

This is the English translation of:

Dessalles, J-L. (2006). "Du protolanguage au langage : modèle d'une transition".
Marges linguistiques 11, 142-152.
www.enst.fr/~jld/papiers/pap.evol/Dessalles_03071803.pdf

From protolanguage to language: model of a transition

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Abstract

The existence of syntactic abilities allowing human beings to process complex languages remains mysterious. According to some authors, these abilities appeared by mere chance at some point in evolution, and their use in communication is, in some way, fortuitous. We try here to show how a simple model of the syntax-semantic interface allows us to consider a quite different scenario. The ability to process syntactic structures would have appeared in a two-step evolutionary process and would be the consequence of a new semantic ability, the ability to form predicates. Recursion is claimed to have appeared in the second step, as a way to link predicates for their arguments to be determined.

Keywords : semantics, syntax, evolution, recursion, cognition

1. Introduction: Anatomy of a transition¹

Human language behaviour relies on various cognitive abilities that are peculiar to our species. Animal communication systems qualitatively differ from ours. Attempts to teach apes various aspects of human language (Premack & Premack 1983 ; Savage-Rumbaugh & Lewin 1994 ; Pepperberg 1999) reveal that various cognitive abilities that allow us to process language seem to be absent from the tested species. One of these abilities that is often mentioned is the use of syntax. It is true that birds, nightingales for instance, are known to emit songs with several combinatorial layers (Hauser 1996:286). However, nothing indicates that the various structures they utter express differentiated meanings. Trained primates sometimes spontaneously produce utterances involving two words that are semantically related to the concrete intended meaning, with some tendency to observe a systematic order (Savage-Rumbaugh & Lewin 1994 :161). This type of performance however remains quite far away from human linguistic productions, what leads some authors to see there rather the expression of a protolinguistic ability (Bickerton 1990 ; 1995).

Protolanguage was defined, extrapolating from pidgins, as a form of expression in which words are merely grouped in short utterances, with no grammatical support. Its characteristics are: no grammatical words, no long-range dependency within the sentence, no inflection, no

¹ This study was conducted thanks to the CNRS-OHLL initiative (Origine de l'Homme, du Langage et des Langues).

consistent order (Bickerton 1990). Protolanguage is what we settle for when we are in linguistic trouble. Bickerton presents it as a precursor of language, an intermediary competence between spontaneous primate communication and language proper, which is universally used in our species. A modern expression of protolanguage can be observed in the use of search engines on the World Wide Web. Though these search engines recognise Boolean expressions and possibly noun phrases, users tend to input sequences of grammatically unrelated words (Guichard 2002).

Whatever the status we grant to the protolanguage hypothesis, the issue of the evolutionary transition to language as we know it cannot be ignored. Some cognitive abilities enable us to process meaningful linguistic structures and to perform non trivial operations on these structures, as questioning, passive voice, modal or temporal modifications, and so on. Without deciding here whether these cognitive abilities are specific to language or depend on more general dispositions (Piattelli-Palmarini 1979), we are looking in the structure of language some clues that may reveal their order of appearance. In this attempt to reconstruct the phylogeny of this transition to language, we will specifically concentrate on the interface between syntax and semantics, from a modelling perspective. By examining the relative complexity of synchronising operations between syntactic structure and meaning, we will be able to propose an order of appearance for some of the abilities that underlie language competence.

In what follows, we will first set the problem by considering some characteristics of syntax that are generally invoked to demonstrate the originality of our communication mode, such as recursion and inflection systems. We will outline a simplified model of the role these characteristics play in the expression of meaning. From this simplified model, we will draw some propositions concerning a plausible sequence in the establishment of the cognitive abilities that underlie these language properties. We will conclude by replacing these propositions in the broader framework of current research on the evolutionary origin the language faculty.

2. Some significant aspects of the syntactic faculty

Languages are highly varied, but not indefinitely so. In particular, all spontaneous languages in the world, with the exception of recent pidgins, involve grammars that rule the flexion of words and their relative position in the sentence. No people in the world spontaneously speaks by grouping invariable words with no consistent order.¹ It is true that syntactic rules highly differ from one language to the next. Some languages like Latin or Dyirbal seem quite permissive about word ordering in simple clauses (Dixon 1972), whereas other languages like French or English are significantly less tolerant on this aspect of grammar. Other languages like Lakhota involve a complex morphological system that mainly affects the verb, while languages like English or Chinese are use inflection quite sparingly (Van Valin & LaPolla 1997). Despite these obvious differences, some general observations can be made concerning the common structure of languages that will be sufficient to support the remainder of our claim.

The first observation concerns the existence of dependencies between words. In a protolinguistic utterance like *house-neighbour-fire*, each of the three words bears a direct semantic relation with the perceived scene that is described. Communication can function with such utterances without words being dependent on each other. Human languages involve several forms of dependence that are clearly indicated by grammar. In a sentence like *the neighbour's house is on fire*, words bear formal relations that are independent of their meaning. For instance, words like *on* and *fire* are tied together by some relation, as are *house*

¹ Recently created pidgins clearly constitute an exception. However, they are used as main language only under abnormal social conditions in which adult individuals from different linguistic communities are brought together (Bickerton 1990). The history of creoles and the recent example of deaf signing children in Nicaragua (Kegl, Senghas & Coppola 1999) suggest that pidgins are instable communication forms that disappear as main communication means when the social structure allows children under seven to form communities.

and *neighbour*, while *neighbour* and *fire* are not directly linked. These dependencies most often prevail over meaning: the grammar of a sentence like *the mouse eats the cat* impose a semantic relation that goes against what is suggested by the mere association between the meanings evoked by the words *mouse*, *cat*, *eat*.

The second observation concerns the fact that grammatical dependencies are asymmetrical. In a Latin expression like *domus domini*, the genitive of the word *dominus* unambiguously indicates that the word is a satellite of the word *domus*. In French, the two expressions *la maison du maître* et *le maître de la maison* can be distinguished by the relative position of the words with respect to preposition *de*. This asymmetrical dependency can be interpreted in various ways, either as resulting from a syntactic merging operation (Chomsky 1995) or as a semantic dependency (Van Valin & LaPolla 1997). Thanks to asymmetrical dependencies, linguistic utterances involve phrases in which the head is, in a structural sense, above the dependent elements.

The third observation concerns the "molecular" structure of linguistic utterances. As dependencies can branch on each other, phrases end up embedded into each other. In a simple sentence like *I fairly liked the subject of the conference we attended yesterday*, several embeddings are to be observed: the verb phrase headed by the verb *attend* depends on the noun phrase headed by *conference*; the latter is an integral part of the noun phrase headed by *subject*, which is included in the phrase headed by *liked*. Different syntactic theories may differ by the precise choice of phrase types, but all acknowledge the embedding principle. The resulting structures can be said to be tree-like (if one represents the graph of dependencies), molecular (by analogy with biochemistry in which macro-molecules are composed of other molecules), fractal (in reference to living or physical structures that are scale-invariant) or recursive. This last qualifier refers to a property of the procedure that allows to read or to generate the syntactic structure. Recursive procedures have the property of calling copies of themselves during their execution. The same procedure is used to analyse the noun phrase *subject of the conference we attended yesterday* and the embedded noun phrase *conference we attended yesterday*. From a technical point of view, the remarkable fact is that the recursion at work in human language is a central recursion that cannot be reduced to a mere repetitive iteration.

Our last observation concerning syntactic dependencies is that they have long distance effects. In: *the subject of the conference we were lucky enough to attend yesterday*, the noun *conference* acts as a complement both of *subject* and of *attend*, despite the fact that the latter and *conference* are separated by five words. The distance in this kind of dependency can grow arbitrarily (*the conference that the friend who was my roommate before I moved to Paris was lucky enough to attend yesterday was on a scandalous topic*). Syntactic theories may give different accounts of these long range dependencies, depending on whether they consider movement (the complement of *attend* would migrate toward the head of the main clause) or silent duplication.

For several authors, some of the above mentioned syntactic properties are inseparable. The existence of asymmetrical dependencies, phrase embedding and the various forms of long range dependencies would go together; they would constitute a package that Nature would have offered us together with syntactic competence. This set of properties would be the automatic result of the sole "merge" operator (Berwick 1998) or, equivalently, of the fortuitous appearance in our species of the ability to process recursive structures (Hauser, Chomsky & Fitch 2002). Indeed, it is difficult to imagine intermediary steps in the mastery of recursion. It seems, therefore, that the transition from protolanguage (or from non-language) to language can only be a sudden one. Some have invoked the possibility of an improbable macro-mutation (Bickerton 1990). Its cause could have been fully fortuitous, and it would owe nothing to any increase in communication power (Chomsky 1975 :75 ; Piattelli-Palmarini 1989 ; Lightfoot 2000). The new recursive ability, possibly thanks to the break of some functional encapsulation (Hauser, Chomsky & Fitch 2002), would have produced the whole set of syntactic properties that are to be observed in the various languages, including the dependency properties that we mentioned above.

The evolutionary transition toward syntactic competence looses much of its scientific interest if it is supposed to have been sudden and fortuitous, as it was likely to produce a device that is poorly adapted to the communicational needs of humans.

Language design as such appears to be in many respects “dysfunctional,” yielding properties that are not well adapted to the function language is called upon to perform. (Chomsky, 1995:162).

[...] full-blown evolutionary novelty can also suddenly arise, so to speak, for no reason, because novelty caused by sheer proximity between genes is not governed by function and it, therefore, eludes strict adaptationism. » (Piattelli-Palmarini 1989:8)

The thesis according to which evolution would produce complex and poorly functional structures or competences is at odds with biological laws (Dessalles 1996) and do certainly not apply to language (Pinker & Bloom 1990 ; Pinker & Jackendoff 2005). Both the theory of evolution through natural selection and the study of language suggest that syntax fulfils a definite function, which is to serve the expression of meaning on the vocal-auditory channel, and that its structure is an evolutionary consequence of this function. It is thus legitimate to wonder which function is carried out by syntax, and especially recursion, and then to propose a tentative reconstruction of the main steps through which the evolution of language may have gone.

In what follows, we will question these two alleged properties of the transition from protolanguage to language, namely its abrupt and its fortuitous character. By observing, from a modelling perspective, the interface between syntax and semantics, we will suggest a at least two-step transition, each step being motivated, on the biological ground, by its consequences on the new types of communication it makes possible.

3. At the interface between grammar and meaning

The way an utterance is built up from its grammatical structure has been thoroughly studied and is still the subject of many studies. Paradigms differ largely, ranging from isomorphic constructions (Montague 1974 ; Jackendoff 1990 ; Carpenter 1997) to various conceptions in which grammatical structure only imposes constraints to a semantic process running in parallel (Johnson-Laird 1977 ; Kamp & Reyle 1993 ; Talmy 2000). For our purposes here, a global theory of meaning construction is not necessary. We just need to consider some aspects of the synchronisation between the syntactic code and the semantic level.

The first aspect of this synchronisation concerns the recognition of the predicate-argument relation. We consider the simplifying hypothesis that the semantic representation of a given utterance involves a logical predicate.¹ This hypothesis is compatible with most models of semantics.² It is important to note that this hypothesis does not require the existence of a language of thought, as the predicate in question can be a transitory representation that is constructed on the fly from non symbolic elements (Ghadakpour 2003).

Let us take the example of a two-place predicate $P(x,y)$, such as the predicate associated with the sentence *Pierre hits Paul*. One of the fundamental functions of syntax is to offer means to locate x , y and P in the sentence. In particular, it makes the distinction between the sentences corresponding to $P(x,y)$ and $P(y,x)$. Languages make use of various means to achieve this identification of participant roles. The most obvious are position and inflection. In a language like English, the relative location of words is strict enough for listeners to locate the predicate and its arguments, and to distinguish the meanings of *Pierre hits Paul* and *Paul hits Pierre*. In Latin, the nominative and accusative cases fulfil the same function in a sentence like *Paulus Petrum ferit*. The grammar of a given language also give means to locate predicates

¹ Logical predicates are the easiest way to interface meaning with pragmatic aspects, especially argumentation (Dessalles 2000).

² In particular, one can convert into logical predicates all constructs hypothesised in models based on feature structures, on logical or functional formalisms, on graphs or on schematic representations. Models that only consider analogue meaning representations, such as images, could constitute an exception.

and arguments in the case three-place predicates (*Paul sells his car to Jacques*), one-place predicates (*Paul is sick*) or zero-place predicates (*it rains*).

In the preceding section, we presented the existence of asymmetrical dependencies within the phrase as a fundamental characteristic of language. One of its effects is precisely to make the identification of the relation between the predicate and its arguments possible. In other words, phrases are the visible counterpart of predication. Let us call argumental function this property of syntax.

The second aspect of the synchronisation between syntax and semantics that we will consider is determination. To be of any use at the pragmatic level, the semantic representation must be sufficiently instantiated. In some contexts, it is not the fact that whatever living being ate something that matters, but rather the fact that the house cat ate the joint of roast beef that I intended to our guests. In another context, for instance the case of a sick person recovering her appetite, the identity of the eater is relevant, whereas the eaten entity may remain unspoken. Let us see how syntax fulfils the function of determining the arguments of predicates.

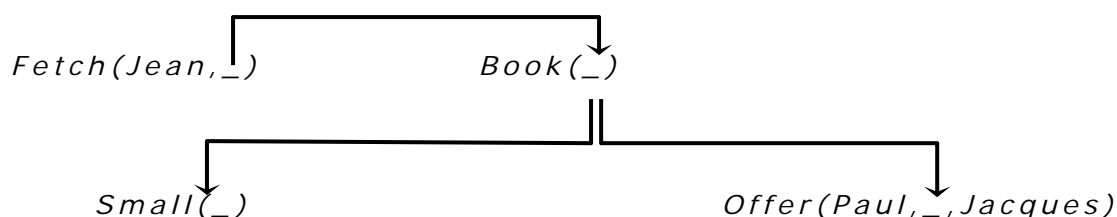
There is a variety of means through which syntax performs the determination of arguments. Let us concentrate on two of them, modification and relative clauses. In the following sentence:

Go and fetch the small book that Paul offered to Jacques

the modification of *book* by the adjective *small* and the relative clause *that Paul offered to Jacques* helps the listener understand which book the demand is about. If one represents the corresponding meaning with predicates, one gets a representation like *Small(x) & Book(x) & Offer(Paul, x, Jacques)*, under the assumption that the listener is able to form, in the current context, the predicates noted *Small*, *Book* and *Offer*. In this type of representation (which reminds the computer programming language Prolog), the convention is that two variables of same name, within the same logical clause, designate the same object. One could think of human beings expressing that way, with simple clauses and variables:

{ *Go and fetch something;*
 { *That something is a book;*
 { *That something is small;*
 { *Paul offered that something to Jacques.*

This expression mode, based on variable sharing between simple propositions, appears rather clumsy to most of us (though a minority of computer scientists really like using it to express precise knowledge in Prolog). Thanks to the syntax of natural languages, the use of explicit variables proves unnecessary, as illustrated in the following schema.



In this schema, arrows stand for the semantic link that exists between phrases. This semantic link results from various syntactic devices. One of them, the principle of semantic linking, states that two phrases that bear a syntactic relation (complementation or adjunction) must share a variable at the semantic level¹ (Dessalles 2000). This principle corresponds to

¹ This principle must be applied with some caution. For instance, it requires distinguishing the predicative sense of a preposition like *on* (as in *she saws the book on the table*) from the non predicative sense (as in *she relies on Paul*). In the latter case, there is only one predicate and thus no semantic linking.

the linking of discourse fragments that is hypothesised in a formalism like DRT (Kamp & Reyle 1993). The principle of semantic linking is not an infallible way of establishing the link between logical arguments. In English, a phrase like *the overtaking of the car* is ambiguous, as one cannot know whether the car in question is overtaking or is overtaken. The ambiguity is explained by the fact that the principle of semantic linking underspecifies, in this case, the shared argument in *Overtake(⌊,⌋) & Car(⌊)*, where each of the two arguments of *Overtake* can be linked to *Car*.

The essential function of the principle of semantic linking and of the various syntactic devices that implement it is to allow for the determination of the objects of discourse. If one sees each of the predicates as a constraint laid by the speaker on the perceived world, each link with a new predicate restricts the range of possibilities, and thus facilitates understanding on the listener's side. Identify what the discourse is about consists in solving equations like *Small(x) & Book(x) & Offer(Paul,x,Jacques)*, where *x* is the unknown. A relevant speaker will take care of giving sufficient predicative constraints for the solution to appear unique in the eye of listeners (the use of a definite determiner like *the* announces this uniqueness to them). In an already constrained context, merely expressing *Book(x)* may suffice. The principle of semantic linking makes the role of syntactic recursion clearer: Each new predicate that is introduced to specify the argument of another predicate can necessitate the introduction of further predicates to instantiate its own arguments. The result is a tree-like structure that links predicates together.

The principle of semantic linking acts locally on predicates that are close: complements or adjuncts. Paradoxically, the same principle of semantic linking accounts for some long range dependencies. In particular, it gives a role to movement (or silent duplication) of noun phrases, when two phrases must be connected despite their structural distance. In the phrase: *the subject of the conference [that] we were lucky enough to attend yesterday*, the problem is to link the arguments of *Subject(⌊)*, of *Conference(⌊)* and of *Attend(⌊,⌋)*. The word *conference* cannot be simultaneously the complement of the noun *subject* and of the verb *attend*. The optional pronoun *that* refers to the silent complement of *attend* and implements this double link. The principle of semantic linking operates between *subject* and its complement *conference*, and between *conference* and the optional pronoun *that*.¹ Semantic linking is also transmitted between *that* and the silent complement of *attend*. If our example is classically analysed as resulting from the complement of *attend* having moved towards the top of the clause, then the function of that movement is to bring *conference* to a position where it can link with *subject*.

We just mentioned two important functions of syntax, the argumental function and its role in determination. In a scenario in which the ability to process syntactic relations would be a pure result of chance, brought in for no reason into the human cognitive landscape, the very existence of these two functions and the fact that syntax makes a rather good job in fulfilling them looks rather miraculous. We suggest to reverse the picture and to see the ability to process syntax, not as a wondrous event devoid of any cause, but as the result of a multi-step evolution.

4. From modelling to the reconstruction of evolution

From a modelling perspective, syntax looks like a rather well-designed device that achieves at least two essential functions, the identification of predicate arguments and the determination of discourse objects through semantic linking between phrases. Understandably, we may go beyond these observations and investigate what the phylogeny of this device may have been. If one accepts to see in syntactic competence something else than a cognitive ability cast in one piece, given as a turnkey device thanks some evolutionary luck, then it is

¹ The status of this link between the relative pronoun *that* and its antecedent may vary according to the linguistic theory. We just need to say that semantic linking goes through it, even when the pronoun remains silent.

relevant to wonder about the order in which the various components of this capacity have appeared during the phylogeny of the species.

The reasoning is similar to what scientists studying anatomic evolution typically do. They draw a distinction between ancestral and derived characters. Whenever some morphological feature cannot exist in the absence of some other morphological character, it is necessarily derived. The ocellus that can be seen on some butterfly wings are derived characters that appeared after wings in the course of evolution. In the case of syntactic processing, it is relevant to wonder which, of the two functions that we considered, came first.

When asked this way, the question receives an unambiguous answer. Identifying predicates arguments is unquestionably a prerequisite of the possibility of performing semantic linking between predicates. In other words, the mastery of the syntactic tools that allow us to identify arguments *must have been present before* the ability to use semantic linking for determination.

The most important consequence is that the ability to process syntactic relations must have emerged in two steps, *with recursion coming into play only in the second step*. The scenario is the following one. First step: emergence of the ability to handle simple clauses that express only one predication. This predication can be said to be the main one: it is used at the pragmatic level for argumentation (Dessalles 2000). The utterance *Pierre hit Paul* is directly exploitable by the listener, who can adopt a conversational attitude or even engage in some action. At this stage, predication is explicit in language, whereas it was absent from protolanguage (in a protosentence like *fight–Pierre–Paul*, where the three words come up to be together only because they relate to the same scene, the make up of a possible predication is the entire responsibility of listeners, who must in addition guess who is the hitter and who is the hittee).

In a second step, the ability to express predicates came to acquire a derived function. At that stage, utterances still include a main predication, which is the one that is used at the argumentative level. However, they now include auxiliary predications that are here for determination purposes. These secondary predications are expressed through modification by complementation or adjunction. Thanks to the principle of semantic linking, auxiliary predications can play the role of specifying the objects of discourse.¹ The remarkable phenomenon is that argument specification does not concern only the main predication, but also the secondary ones, as their arguments require specification as well. What results is a recursive linking of auxiliary predications which, thanks to the principle of semantic linking, can link to each other. It is thus at this point that the ability to process recursive phrase structures found its *raison d'être*.

5. Discussion

The main interest of the scenario that we just sketched is to make the unlikely hypothesis of a turnkey syntactic ability, appearing by chance to find a subsequent function in communication, dispensable. By taking the syntax-semantics synchronisation into account, we could distinguish two fundamental syntactic abilities that emerged successively, each one being motivated by a functional role. The first one made the expression of the main predication possible, by using simple isolated clauses for each predication. No need to invoke any miraculous event here. Various experiments in evolutionary simulations have shown that this form of syntax could emerge in a context where it is advantageous to express predications (Batali 1994, 1998 ; Kirby 2002). The role of syntax, in this case, is to provide visible marks of asymmetrical dependencies between the predicate and its arguments. The various inflection systems (case marking, gender, classes ...) are in competition with word position to fulfil this

¹ In a marginal way, auxiliary predications can play an argumentative role. In: *I saw the beautiful Mary who was in a hurry*, the predications introduced by the adjective *beautiful* and by the relative clause *who was in a hurry* are not used to specify the objects of discourse, but express pieces of knowledge for argumentative purposes. In our scenario, these predicative use of auxiliary predications is, itself, derived from the their use in determination.

function (Jackendoff 1999 ; 2002). If there are two competing devices for the same function, fulfilling it cannot be a miracle, contrary to what the above mentioned authors seem to suppose (cf. section 2).

What prompts some authors to think that the mastery of syntax results from a unique and unlikely innovation is due to the molecular nature of linguistic utterances. The ability to embed phrases into each other, in a recursive way, cannot seem to be acquired in a progressive manner. In our scenario, this ability emerges in the second step, when auxiliary predications are used as determination constraints. We do not know if the emergence of recursive syntax is especially improbable when the problem is to express secondary predications that are semantically linked. There are, however, two indications that limit that improbability. First, some studies showed that recursive syntax could emerge in other contexts, to solve a problem of lexical economy (Nowak, Plotkin & Jansen 2000) or of semantic generalisation (Kirby 2002). Second, recursive syntax is not the only way to express secondary predicate links. One can easily think of a way of expressing these links based on variable sharing, as in Prolog (cf. section 3). If such a device did not emerge to serve spontaneous human expression, it is probably because the principle of semantic linking emerged more rapidly, giving utterances a molecular structure and long range dependencies.

Some studies present syntax as an innovation whose purpose was to solve the problem of heavy lexical pressure. Facing the increasing number of meanings to be communicated, syntactic combination appears as a way to limit the number of lexical forms that must be memorised (Kirby 2000; Nowak, Plotkin & Jansen 2000). From what precedes, one can understand that lexical pressure justifies, at best, the emergence of protolanguage. Protolanguage utterances, by combining meanings of juxtaposed words, can evoke scenes for which speakers have no unique adequate words (Dessalles 2000). Syntax achieves a quite different job. It allows to express predication. According to our scenario, protolanguage was bound to the evocation of concrete scenes. The transition from protolanguage to language constituted a genuine innovation, though which our ancestors, by accessing to predication, engaged in the path to argumentation (Dessalles 2000).

The semantic capacity of predication has often been reduced to the activity of categorisation, which requires establishing a relation between a located object and a set of properties (Hurford 2003). Presented in this way, predication looks like a quite banal capacity that must be shared with many animals. We have stressed elsewhere the fundamental difference that exists between categorisation and argumentative predication as it is expressed through language¹ (Dessalles & Ghadakpour 2003). Language predication would be a recent acquisition of our lineage. Its emergence gave rise, in two steps, to the appearance of the ability to master syntactic relations.

By proposing this scenario, we are aware of sending part of the mystery of the evolution of language competence back to the semantic realm. The syntactic expression of the main predication, and then of secondary predications, ceases to be miraculous, but the improbability of the transition from protolanguage to language seems to rest entirely on the cognitive abilities that allow us to think of such predications. We fully accept the consequences of such a change of perspective, which can be summarised as follows.

- First step: a new semantic ability emerges through which individuals can form predicative relations for argumentative purposes (Dessalles 2000). A first form of syntax then appears to express these predications, with one simple clause for each predication. Expressing the relations between the predicate and its arguments is carried out by systems like inflection (case, gender, classes...) or position.

- Second step: a new semantic use of predication emerges. Predicates can be used as constraints to help in the determination of objects of discourse. New syntactic tools then

¹ One fundamental difference is that language predication, contrary to categorisation, can be systematically and explicitly negated in context: *This object is not a book because it is not made of paper*. Language predication can be formed in context by a *mental operation of contrast* between representations (Ghadakpour 2003).

appear to express these auxiliary predications. The principle of semantic linking is used to locally link predications together. The recursive embedding of phrases and long range dependencies emerge as efficient tools to express predication linking.

When taking simulation studies on language evolution into account, one may rightfully consider that the emergence of these syntactic tools has no miraculous character, as soon as the corresponding semantic abilities are supposed to be present. By contrast, it is difficult, in the present state of knowledge, to assess the odds for the emergence of the ability to form mental predication.

6. Conclusion

By modelling the synchronisation between syntax and semantics, we were able to distinguish two important functions of syntax: the argumental function and its role in implementing determination. We suggested that these two functions emerged successively. The former, implemented mainly through inflection and word position, fulfils the role of expressing the main predication that is used at the argumentative interface. The latter, implemented through phrase embedding and long range dependencies, allows using auxiliary predications to help listeners constrain the objects of discourse.

The scenario we just proposed relies on a simplified model of the syntax-semantics interface. Syntax includes various other refinements that were left aside for the sake of simplicity. Our objective was to sketch a simple framework, a two-step scenario, on which it is possible to add further hypotheses concerning other features of language. We wanted to enhance the contrast between the devices used for the expression of the main predication and those used for auxiliary ones, by highlighting that recursion and long range dependencies serve only the second function.

What prompted the transition, in our scenario, is not the emergence of a new syntactic competence, but the emergence of a new semantic ability. By forming predicates, by expressing them through simple utterances, and then through molecular sentences to achieve a precise determination of discourse objects, our ancestors were able to assert relations and put into question the relations asserted by others. In conformity with what is generally considered, we have all reasons to think that this transition corresponds to the emergence of *homo sapiens*.

Acknowledgments

I thank Laleh Ghadakpour who accepted to read an earlier version of this paper. I would like to express my gratitude to the persons who promoted the CNRS initiative "Origine de l'Homme, du Langage et des Langues", which put the issue of the origins of language back into the French scientific debate.

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