the shape of teeth in which kind of environment an animal lives. This falsely suggests intrinsic functional transparency. There only is transparency in relation to certain external environments and the biologist knows those environments, hence the illusion of transparency. For a physicist from Mars, with no knowledge about habitats and life styles, the various dental shapes of mammals would be a complete mystery.

From the vantage point of physics, then, the relation between form and function follows physical constraints, but is otherwise as arbitrary as the relation between *signifiant* and *signifié* in linguistics. The set of functions that can be fulfilled by a given structure is potentially as infinite as the set of possible environments and Kauffman (2007, 911) rightly observes "that the biosphere and human culture are ceaselessly creative in ways that are fundamentally unpredictable and presumably non-algorithmic or machinelike." Since the relation between form and function cannot be predicted by physical law, biology is essentially historic, in spite of the fact that it is narrowly constrained by the laws of physics. In practice, this means that successful form-function relations can only be preserved thanks to memories. There are various kinds of memory in the living world (see Jablonka and Lamb 2005), but for the biosphere as a whole, DNA is by far the most important memory type. There is a direct link between the emergence of memory molecules and the non-deterministic, "historical" nature of form-function relationships in living organisms.

As the set of possible functions of physical structures cannot be predicted by physical law, the idea that biology can be reduced to physics or chemistry is an illusion. This insight goes back to Aristotle and in the long tradition of opposition against his concept of a *causa finalis* next to other forms of causation, it has been stated numerous times that description of biological functions can be translated into normal physical talk about cause and effect.[10] Kauffman (2007, 911) convincingly articulates the view that this misses the point:

> Asked what the function of the heart is, Darwin would have replied, "To pump blood." That is, the causal consequence of the heart, by virtue of which it was selected by natural selection, is pumping blood. But the heart also makes heart sounds. These are not the function of the heart. Thus, the function of the heart is a subset of its causal consequences and must be analyzed in the context of the whole organism in its selective environment. Again, this says that biology cannot be reduced to physics, for while the string theorist might (actually could not) deduce all the properties of a given heart, he/she would have no way to pick out as the relevant property that of pumping blood. But it is that property that accounts for the existence of hearts in the biosphere.

The "ceaseless, unpredictable creativity" of the biosphere, with its fruits preserved via DNA, is a very slow process, with non-agentive natural selection as the driving force. In spite of millennia of primitivist propaganda against the obvious, the emergence of the human mind in the biosphere is an event in magnitude comparable to the emergence of life itself. It involved the introduction in the biosphere of agentive creation of form-function relations and a new type of memory to preserve the fruits of its creativity. This memory, of course, is the shared, supra-individual symbolic memory implied by our culture, as discussed in section 1. Animals certainly show forms of agentive function assignment, such as when chimpanzees use stones to crack nuts. However, to the extent this leads to traditions, these traditions are passed on by imitative behavior, not by symbolic means (cf. Jablonka and Lamb 2002, ch. 5). Humans are unique in that their agentive function assignments take place in relation to a shared symbol-based memory.

The distinction between agentive and nonagentive functionality has been extensively discussed by Searle (1995, 20). It is directly relevant for an understanding of cultural creativity as intended in this article. Cultural functionality involves human decisions and is therefore agentive, for instance when we use a stone as a paperweight. This illustrates once more the fact that functionality can be assigned to arbitrary objects that meet certain physical constraints (a boulder would not have the right size and 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. Interestingly, one and the same organ can be functional in an agentive and in a nonagentive way. The lungs, for instance, function nonagentively in respiration and agentively when we are making music on wind instruments. In normal usage, respiration is seen as part of our biology, while the playing of trumpets or clarinets is seen as part of our culture.

Is the use of our capacity for recursion, as manifest in language, more like the lungs in respiration or like the lungs in the creation of wind music? Since words are man-made instruments, the use of our capacity for recursion in language sides with lung function in wind

music: in both cases, unlike what we see in respiration, a biological structure is made functional the agentive way, i.e., by human invention. Referring to the capacity for recursion as "the faculty of language in the narrow sense" is just as odd as to refer to lung capacity as "the faculty of trumpet playing in the narrow sense." Such usage would be Panglossian, erroneously suggesting that physical structures can have an intrinsic cultural function. As the example of the lungs shows, innateness of structure is not the issue here: the same genetically determined biological structure is used in a nonagentive way (respiration) in one case and in an agentive way (trumpet playing) in another case.

This is, of course, not to say that language is acquired in the same way as how we acquire musical skills. All our cultural activities utilize human inventions to exploit our innate capacities and all differ among each other in the degree to which genetic factors are involved. Thus, riding a bike and driving a car both use invented mechanisms to give new functions to some of our biological capacities. Nevertheless, riding bikes is already done by kids, often without much instruction. Driver's education, in contrast, is most fruitfully started later in life, often with long trajectories of instruction and with varying degrees of success. Given our biological capacities, some cultural activities are more accessible and attainable than others.

Language might be on one extreme of this spectrum, things like theoretical physics on the other extreme. Given the enormous advantage of language, it is even likely that its invention has stimulated a form of co-evolution of culture and brain structure, making the use of language the most readily accessible of all cultural activities.[11] But this possibly extreme genetic facilitation in no way alters the basic logic of the situation: the structures involved in language thank their functionality to a human invention, unlike the functionality of organs like the kidneys or the heart.

As to their variety, the properties of agentive function assignment are very much like what we find in organic evolution. Thus, we can agentively give a function to a functionless object, as when we use a stone as a paperweight. Human culture is also full of (the agentive equivalent of) exaptations, namely when we give a new function to an existing functional object. Human tinkering is full of exaptations, for instance, when we use beer cans as car wheels for model cars or wooden shoes as sailing dinghies. The creative fruits of agentive function assignment are just as unpredictable and potentially infinite as the possible exaptations in nonagentive evolution. There is no law-like, deterministic relationship between our biologically given properties and the environments we can invent to make our potential functional. Therefore, just as biology cannot be reduced to physics, human culture cannot be reduced to biology (or physics). In both cases, function assignment is arbitrary as seen from "below". It always is the higher level (in the order culture > biology > physics) that determines the functionality of structures at a lower level.

4. Agentive functionality and word meaning

A less lofty term for "agentive functionality" is the notion "application" we use in daily life, particularly in technological contexts. The logic of application might seem trivial, it is a key factor in human creativity. In order to understand the role of "application" in word semantics, it is useful to highlight some features of applications in general. As an example, consider electric motors. Electric motors are themselves applications of physical principles producing something as abstract as an automated rotating movement. Such rotating movements are like mathematical structures in that they are not intrinsically functional. Therefore, human technology has developed numerous secondary applications, in which electric motors are made functional "from outside," by inventing new contexts for use. These applications range from coffee grinders to electrical toothbrushes to the engines of locomotives. Like in all cases of agentive function assignment, the possible relations between an electrical motor and its applications are:

(1) a. infinite
b. unpredictable
c. contextual
d. constrained
e. partially conventional, partially innovative

The infinity and unpredictability of applications (1a-b) follow from their contextuality (1c). Essentially, novel applications involve new functional contexts. Thus, in order to use an electric motor for a coffee grinder, there must be a context in which coffee exists together with invented techniques to brew it, etc. It is clear that all future contexts and technologies cannot be predicted. Furthermore, there are numerous physical constraints on the application of devices in real life situations (1d). Electric motors , for instance, cannot be used under water without protective insulation. Size is a very important factor in agentive function assignment to technical devices. Earlier on, I gave the example that boulders are not suitable as paperweights. For comparable reasons, windmills are excellent power sources for water pumps, but less so for toothbrushes. Last but not least, applications can be innovative or conventional (1e). Successful applications become part of the cultural record, so that not each generation has to reinvent the wheel. The properties of agentive function assignment as listed in (1) are the key to understanding the semantic functioning of words. But first I will make a few critical remarks about the naming paradigm, which has been the curse of lexical semantics.

Although both Saussure and Wittgenstein have taught us that words do not form a nomenclature for things in the world or in the mind, the naming paradigm seems almost insurmountable in common sense thinking about language. It is implicit in "Fregean", referential approaches to semantics ("externalism" in the other, philosopical tradition) and from Descartes and Locke to Katz and Fodor (1963), it has been thought that words stand for "ideas", "concepts" or "meanings". These ideas are situated either in some abstract realm (Platonism) or in the mind/brain (Rationalism and Empiricism).

According to the approach in question, what the French word *arbre* and the English word *tree* have in common is that they name the same concept, namely TREE. Sometimes the concepts named are not specified as words in capital letters but as feature complexes. All such approaches beg the question because everything that is mysterious and in need of clarification about the word *tree* is mysterious and in need of clarification about TREE and in exactly the same way. Capital letters and feature notations only disguise the fact that words are explicated this way in terms of other words. Such verbal explications do not give meanings but hints about how to use words. Paraphrases are only useful if the periphrastic elements are already known to those for whom the paraphrase is intended to clarify things. Thus, if we explicate "pork" as MEAT FROM PIGS, something is clarified only for those who already know what pigs are. Personally, I learned the word "pork" before I learned the word "pig", namely by direct acquaintance with a kind of meat with a kind of color and taste (see Koster 1990). Paraphrases do not specify THE meaning of a word but are one way, among many, to learn something (but by no means all) about the usage of a word.

The strongest refutation of the naming paradigm comes from the traditional notion of polysemy.[12] Consider the varied use of an ordinary noun like *book*:

(2) a. The book weighs a pound
b. The book is exciting
c. The book fits on a 256Mb memory stick
d. The book only exists in her head
e. The book is his main income

In all these cases, the word *book* corresponds with a different concept, leading to corresponding variation in possible reference. This suggests that what corresponds to word like *book* is not one concept BOOK, but an infinite set of concepts, depending on context. In (2a), for instance, *book* is used to refer to a physical object, while in (2e) it refers to generated revenue. Even proper names, which might be considered the "flagships" of the naming paradigm, behave in this fashion:

(3) a. Schubert is difficult
b. Schubert will take 30 pages
c. Schubert is for sale
d. Schubert will be reburied next year
e. Schubert can be downloaded everywhere
f. Schubert will be burned on request

Suppose these sentences are about Schubert the composer. Even then it is impossible to say without further context whether (3a) is about playing his music or about his character. And in (3e) and (3f), *Schubert* refers to what it can refer to only thanks to the context provided by recent inventions. These sentences (and what "Schubert" refers to) are perfectly intelligible in 2009, but would have been a riddle only 10 years ago. In short, as has often been observed, names cannot only refer to persons but, in the right context, also to anything related to those persons. This comes down to an infinite set of concepts and an infinite set of potential referents. Like exaptations in evolution and the technological applications of hardware, the interpretation of words is a case of "ceaseless, unpredictable creativity." [13]

Word interpretation has the properties listed in (1), which suggests that we are talking about forms of agentive functionality: limiting ourselves here to common nouns and proper names, what is stored in association with such words in our brain is not meanings or concepts but something that only becomes meaningful from outside, i.e., by the agency of a human interpreter operating in a given context. *Concepts (and extensions) are not properties of words but properties of interpretations of words*. But if what the various uses of words like *book* or *Schubert* have in common cannot be a concept or a meaning, what else could it be? What can be stored in the brain in association with words must be physical, i.e., something representable by neural circuitry or other material properties making up the memory banks of the brain. In short, words must be associated with coded information in the brain, not with meaning, because all known physical structures are without inherent meaning.

It is the hallmark of coded information that it only is "something" in relation to an interpreting, external environment. DNA, for instance, only is what it is thanks to its functioning in the chemical environment provided by living cells. The information stored on CDs is not inherently audio or video, but only in combination with the right electronic output devices. Something similar is true, I suppose, for the coded information associated with words in the brain. Following this line of thought, we can furthermore assume that what the various uses of *book* or *Schubert* have in common is not some kind of core meaning, but coded information about *books* and *Schubert*, respectively. In that sense, words are addresses of information clusters of unknown but presumably considerable size. It is impossible and

unnecessary that these information clusters are the same for each person. Some people have stored enough information to distinguish an elm from a beech, others have not, as was pointed out by Putnam (1975). A certain "linguistic division of labor" is an obvious fact of life and successful communication is possible because our information banks overlap to various degrees.

Note, incidentally, that as before, data structures are not individual-psychological or internal in any strict sense. The information associated with the words of a language is distributed over all the speakers of a language plus what we find in books and in other media. When we produce or understand sentences we can use our "onboard" data banks, but we do not step out of language when we let ourselves occasionally be assisted by a dictionary. The informational basis of meaning is essentially external in this sense. What is mostly internal is our capacity for processing and interpretation.

The information associated with words must include coded instructions for what must be seen as standard applications. The meaningful use of words is not permanently innovative but largely conventional, where, as mentioned above, different languages do not apply exactly the same conventions. As inter-personal agreements, conventions are not individual-psychological or biological, but part of the culture of a community. This is another reason why an exclusively internalist approach to meaning does not work. There is no meaning without a living individual's capacities for processing and interpretation, but there is no meaning either without supra-individually distributed information and conventions. That the use of words is partially conventional corresponds with property (1e) of what we see for agentive function assignment in general. As in the case of electric motors, partial conventionality by no means refutes the potential open-endedness of application. The distinction was appropriately described by the great 19th-century linguist Hermann Paul (1880 [1975, 103]), who was speaking of the "usual" and "occasional" application of words.

It is unlikely that the information involved in the interpretation of words is completely specified for each word individually. If we look at coded information and its decoding devices in technological contexts, it is always the case that the decoding devices add information of their own. The speed of music, for instance, is not coded on records or CDs but depends on the speed of the rotating parts of the decoding devices, such as turntables or the corresponding parts of CD players. In the case of the information stored for words, we do not know how much information is stored for the word itself and how much information is added by the interpretive mechanisms. But the high plausibility of the division of labor in question further undermines the idea that meanings or concepts are directly found in the brain as stored properties of words. Concepts only exist as the results of agentive function assignment, as

created elements involving three factors: the information stored for the word itself, the contributions made by our (possibly innate) capacities of processing and interpretation, and, last but not least, the context of use.

An example of what might be a general aspect of the meaning of words dependent on interpretive capacities is what I would like to call "the Platonic residue" of words. No matter what one thinks of Platonic universals in general, a minimal notion of universals seems unavoidable, namely the types of the type-token distinction made since Charles Sanders Peirce. It is just a fact that we think in terms of types, not tokens. Thus, when we find a concrete book (the token) somewhere we see it as an instantiation of the general notion of a "book" (the type). What is fascinating is that the type-token distinction applies to all cases where we use words for things, even things just invented, like iPods. Each individual iPod is seen as an instance (token) of the general notion "iPod" (type). Given its generality, it is unlikely that the type-token distinction is part of the stored informational make-up of each individual word. That would mean that even essential parts of the meaning of certain words (like being a type) are not represented as individual properties of those words. As a matter of fact, universals (minimally: types) are completely beyond the scope of naturalistic inquiry, as the physical world is populated by particulars (tokens) and not by universals (types) (see Koster 2005a).

Another general addition of the process that interprets coded word information is awareness, which eventually will contribute to subjectively experienced understanding. Presumably, the traditional idea of naming-based word meaning has been so irresistible over the centuries because meaning is what we seem to be aware of when we think of words via introspection. In other words, introspection creates the "optical" illusion that meanings are properties of words rather than of interpretations of words. When we think of words, the associated "dead" information is brought to life by the interpretive process. It implicitly adds the usual ingredients of interpretation, such as virtual contexts, the Platonic residue and other general elements, thereby obscuring the fact that what is actually stored for individual words is coded information. This coded information is not directly accessible at all. Interpreting it by introspection is a form of use, it adds interpretive information as in other forms of use and it creates the actual meaning in the process.

Word meaning, then, at least for the common nouns and proper names we discussed, is another example of "ceaseless, unpredictable creativity" and as such entirely comparable to what we see in the applications of technical devices like electric motors. This is the case because in both domains the creativity is based on agentive function assignment and has the properties listed in (1). The fruits of successful agentive function assignment are usually

stored in our cultural memory, in this case accounting for the conventional aspects of word interpretations. As in the case of technological applications, this will not prevent us occasionally from applying the information associated with words in innovative ways in new contexts. That the word *Schubert* can, in recent times, refer to something that can be downloaded depends on novel contexts that were completely unpredictable in the composer's days.

The way we create concepts, by interpreting the coded information associated with words, is as far as I can tell unique for humans and at least as revolutionary and essential for language as the use of recursive syntax. As we saw earlier on, chimpanzees and other animals know certain forms of agentive function assignment which are mainly preserved as "cultural traditions" by imitative behavior. What is unknown in the worlds of animals is the agentive function assignment to the information complexes associated with words and other signs. As taught to us by Saussure, the life of signs goes way beyond the individual, is conventional in many essential respects and therefore irreducibly social-cultural. As before, this social-cultural view does not exclude the biologically-based interpretive capacities of the individual, but simply says that these capacities only lead to meaning by the *combination* of internal mechanisms and external data structures. Neither meaning nor mind would exist without supra-individual, shareable information structures.

The conventional aspect of words lies not only in the arbitrary choice a culture makes of outer forms (*tree* vs. *arbre*, etc.). As was mentioned before, it also shows up in the way words help us to conceptualize reality. Thus, it is partially a matter of convention how languages divide the color spectrum. According to Saussure, a sign always gets its value in relation to how it contrasts with other signs of the same system. It is therefore misleading to say that apes have a primitive form of the concept of "ownership" (as suggested by Fitch *et al*., 2005; see Koster 2005b for a critique). Showing more or less consistent possessive behavior with respect to objects across a variety of contexts is something very different from having a primitive form of the human concept of "ownership." What is shown in the animal behavior is about some necessary conditions at best. As discussed, human concepts are the result of an interpretive process which involves agentive function assignment to information complexes. These information complexes are distributed over a culture and the creative interpretive processes associated with a word like *ownership* may lead to an, in principle, infinite variety of concepts (polysemy). Application of the word information to forms of possessiveness is a possible choice governed by implicit conventions. These conventions constitute a semantic field, among other things, in which *ownership* is contrasted with other words that also apply to possessive behavior, such as *borrowing*, *leasing* and *renting*, etc. There is zero evidence

among chimpanzees for either the endless polysemy of interpretation or for the necessary conventionality involved in semantic fields.

Another essential aspect of human word meanings so far not attested among animals is what I called "the Platonic residue," i.e., the fact that the human mind takes "ownership" as a universal (a type), of which observed possessiveness can be a token. All in all, it seems to me that it is entirely misleading to say that animals (particularly chimpanzees) have anything coming even close to human concepts. Whatever biological capacities enabled humans to invent and interpret words and preserve them in their cultural, supra-individual memory is truly revolutionary. Invented words and the associated astonishing capacity for conceptual creativity in forming bridges between our inner life and the external realm shared by a community is the basis of language. I therefore strongly disagree with the idea that human language is primarily based on our capacity for recursion. The essence of linguistic functionality is the giving of an outer form to our inner ("conceptual-intentional") life. Signs have this capacity independently of syntax, as is shown for instance by traffic signs. Recursive syntax, in contrast, has no linguistic functionality whatsoever independent of linguistic signs (morphemes, words). Recursive syntax is no doubt an extremely powerful addition to what we do with words, but we should remember that it only makes complex signs of simpler signs. Language construed in the narrowest way possible is about words (or morphemes) and their creative use. Recursive syntax gives a tremendous boost to this creativity, but clearly is a secondary broadening of the primary role played by words given in our culture.

5. A revisionist sketch of the recent history of linguistics

My conclusion so far is that linguistics is only indirectly about biology and that it primarily is the study of simple cultural objects (morphemes and words) and complex cultural objects (sentences). These great human inventions *apply* our biological capacities, meaning that language is a technology, with functionality closer to how the lungs function, say, in cultural activities like trumpet playing rather than in purely biological contexts as in respiration. Linguistics seen this way entails a partial return to a Saussurian, sign-based view in lieu of a syntax-based view, without denying the enormous importance of our capacity for recursion. The latter is no doubt biologically based and in that sense the Chomskyan view was a much needed correction in the direction of a more balanced view. However, generative grammar of the last 50 years disturbed the balance in the opposite direction, developing large-scale denial about the essentially cultural nature of language. Recent conceptions of "biolinguistics," together with a minimalist practice more and more degenerating into the latest descriptive

technology, make it necessary in my view to rethink the foundations of linguistics and to try to achieve a synthesis between the traditional Saussurian ideas and the more recent Chomskyan perspective.

From this vantage point, unfortunately, the history of generative linguistics is not a continuing story of success after success. In fact, we cannot entirely avoid criticizing the inflated, sometimes somewhat self-congratulatory rhetorical style of our field. Once upon a time, *Aspects* (Chomsky 1965) was hailed by some as "the New Testament," which was supposed to supersede "the Old Testament" of *Syntactic Structures* (Chomsky 1957) . This allegedly led to the innovative lexicalism of *Remarks on Nominalizations* (1970), which was the beginning of the second great revolution in linguistics, the principles and parameters framework of *Lectures on Government and Binding* (1981), which was sometimes said to be the first "construction-free" theory in the more than 2000-year history of the field.[14] With equal revolutionary pathos and enthusiasm, many adopt Minimalism since the late 1980s, dismissing X-bar theory and fruitful notions like government and binding almost without discussion.

I reject this narrow view of what happened and think we can still learn much from the more than 2000-year history of the field. Before going into that, I would first like to emphasize that linguistics is a much livelier and richer field than 50 years ago. The changes since the 1950s led to more or less uniform terminology, representational techniques and methodology involving many more languages and linguists than before and from all over the world. In terms of descriptive richness and partial insights, the field has truly exploded in recent times. The connection to theories about human nature added much to the appeal of modern linguistics, and the victory over behaviorism was definitive, not only in the US but also in Europe, where behaviorists were a rare species to begin with. In spite of all these positive developments, however, I believe that conceptual-theoretical progress has been minimal in the last few decades. Why is this the case?

Seen from my (partial) Saussurian vantage point, the history of linguistics of the last 50 years is not a continuing revolutionary success story, but a story of the rise and fall of the appreciation of what I see as the correct perspective, namely lexicalism. The synthesis of Saussurean and Chomskyan ideas that I advocate is only compatible with the lexicalist versions that dominated generative grammar roughly between 1970 and 1990. This means that I reject both the non-lexicalist (or less lexicalist) versions of early generative grammar (c. 1955-1965) and the partial return to those in minimalist practice (after 1990). But even of the lexicalist period, I reject the almost exclusive internalist emphasis and the non-lexicalist

residue of earlier theories, namely "move alpha" (not to speak about the even more dubious covert movement supposedly leading to Logical Form).[15]

In retrospect, then, *Syntactic Structures* was not in all respects a revolutionary improvement over what was historically seen as syntax, but an ill-advised denial of what was grammatical wisdom since the Stoics, namely that syntactic structures are properties of words. The problem was caused by adopting models for natural languages that were derived from studying the artificial languages of logic and mathematics. Looking back, the use of mathematics and of elements from recursive function theory was more successful from a propagandistic point of view than from an empirical and theoretical point of view. It invested linguistics with the false prestige and illusion that it was a very sophisticated discipline, a beacon for the humanities in its transition to mathematically based science. As every linguist must be aware of in 2009, sophisticated mathematics does not play any role whatsoever in syntactic theorizing.

In *Syntactic Structures*, grammars are introduced that replace the terminal symbols of context-free artificial languages with words from English. This kind of move is based on superficial similarities between natural languages and the artificial languages in question and it did not lead to much new insight. The reason is that the words of natural language are signs with rich internal properties, while the terminal symbols of the artificial languages had no intrinsic properties whatsoever. At best, one could say that their combinatorial properties were implicitly defined by the phrase-structure rules in which they figured.

The most important characteristic of words of real human languages is that their potential syntactic environments are among their properties in abstraction from any rules or other word-independent computational devices. Thus, somebody who knows English knows that the word *book* can be preceded by an article: *the book*. This is public knowledge: one can find it in reference grammars and if English were part of a culture with an oral tradition only, every native speaker could confirm it. Similarly, every native speaker of English knows that the verb *like* can have a subject and an object: *John likes Mary*. In fact, then, the basic structure of a sentence can be seen as a property of the verb. That a verb "projects" arguments is such an obvious fact that it has been known since Antiquity: it was known to the Stoics, to the medieval modists and to the structuralists, who called it "valency."[16] *Syntactic Structures* must be unique in a grammatical tradition of over 2000 years in that it introduces syntactic structure mostly in abstraction of the projecting properties of words. It was a fundamental error, directly traceable to the idea that natural language grammars must be modeled after certain formal languages.

Fortunately, the error was corrected in *Aspects* by the introduction of a lexicon. This lexicon contained subcategorization frames to account for the valency of verbs, among other things. In all honesty, it must be said that, in this respect, *Aspects* was not the next revolutionary step forward but the return to a traditional insight. In other words, the development from *Syntactic Structures* to *Aspects* is, apart from some new ideas and improved explicitness, more accurately characterized as a return to the tradition than as something revolutionary. It was soon understood that when syntactic structures are projected from lexical items, separate rules to generate syntactic structure are redundant. Hence, the return in *Remarks on Nominalization* (Chomsky 1970) to X-bar theory, a concept derived from Harris (1951).

By that time, the redundancy problem was well understood. Chomsky (1981, 31) formulated it as follows:

> 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.

What had been achieved by that time was greater explicitness than in the tradition, based on better and more uniformly applied representational techniques (trees, labeled bracketings, etc.). Naturally, that led to new empirical discoveries, like the pervasive locality of syntactic relations (island phenomena, etc.). Conceptually, however, generative grammar since the 1970s had become a more or less explicit version of the traditional word-based conception of grammar, rather remote from the idea that *Syntactic Structure* had introduced something revolutionary by applying the formal methods of recursive function theory to natural language. Indirectly, this is confirmed by the fact that mathematical linguistics gradually disappeared into the background.[17]

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 phrase structure 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 public knowledge about a language.

What used to be called trace theory (since Chomsky 1973) was another aspect of structure-preservingness. Whereas Emonds's theory had the ultimate consequence that a core class of transformations does not create new structures other than the lexical template structures given by X-bar theory, trace theory had the consequence that no information of earlier levels was lost. This was the beginning of the end of the idea of levels of representation (like D-structure, S-structure and Logical Form). Level theory was still fiercely defended by Chomsky (1981), but rejected in my own work (Koster 1978, 1987). In Chomsky's more recent work, level theory is rejected as well and even presented as one of the fruits of Minimalism. However, the disappearance of level theory was a consequence of appreciating structure-preservingness.

In contrast to how it was often perceived, then, transformational grammar was conceptually dead by the 1970s. Lexical-independent phrase structure rules had been replaced by lexical template theory (X-bar theory), which was a return to the pre-generative tradition. Thanks to structure-preservingness, major transformations (particularly the core "families" of NP- and Wh-movements) were superfluous. Nevertheless, it was never sufficiently appreciated that, thanks to structure-preservingness, for every structure generated with "move alpha" the very same structures could be generated without "move alpha." It is odd, therefore, that theories that eliminate redundant concepts as crucial to earlier theories as "movement" and multiple levels of representation were often seen as notational variants of theories that maintained these superfluous elaborations.

It should be noted that structure-preservingness led to theories that, in fact, eliminated structure-preservingness itself. In theories like those in Koster (1978, 1987) traces are no longer residues of movement but incompletely lexicalized templates, to be completed by the syntactic environment of the unlexicalized element. For this, no new mechanisms had to be stipulated (which would have led to notational variants of movement-based theories). On the contrary, completion in filler-gap constructions ("movements") could be seen as an instance of a very general property of template structures, namely that their nodes can share their properties with sister nodes and mother nodes. This can be done in a strictly variable-free (= local) way, eliminating the need for "constraints on variables" in the sense of Ross (1967) . Island conditions could be redefined as upper bounds on the vertical spread of a feature (see Koster 2003 and 2007 for details).

Thanks to the idea that basic syntactic structure is nothing other than the (sometimes partial) realization of the template structure associated with lexical items, full historical continuity with the more than 2000-year old tradition of the field could be restored. This does not mean that no progress was made since pre-generative times. I already mentioned the increased explicitness of representation and the use of more or less uniform techniques and methods world-wide. Perhaps the greatest achievement of generative grammar, up until the present day, is the mass of insights developed about "displacement" (the phenomenon originally described as "movement"). The recognition of the more ubiquitous presence of empty elements of partially lexicalized templates (formerly: trace, pro, PRO, etc.) has led to enormously increased understanding of the abstractness of syntactic structure, with classical discoveries as the establishment of the local nature of all secondary computation (i.e., computation based on the primary structures provided by X-bar theory). Furthermore, traditional X-bar structures were expanded with numerous functional projections (based on C, D, Infl, Agr, etc.) that had the same general structure as lexical projections.

But all these fruitful developments should not obscure the fact that modern abstract syntax is nothing other than an elaboration of the traditional idea that syntactic structures are realizations of the properties of words. Almost everything that made appear generative grammar revolutionary in the 1950s and 1960s has turned out to be wrong. I am thinking about the application of formal methods derived from recursive-function theory, phrase structure rules, transformations (including the residue "move alpha"), levels of representation, etc.

Minimalism (not as a program but in practice) is another non-revolution and a partial return to the failed pre-lexicalist theories of the 1950s and 1960s. Lexicon-independent theories of sentence generation inevitably lead to the redundancy problem, indicating that something is wrong. Unfortunately, this insight, that was so clearly formulated by Chomsky (1981, 31), was forgotten by the time the minimalist framework was developed. In most minimalist theories, lexicon-independent sentence generation has made an unexpected 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 while ignoring the fact that they are not dummies. Lexical items, even before Merge has applied, already have full-fledged combinatorial properties that fully specify the hierarchical configurations that are redundantly generated once more by Merge. This redundancy includes the property of recursion. In agreement with the tradition, X-bar theory correctly accounted for the fact that, for instance, verbs can have complements that contain verbs (clauses). When in some minimalist numeration a verb is impatiently waiting to be merged, it already has recursion among its projectable properties, *before* the operation Merge applies. Merge is just as redundant as

phrase structure rules because it mimics parts of the lexical properties of the verb, particularly its property that it can be combined into a hierarchical structure with recursion.

In spite of this obvious problem, it is widely believed that X-bar theory is superseded by Merge and its generation of bare phrase structure. However, it seems to me that this belief is based on confusion between our (possibly innate) background capacity for recursion and the application of this capacity to words. Merge could be a correct description of the former, while X-bar theory could be a correct characterization of the application. In fact, I believe the redundancy problem is inherent to this confusion between unapplied background capacity and actual application. Assuming that the capacity for combining things recursively has a biological basis, this capacity only has something to do with language in that it has been used to give complex properties to certain cultural objects, namely our invented words. Thanks to our biologically-based capacities, we are able to assign to our little inventions not only information about the extra-linguistic world but also information about how to combine words with other words. Associated with each word is a template structure that is tentatively described by X-bar theory. Sentences are generated by partially lexicalizing the template structure of some word (perhaps beginning with the verb in most cases). Since the templates allow for recursion, there is no upper bound to the potential syntactic environments of words.

Only if sentences are generated by lexicalizing the templates associated with words, we can avoid the redundancy problem. There is no evidence that sentences must be generated by an operation Merge that treats the morphemes in some numeration as dummies, without accessing their internal properties before the end of some phase at which "the interfaces" are reached. Each word is a complete interface element connecting three kinds of information: public form (for instance sound form), information for conceptual-intentional interpretations and information about possible syntactic environments.

Originally, bare phrase structure was used as an argument against Kane's derivation of his LCA (Kane 1994; see Chomsky 1995, ch. 4). Whether the critique of Kayne's derivation was justified or not, bare phrase structure (via Merge) seems to have thrown away the baby with the bath water. With truly minimalistic zeal, bar levels, labels and indices were dismissed. However, bar levels, as in the three-bar level representation [$_{N''}$ [$_{N'}$ [$_{N}$ book]]], are not empirically vacuous, as the bar levels more or less correctly indicate that the word *book* has the potential to be expanded two levels "up": it can be followed by a PP and preceded, at the next level up, by an article:

(4) [$_{N''}$ the [$_{N'}$ [$_{N}$ book] about linguistics]]

Whether this representation is correct or not, it certainly has empirical content, as it seeks to account for the (potential) combinatorial properties of the word *book*. If bar levels are given up, the question arises which alternative way there is to account for the "ranked" combinatorial properties of the noun. Reference to "the interfaces" will not do, as those are only reached post-Merge, while the word has the properties in question pre-Merge. Similar considerations can be held against the ban on labels and indices: these are elements of a meta-theory accounting for real properties of the world. All representational devices are fine in science, as long as they have empirical content. Thus, the indices in (5), interpreted in the linguist's practice, correctly account for the fact that *John* is coreferential with *himself*:

(5) John_i saw himself_i

Indices are empirically motivated notational devices that account for a real fact *about* sentence (5). It is not very fruitful to criticize notational devices independently of the empirical content they stand for. It would be like devising critique against theories of optics in physics for their non-minimalist practice of representing rays of light by arrows.

In many cases, minimalist theories show a regrettable lack of explicitness, so that they are often hard to evaluate. It is not clear, for instance, how the conceptual-intentional interface deals with the massive misgeneration resulting from the mismatch between s-selection (properly seen as conceptual intentional) and purely syntactic c-selection (see Chomsky 1986 for the terminology and, for instance, Odijk 1997 for discussion). The same can be said for things like subcategorization. In the rare cases that the minimalist counterpart of subcategorization is made explicit (Adger 2003, 86), a verb like *kiss* is given the following c-selection property:

(6) *kiss* [V, *u*N]

According to Adger, this means that *kiss* is a verb V with an uninterpretable feature *u*N. Whenever *kiss* undergoes Merge, the derivation will eventually "crash" unless *kiss* has the good luck to be merged with an N, which would "check" the offending feature and eliminate it. Apart from the ever more exotic terminology of crashing and checking, I see no progress here over the way subcategorization was accounted for in the style of Chomsky (1965):

(7) *kiss* [+V, --NP]

What is disturbing about this reformulation is that the basic idea of X-bar structure implicitly remains intact (VP structure as a property of the V), but that it is falsely pretended that we have an alternative to X-bar theory. In fact, Adger deserves credit for having made this

explicit, because very often reference to Merge is some kind of lip service rather than part of an explicit account of sentence structure. More often than not, *how* exactly Merge cooperates with the interfaces to specify real structures is left in the dark. There is nothing against Minimalism as a program, but its practice often shows lower standards of explicitness than what the field was used to in earlier periods.

But there is a deeper reason why sentence generation by Merge will not work, at least not along "internalist" lines. The point is that possible syntactic environments are conventional ("c-selection") and therefore part of our external, cultural memory. In other words, they are not "biological" in any sense (particularly not as following from some innate conceptual-intentional system). Suppose that our conceptual system (innate or not) is such that we know that a verb corresponds to something selecting two arguments. Then nothing biological determines whether these arguments are expressed as DPs, PPs, CPs or even silent categories (as in pro-drop languages and languages relying more on discourse completion, like Chinese). The way arguments are expressed is, even when possible choices are "biologically" constrained, ultimately conventional, and therefore determined by our culture.

The idea that language is a cultural phenomenon, partially based on biology but ultimately a technology (i.e., *applied* biology), is confirmed by the fact that a similar capacity is applied in other cultural creations, such as arithmetic and computer programs. Recursion in computer programs can only be created by us thanks to our biologically given capacity to deal with recursion. But nobody will conclude from that that we need a new scientific discipline called "biocomputing" that concerns itself with recursion as the core of our faculty of computer programming "in the narrow sense." The difference with language is not a matter of principle, but possibly the fact that the application in language is genetically facilitated in ways computer programming is not. But genetic facilitation is something different from genetically-based function assignment. The former still leaves room for human agency, while the latter does not involve human interference at all. As we discussed before, no matter how much language is facilitated by evolution, its ultimate functionality depends on the human creations -words- preserved in our culture. The functionality of the heart as a pump does not crucially depend on the fruits of human agency this way.

Interestingly, both Hauser *et al*. (2002) and Chomsky (2007) suggest ways of looking at things not too remote from what I am advocating myself. In Chomsky (2007, 7) we read the following:

> 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. However, as we just discussed, there is no evidence at all that Merge is directly used "to form structured linguistic expressions", so that it does not make sense either to say that there is "a genetic instruction" to do so. At best, there has been some kind of culture-brain co-evolution, so that there are genetic factors that facilitate to some degree the process of investing certain cultural objects -words- with the complex properties they happen to have.

6. Conclusion: against "fatalism light"

Let me now summarize some of the main points of this article and conclude with the deeper reasons why I am skeptical about biolinguistics. To begin with, there is a trivial interpretation of the biolinguistics thesis that is no doubt true, particularly the idea that human language is possible thanks to a genetically based capacity to deal with recursion. The reason that this is true is trivial because *all* human capacities are genetically based. Something in our genetic make-up makes us dramatically different from apes and must allow us to create recursive grammars. However, what the biolinguistics thesis seems to be about is the non-trivial idea that there is a language faculty (in some narrow sense) comparable to organs like the kidneys and the heart. This non-trivial thesis, it seems to me, is false and denies the role of human agency and culture in the creation of language, no matter how narrowly construed.

No physical structure is intrinsically functional, including the physical structures that allow us to deal with recursion. Physical structures are only functional in some context and thanks to some historical process. In biological evolution, structures become functional thanks to long historical processes involving natural selection. There never is an intrinsic and deterministic relation between form and function, even after long optimization through adaptation, as shown by the numerous and unpredictable exaptations. Since functional dedication of structure is a historical, non-deterministic process, successful cases can only be preserved by

some kind of memory. During most of evolution, the memory was provided by big molecules, like DNA.

Whatever other types of memory there are, humans distinguish themselves by a symbiotic relationship with a shared, external and symbolic memory in which the fruits of successful agentive function assignment are preserved. Our culture conceived this way is a man-made environment providing numerous new contexts to give a function to our biological capacities. These biological capacities themselves are culture-neutral, that is, they only have something to do with our culture when seen "from above," from the vantage point of our man-made environment. The example of dyslexia may illustrate this. According to current insights, dyslexia is caused by a brain disorder. But at a purely neurobiological level, in abstraction of our cultural context, there is nothing in the brain that has anything to do with reading. Writing and reading are very recent inventions (of, say, 6000 years ago) and the neurobiological condition causing dyslexia must have occurred long before reading was invented.

This is the pattern we see throughout the worlds of biology and culture: no structure is intrinsically functional (or dysfunctional) in isolation but only with respect to some environment. Language is like dyslexia in that it only is functionally related to certain brain structures in relation to a context of our own making and external to the brain. This makes linguistic functioning different from organic functioning, or to put it differently: there is no language faculty at a purely biological level. Like all our culture-based activities, language is *applied* biology and therefore a form of technology.

There are also reasons to resist biolinguistics -in the non-trivial sense- on more general grounds. Conceptually, it is related to sociobiology, certain forms of evolutionary psychology and, ultimately, to social Darwinism. Most biolinguists, if there is such a species, are not ultra-Darwinists and are considerable more skeptical about the application of sociobiological ideas to humans than, say, Edward O. Wilson or Steven Pinker.[18] Nevertheless, biolinguistics seems to share with those frameworks the downplaying of human agentive creativity and the role of culture in preserving the fruits of that creativity. Humans are fundamentally different from animals in the (cultural) ways they depend on their biology and can overcome biological constraints. We are certainly constrained by our biology but we do not live a life dictated by our genes.

As this fact cannot be missed, it is sometimes recognized by Wilson and Pinker, but they replace the rejected biological determinism and fatalism by some form of "fatalism light." This means that we have the liberty to deviate from the dictate of our biologically given nature, but only at a certain cost. Pinker (2002, 237ff.) even goes so far as to suggest that

resisting what Thomas Sowell calls "the Tragic Vision" (of social conservatives from Edmund Burke to Milton Friedman) is possible but will be an uphill battle.[19] I am not denying that, due to our biological nature, social reform involves uphill battles sometimes, but there is no way to make reliable general statements about that, as Pinker wants to have it. The idea that our genes make conservatism less costly than the progressive advancement of social justice should be approached with the utmost suspicion.

Somehow, an elementary Panglossian error is lurking behind Pinker's assumptions (as has been observed for practically all sociobiology and evolutionary psychology), namely the idea that if our biological nature is the result of adaptations to certain environments, those environments are optimal to our nature in some absolute sense. More concretely, evolutionary psychologists like to say that progressives fight uphill battles in modern times due to the fact that our nature was an adaptation to the contingencies of hunter-gatherer societies over long periods of time. This idea has close to zero credibility for all kinds of reasons, but the most important point is that even if our nature was optimized by natural selection for hunter-gatherer societies, that would say absolutely nothing about how our nature would fare in other types of societies.[20]

As shown by the numerous exaptations in nature, certain structures can be optimized by natural selection for one function and be used later on in other contexts with equal or even more success. Stuart Kauffman, quoted above, rightly observed that future exaptations are a mattter of "ceaseless, unpredictable creativity." For any available structure, the most optimal context of application might still be something of a world to come. This is even true for the famous Swiss army knife used as a metaphor by evolutionary psychologists to illustrate the modularity of the mind. A Swiss army knife is not one general tool (like an ordinary knife) but has various "modules" optimized for specialized tasks. Its corkscrew, for instance, is optimized for pulling corks out of bottles. As always, this function (of the corkscrew) is contextual and not intrinsic. In a world without cork -not an unrealistic perspective at some not too distant future moment- it does not make sense anymore to talk about corkscrew functionality. But thanks to our capacity for agentive function assignment, we can give a new function to the corkscrew. We can use it even now to clean our finger nails, but we can also invent entirely new functional contexts. For any structure -mathematical, physical or biological- there is an infinite set of functional contexts. It is not possible to predict which context will be the most optimal. It is a matter of invention and experimentation. Similarly, it is a matter of invention and experimentation (next to our commitment to ethical principles) which socio-cultural environment is the best for our inherited biological nature.

The biolinguistics thesis -in the non-trivial sense- has no direct relation with "fatalism light" and Chomsky would be the last to embrace it. Nevertheless, throughout his work, a thinker like Steven Pinker seems to be inspired by the example of the flawed form of biolinguistics criticized in this article. It sets a bad example and it is paradigmatically undesirable that the most characteristic human attribute -language- is falsely reduced to the level of organic evolution rather than seen as the combined fruit of our innate biological structures and our own "ceaseless, unpredictable creativity" in assigning functions to these structures. Unlike what we see in the evolution of other organisms, the human version of the universe's creativity is agentive, free and sustained by a shared symbolic world of our own making.

Bibliography

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

Amundsen, Ron
2005 The Changing Role of the Embryo in Evolutionary Thought: Roots of Evo-Devo. Cambridge: Cambridge University Press.

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

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

Burger, Tyler
1979 Individualism and the Mental. *Midwest Studies in Philosophy* 4, 73-121.

Cassirer, Ernst
1953 *The Philosophy of Symbolic Forms. Vol. 1, Language.* New Haven: Yale University Press.

Chomsky, Noam
1957 *Syntactic Structures*. The Hague: Mouton.
1965 *Aspects of the Theory of Syntax*. Cambridge, Mass.: MIT Press.
1966 *Cartesian Linguistics*. New York: Harper and Row.
1970 Remarks on Nominalization. In R. Jacobs and P. Rosenbaum, Eds., *Readings in English Transformational Grammar*. Waltham, Mass.: Ginn and Company, 184-221.
1981 *Lectures on Government and Binding*. Dordrecht: Foris.
1986 *Knowledge of Language*. New York: Praeger.
1995 *The Minimalist Program*. Cambridge, Mass.: MIT Press.
2007 Approaching UG from Below. In Uli Sauerland and Hans-Martin Gärtner, Eds., *Interfaces + Recursion = Language?* Berlin: Mouton de Gruyter, 1-29.

Clark, Andy and David Chalmers
1998 The Extended Mind. *Analysis* 58, 7-19.
Dawkins, Richard
1976 *The Selfish Gene*. Oxford: Oxford University Press.
Deacon, Terence W.
1997 *The Symbolic Species: The Co-evolution of Language and the Brain.* New York: W.W. Norton & Company.
Degler, Carl
1991 *In Search of Human Nature: The Decline and Revival of Darwinism in American Social Thought.* New York: Oxford University Press.
Dennett, Daniel
1995 *Darwin's Dangerous Idea: Evolution and the Meanings of Life.* New York: Simon & Schuster.
Donald, Merlin
1991 *Origins of The Modern Mind*. Cambridge, Mass.: Harvard University Press.
2000 The Central Role of Culture in Cognitive Evolution: A Reflection on the Myth of the 'Isolated Mind'. In L. Nucci, Ed., *Culture, Thought and Development*. Philadelphia: Lawrence Erlbaum Associates, 19-38.
Egli, Urs and Renata Egli-Gerber
1992 Sprachsysteme: logische und historische Grundlagen der erweiterten Phrasenstrukturgrammatik. Konstanz: Fachgruppe Sprachwissenschaft Universität Konstanz. *Arbeitspapier* 28.
Emonds, Joseph
1970 Root and Structure Preserving Transformations. PhD Dissertation. MIT: Cambridge, Mass.
Fitch, Tecumseh W., Marc D. Hauser and Noam Chomsky
2005 The Evolution of the Language Faculty: Clarifications and Implications. *Cognition* 97, 179–210.
Gould, Stephen Jay and Richard C. Lewontin
1979 The Spandrels of San Marco and the Panglossian 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, and Tecumseh W. Fitch
2002 The Faculty of Language: What Is it, Who Has it, and How Did it Evolve? *Science* 298, 1569-1579.

Jablonka, Eva and Marion J. Lamb
2005 *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral and Symbolic Variation in the History of Life*. Cambridge, Mass.: MIT Press.
Jacob, François
1982 *The Possible and the Actual*. New York: Pantheon Books.
Jenkins, Lyle
2000 *Biolinguistics*. Cambridge., Mass.: MIT Press.
Jespersen, Otto
1928 *An International Language*. London: Allen & Unwin.
Katz, Jerrold J. and Jerry A. Fodor
1963 The Structure of a Semantic Theory. *Language* 39, 170-210.
Kauffman, Stuart
2007 Beyond Reductionism: Reinventing the Sacred. *Zygon* 42, 903-914.
Kayne, Richard.
1994 *The Antisymmetry of Syntax*. Cambridge, Mass.: MIT Press.
2005 *Movement and Silence*. Oxford: Oxford University Press.
Koster, Jan
1978 *Locality Principles in Syntax*. Dordrecht: Foris.
1987 *Domains and Dynasties: The Radical Autonomy of Syntax*. Dordrecht: Foris.
1988 *Doelloze Structuren*. Inaugural Lecture. University of Groningen. Dordrecht: Foris.
1989 How Natural is Natural Language. In J.E. Fenstad *et al*., Eds., *Logic, Methodology, and Philosophy of Science VIII*. Amsterdam: Elsevier.
1990 Pork without Pigs. In Joan Mascaró and Marina Nespor, Eds., *Grammar in Progress. GLOW Essays for Henk van Riemsdijk*. Dordrecht: Foris, 305-315.
2003 Move, Merge and Percolate are One! On the Elimination of Variables in Grammar. In L.-O. Delsing, C. Falk, G. Josefsson and Halldór Á Sigurðsson, Eds., *Grammatik i Fokus. Grammar in Focus: A Festschrift for Christer Platzack, November 18 2003*. Lund: Department of Scandinavian Languages, University of Lund.
2005a Is Linguistics a Natural Science? In Hans Broekhuis, Norbert Corver, Riny Huybregts, Ursula Kleinhenz and Jan Koster, Eds., *Organizing Grammar: Linguistic Studies in Honor of Henk van Riemsdijk*. Berlin: Mouton De Gruyter, Berlin, 350-358.
2005b Hebben Dieren Concepten? *TABU* 34, 187-208.
2007 Structure-Preservingness, Internal Merge, and The Strict Locality of Triads. In Simin Karimi, Vida Samiian, and 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.

Malik, Kenan
2000 *Man, Beast, and Zombie: What Science Can Tell Us About Human Nature.* New Brunswick, N.J.: Rutgers University Press.
Mehler, Jacques, P. Jusczyk, G. Lambertz, N. Halsted, J. Bertoncini, and C. Amiel-Tison
1988 A Precursor of Language Acquisition in Young Infants. *Cognition* 29, 143-178.
Moravcsik, Julius
1990 *Thought and Language*. London: Routledge.
Müller, Gerd B. and Stuart A. Newman
2003 *Origination of Organismal Form: Beyond the Gene in Developmental and Evolutionary Biology.* Cambridge, Mass.: A Bradford Book, The MIT Press.
Muysken, Pieter
2002 *Waar is de Taalwetenschap?* Inaugural Lecture. Radboud University, Nijmegen, Nijmegen.
Odijk, Jan
1997 C-selection and S-selection. *Linguistic Inquiry* 28, 365-372.
Paul, Hermann
1880 *Prinzipien der Sprachgeschichte*. [Tübingen 1975: Niemeyer].
Petitto, Laura-Ann
2005 How the Brain Begets Language. In James McGilvray, Ed., *The Cambridge Companion to Chomsky*. Cambridge: Cambridge University Press.
Pinker, Steven
2002 *The Blank Slate: The Modern Denial of Human Nature*. New York: Viking Penguin.
Popper, Karl R.
1972 Epistemology Without a Knowing Subject. In Karl R. Popper, *Objective Knowledge: An Evolutionary Approach*. Oxford: Oxford University Press, 106-152.
Pullum, Geoffrey K.
1991 Formal Linguistics Meets the Boojum. In G. K. Pullum, Ed., The Great Eskimo Vocabulary Hoax and Other Irreverent Essays on the Study of Language. Chicago:
Pustejovsky, James, Ed.,
1993 Semantics and the Lexicon. Dordrecht: Kluwer.
The University of Chicago Press.
Putnam, Hilary
1975 The Meaning of 'Meaning'. In Hilary Putnam, *Mind, Language, and Reality. Philosophical Papers, Volume 2.* Cambridge: Cambridge University Press.
Reichling, Anton
1935 *Het Woord: Een Studie omtrent de Grondslagen van Taal en Taalgebruik.* Nijmegen: Berkhout.
Rose, Steven, Leon J. Kamin and Richard C. Lewontin
1984 *Not in our Genes: Biology and Human Nature*. Harmondsworth: Penguin Books.
Ross, John Robert
1967 Constraints on Variables in Syntax. Cambridge, Mass.: PhD Dissertation, MIT.

Ruse, Michael
2003 *Darwin and Design: Does Evolution have a Purpose?* Cambridge, Mass.: Harvard University Press.
Sapir, Edward
1921 *Language: An Introduction to the Study of Speech*. Harcourt, Brace & World, New York.
Saussure, Ferdinand de
1916 *Cours de linguistique générale*. C. Bally and A. Sechehaye, Eds. Lausanne and Paris: Payot.
Searle, John R.
1995 *The Construction of Social Reality*. London, etc.: Penguin Books.
Segerstråle, Ullica
2000 *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond.* Oxford: Oxford University Press.
Tesnière, Lucien
1959 *Éléments de syntaxe structurale*. Paris: Editions Klincksieck.
Tomalin, Marcus
2002 The Formal Origins of Syntactic Theory. *Lingua* 112, 827–848.
2006 *Linguistics and The Formal Sciences: The Origins of Generative Grammar*. Cambridge: Cambridge University Press.
Uhlenbeck, Eugenius M.
1973 *Critical Comments on Transformational-Generative Grammar 1962-1972.* The Hague: Smits.
Wilson, Edward O.
1975 *Sociobiology: The New Synthesis*. Cambridge, Mass.: The Belknap Press of Harvard University Press.
Wittgenstein, Ludwig
1953 *Philosophical Investigations*. Oxford: Basil Blackwell.

Notes

[1] See Searle (1995) for modern elaborations of such ideas.

[2] See Cassirer (1953), Popper (1972), and Wittgenstein (1953). A more recent variant of externalism makes use of the notion of "memes" (Dawkins 1976; see also Dennett 1995 and Deacon 1997). Meant as a cultural counterpart to genes, it has not been developed into a notion of similar concreteness. On the contrary, "memes" are so diverse and vaguely delineated that the concept is of little value. Moreover, like the elements of Popper's World 3, external elements are nothing except in relation to very poorly understood interpretation by our capacities for mental processing and understanding.

[3] For the Boas school and the often subtle and complex ideas about the relation between biology and culture, see Degler (1991).

[4] The biolinguistics aspect was part of generative grammar since the beginning, as in Lenneberg (1967). It has been reemphasized since Jenkins (2000) and Hauser, Chomsky and Fitch (2002). These writings also inspired my own renewed interest in the questions raised by "biolinguistics." My thesis of radical autonomy (see Koster 1987, particularly the preface and the last chapter) was an early rejection of the idea that syntax has an intrinsic linguistic function, independent of its application in a shared culture. This cultural perspective was further developed in Koster (1988) and (1989).

[5] See Egli and Egli-Gerber (1992). Throughout this article, I use the term "words" for ease of exposition. Strictly speaking, I often mean "morphemes" when I refer to words. Words in the sense intended here also include functional elements, like Tense, and "silent" words interpreted by context (see Kayne 2005).

[6] Chomsky (1986, 32) suggests a rift between "Saussurian linguistics" and Otto Jespersen's emphasis on our capacity for "free expressions." I do not think this opposition makes sense. On the one hand, nothing in Saussure's *parole* excludes free expressions and, on the other hand, Otto Jespersen firmly believed in the non-natural, artificial character of languages. That Jespersen saw languages as cultural creations also appears from his interest in designed international auxiliary languages (see, for instance, Jespersen 1928).

[7] See also Clark and Chalmers (1998) for similar ideas and Muysken (2002) for a critique of I-language.

[8] The equation of brain and mind is also problematic in the other direction, as many brain functions, like regulating respiration, etc., have nothing to do with what we call mind.

[9] Chomsky (2007, 4) says the following in this regard: "In addition to Merge applicable without bounds, UG must at least provide atomic elements, lexical items LI, each a structured array of properties (features) to which Merge and other operations apply to form expressions". Since UG is the initial state of the language organ, it is claimed here that children are born with abstract lexical elements, perhaps as precursors of normal lexical items. I cannot make sense of this claim, as normal lexical items are based on various public conventions that establish complex, partially language-specific and poorly understood relations with our innate conceptual potential (whatever that may be). Even if there are precursors of lexical items, due to the conventional choices made by languages, there can be no one-one relation between normal, public lexical items and the postulated innate elements (neither in their atomic form nor in complex form as the result of Merge). In fact, there is no evidence at all that something even remotely like lexical items is part of the initial state of some language faculty.

[10] See Ruse (2003, 17-19).

[11] See Deacon (1997) and Jablonka and Lamb (2005) for the idea of brain-language co-evolution. 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. Writing, an everyday form of language use for many, is not biologically facilitated the way speaking is.

[12] Polysemy was emphasized in a Dutch tradition represented by Reichling (1935) and Uhlenbeck (1973). I first got acquainted with examples like those given in (1) and (2) in Reichling's class lectures in the early 1960s. Very similar examples are used in Chomsky (2000, ch. 5).

[13] The kind of (non-rule-governed) creativity shown by polysemy is related to the Cartesian creative aspect of language use discussed by Chomsky (1966). See also Chomsky (2000, 128) and the references to Pustejovsky (1993), Moravcsik (1990) and the Aristotelian origin of polysemy and related forms of creativity.
[14] This is not true, as pre-Chomskyan X-bar theory is construction-independent.
[15] See Koster (1987) for a critique of "move alpha" and levels such as Logical Form.
[16] See Tesnière (1959). A related approach can be found in the German notion "Rektion" (government), which has a history of several centuries.
[17] See Pullum (1991) and Tomalin (2002, 2006) for discussion.
[18] For Chomsky's attitudes towards sociobiology, see Segerstråle (2000, 203-206). Ultra-darwinism is the idea that adaptation to an environment is more important for the understanding of the forms of the organic world than physical, developmental and other intrinsic properties of organisms. It is the pan-adaptationism criticized by Gould and Lewontin (1972). Ultra-darwinism can be seen as the diachronic version of Skinner's behaviorism: both are selection theories that emphasize the shaping role of adaptation to an environment. From this perspective, Pinker (2002) is a unique *tour de force*: in combines ideas akin to those of Skinner's (ultra-Darwinist environmentalism) about our evolutionary past with theories like those of Chomsky's (nativism) about our biological present. Pinker could have avoided these mutually inconsistent foundations of his framework if he had learned from modern linguistics that selection theories (like Skinner's or Darwin's) are explanatory to the extent that their hypotheses are drawn from a limited hypothesis space. Behaviorism was not rejected because it was a selection theory (about behavior) but because it was close to empty as to a priori limitations on the set of possible hypotheses. Ultra-darwinism of the kind of Pinker and Dennett (1995) is not generally accepted anymore by evolutionary biologists these days, as it has the same shortcomings as behaviorism. Evolutionary biology can only rise above the level of "just so" stories by combining the idea of natural selection with a theory of possible form. This is admirably formulated by biologists like Müller and Newman (2003), who claim that "neo-Darwinism has no theory of the generative" (*op. cit*, p. 7). It is hoped for that the emerging discipline of evo-devo will contribute to such a theory. See Amundsen (2005) for a lucid account of some relevant issues.
[19] The myth of the uphill battle is discussed (not under that name) by Edward Wilson (1975, 275), who is, like the later evolutionary psychologists, talking about adaptations to hunter-gatherer societies and "the early hominids still within us," with absurdities like a "genetically accurate" code of ethics. According to Wilson, we do not know yet which behaviors can be altered "without emotional damage or loss in creativity." "Uncertainty in this matter," Wilson continues, "means that Skinner's dream of a culture predesigned for happiness will surely have to wait for the new neurobiology." This kind of view, criticized in the text of this article, would turn human biology into an authoritarian nightmare. See also Rose, Kamin and Lewontin (1984) for a similar critique.
[20] See Malik (2000, 244 ff.) for a critique on the ideas about the role of hunter-gatherer societies in human evolution.