

# Evolutionary epistemology and the origin and evolution of language: Taking symbiogenesis seriously

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## Abstract

Symbiogenesis is a form of horizontal evolution that occurred 2 billion years ago, with the evolution of eukaryotic cells. It will be argued that, just as we can develop universal selection theories based upon a general account of natural selection, we can also develop a universal symbiogenetic principle that can serve as a general framework to study the origin and evolution of language. (1) Horizontal evolution will be compared with and distinguished from vertical evolution. (2) Different examples of intra- and interspecific horizontal evolution will be given to show that horizontal evolution is quantitatively and qualitatively the most commonly occurring form of evolution throughout the history of life. (3) Finally, three examples are given of how a universal symbiogenesis principle can be implemented in the study of language origins and evolution, more specifically within: (a) the study of language variation, (b) language genes and (c) conceptual blending.

## 1. INTRODUCTION

The universal selectionist models (Campbell, 1959, 1960, 1974, 1977, 1987; Cziko, 1995; Hull et al., 2001), universal Darwinism (Dawkins, 1983) or philosophical Darwinism (Munz, 2001) developed by evolutionary epistemologists, are all based upon the evolution of genes by natural selection.

These theories, although they are very useful to study the evolution of animals, are not adequate to study phenomena such as language or culture. Language and culture do not follow rigid evolutionary schemes analogous to the evolution of genes, rather they have their own peculiarities that need to be studied in their own right.

To begin with, it is difficult to pinpoint one unit and one level of selection, because languages and cultures can take on many forms. Languages are the result of many different elements that are combined: speech, thinking, grammar,

semantics, sensory-motor actions, memory, (co-verbal) gesturing, language rules and language games. And in the case of culture, there is the individual that adheres to different (sometimes contradictory) views, that are categorized by a brain; there is the interaction with significant others within a community; and there are cultural artefacts that need to be taken into consideration.

These peculiarities, however, can also be formalized, analogous to different evolutionary theories, one of the most important being symbiogenesis. Ruse (1985) already pointed out that we have to take Darwin seriously, meaning, amongst other things, that our cognitive capacities such as language and culture need to be studied as a product of Darwinian evolution. However, here it will be argued that we should also take symbiogenesis seriously.

Symbiogenesis is a form of horizontal evolution and it will be argued that horizontal evolution is quantitatively and qualitatively the most commonly occurring form of evolution throughout life's history. Evolution by natural selection is a form of evolution that, during and within the evolution of life, only plays a minor role within the evolution of animals.

Given this minor role that natural selection plays within evolution, it is too short-sighted to only develop general normative frameworks based upon Neo-Darwinian theory to study all of life's phenomena. First of all, it is bad science because it neglects all other evolutionary theories that provide adequate and scientific explanations regarding certain phenomena. Secondly, this unnecessarily narrows down the options of linguists and anthropologists, leading to today widely defended views that naturalistic approaches cannot adequately address culture or language, because the, on biology-based, theories of language and culture that are introduced by evolutionary epistemologists, supposedly cannot account for a diversity of research topics within language and culture (e.g. recursivity, creativity, religion, arbitrary rituals and so on).

Here a much more optimistic view is given. The above-mentioned criticisms should not be regarded as negative, but as positive. For where natural selection, or where EE(M)-models (Gontier, this volume) based upon natural selection fail, it is not necessary to abandon a naturalistic approach altogether. We can turn to other evolutionary frameworks, such as symbiogenesis, that *can* deal with, and formalize, these phenomena.

First, horizontal evolution is distinguished from vertical evolution. Secondly, it is shown how both evolutionary concepts are being applied within the study of language. Thirdly, symbiogenesis is universalized and it is shown how we can apply this normative framework to the study of phenomena such as language variation and evolution, language genes and conceptual blending.

## 2. HORIZONTAL VERSUS VERTICAL EVOLUTION

Contrary to received wisdom, horizontal evolution processes occur quantitatively and qualitatively more often than vertical evolutionary processes. We will start off by defining our concepts.

### 2.1. *Vertical Evolution*<sup>1</sup>

Vertical evolution is evolution as we have all learned it at school: it is evolution by natural selection. Neo-Darwinian theory (Ayala, 1978; Mayr, 1978, 1983; Dawkins, 1983, 1984, 2000; Dennett, 1995; Gould, 1980, 1982, 1991; Maynard Smith, 1993) adheres to the view that *only* speciation leads to the evolution of new species.

To give only one standard example of how this speciation takes place, let us look into ‘allopatric speciation by peripheric isolation’. This catchy phrase refers to the following scenario. A subgroup of a population of a certain species gets isolated from the main group (by the eruption of a volcano that burns the ground, leading to the subgroup not crossing this land even if the ground is cooled of, because they do not recognize it as their territory or niche; or by another geographical barrier, such as water because of floods). Given that this isolation takes a very long time, it is possible that one or several random mutations occur and spread within the subgroup. Again, given enough time, should the subgroup and the main group meet again, it could be that these different groups cannot fertilize each other or cannot produce fertile offspring, while members of the same group can produce fertile offspring. If the latter is the case, then we have a new species. Actual examples of allopatric speciation by peripheric isolation have only been reported a couple of times.

Processes like allopatric speciation by peripheric isolation, together with other such processes (for example species-mate-recognition patterns,<sup>2</sup> see for instance Schwartz, 1999) lead, randomly, to the evolution of new species by speciation: new species evolve out of and split off from older, sometimes still existing species. Hence a family tree with a branching pattern is regarded as

<sup>1</sup> What is being argued here might seem trivial but it is not. Most non-biologically schooled scholars think that evolutionary biology is simple, it is not. Evolution in some cultures today is part of a way of life, of a philosophical understanding of the world, leading to the idea that everybody knows what evolution is about and that evolution is easily comprehensible. Again, it is not.

<sup>2</sup> Recognizing that someone belongs to the same species and that this organism is of the opposite sex and hence a potential mate.

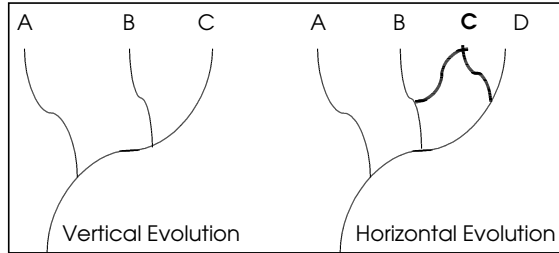


Figure 1. Vertical evolution follows a typical branching pattern: different lineages cannot cross, nor blend, while in the case of horizontal evolution, different lineages can cross.

the most suitable way of iconizing vertical evolution (Figure 1).<sup>3</sup> This is what Darwin talked about: species are not static entities; they evolve out of each other by speciation.

Neo-Darwinian theory, more specifically Ernst Mayr, later on introduced the term allopatric speciation by peripheric isolation. Neo-Darwinian theory also added Mendelian hereditary laws, genes, mutations and mathematics to this speciation concept (Gontier, 2004) to answer the following question: what happens during vertical evolution?

The answer to that question is: *existing or new characteristics are retained by inheritance (genetically) and spread throughout the population across time, from generation to generation, sometimes leading to speciation or extinction.*

Actually, today, we would not say that it is characteristics, but genes that are retained and inherited by recombination. This is because we do not quite know how genes encode for characteristics (all they seem to encode for are amino acids that form proteins that form tissue). The point is, however, that it is presumed that genes, in a yet to be explained manner, encode for certain characteristics of an animal, and that these genes need to be inherited from one generation to the next, in a vertical fashion.

<sup>3</sup> Gould (1984, 1991) already emphasized from within Neodarwinian theory that this iconicity however is not suitable to explain evolution, because vertical evolution implies that there is one common point of departure (and beginning) and from there, the tree diversifies, the idea being that the maximal diversification lies at the end of the tree, comparable with a Christmas tree turned upside down. However, he showed that the maximal diversity lies not at the end of the tree of life, but somewhere in the middle. After the Cambrian explosion, there was a decimation of most phylogenetic branches. Only the few phylogenetic branches that did survive this decimation show an enormous diversification within these different phylogenies. There are few branches (body designs), but lots of twigs on these branches (species with a certain body plan), a process that he characterizes as early experimentation and later standardization.

Again, we need to be more cautious with our definition: vertical evolution at the animal level implies that two members of the same species, of the opposite sexes, mate, and that during this mating process, one sex cell from each parent merges with the other to form a fertilized cell, from whereupon an embryo develops. So half of the genes of the mother and half of the genes of the father are recombined in a fertilized egg cell (as we shall see under Section 2.2.1, this is not totally correct either).

Vertical here has two meanings: (1) half of the genes of the parents are passed on to the next generation; (2) only those characteristics that are somehow genetically encoded for in the individual *can* possibly get passed on to the next generation. If they are passed on, these genes and hence the characteristics are retained in the next generation.

The more a gene is retained within the next generation through time, because the carrier is fit and hence able to reproduce, the more it is spread throughout the population in general and the more it can get fixed within a species. P1 gives the gene to offspring F1,<sup>4</sup> who mates with x, and passes the gene on to their offspring and these in turn have offspring with y and z and pass the gene on to their offspring. Hence an existing gene will spread throughout a population, which does not necessarily lead to the evolution (by speciation) of a new species.

Sometimes a gene undergoes a random mutation. If this mutated gene is to be passed on to the next generation, a few conditions are given by Neo-Darwinian theory. The mutation *can* (possibly, not necessarily) only be passed on to the next generation, if the mutation occurs in one of the sex cells and if this sex cell (a sperm or an egg cell) is used during reproduction to form a zygote.

This means that the organism with the mutation has to be able to reproduce itself. It can only reproduce itself if it is able to survive long enough to find a mate, and it can only find a mate if the two parents recognize each other as potential mates. Hence we find the introduction of concepts such as adaptation (to the environment in order to survive long enough) and fitness (to be able to reproduce itself at a maximal rate), concepts that all too often are intertwined.

So Neo-Darwinian theory basically studies two processes: (1) the recombination of genetic material at the level of the sex cells (meiotic recombination); and (2) the possible occurrence of genetic mutations at the level of these sex cells, because if advantageous to the individual and passed on to the next generation, the mutations possibly lead to new species (Gontier, 2004).

Vertical evolution though, is primarily a zoological concept that can only be applied to a certain degree to animal evolution. Most Neo-Darwinians are zoologists as well.

<sup>4</sup> P (parentes) is the symbol for parents and F (filius) is the symbol for offspring. The number after the symbol indicates the number of generations.

## 2.2. Horizontal Evolution

Horizontal evolution (Figure 1) is evolution through symbiogenesis (Section 2.2.1) or hybridization (Section 2.2.2) but it can also occur at the inter- and intraspecific level of animal evolution (Section 2.2.3). Two general definitions can be given:

- (1) *Horizontal evolution is the coming together and merging of existing and independently evolved evolutionary lineages* (we will return to this definition under Sections 2.2.1–2.2.3).
- (2) *Horizontal evolution happens when existing characteristics are retained and spread out geographically within members of a population (and across generations through time).*

The second general definition of what horizontal evolution is about resembles the definition of vertical evolution, but there is a difference: only *existing* characteristics are retained and spread throughout a population. Neo-Darwinians do not explain this phenomenon of horizontal evolution as a form of evolution, rather they regard the process of passing on already existing genes as part of *variation*. The more variation, the less genes are held in common within members of the same species; the less variation, the more genes are ‘fixed’ within a population and hence are regarded as (linked to) typical traits of that population.

As mentioned above, the Modern Synthesis focuses on two steps: the sex cells, where genes possibly are passed on from one generation to the next, and possible random mutations that occur within these genes. Hence the popular idea put forward by Neo-Darwinians that animals pass on their *genes* from one generation to the next (Gontier, 2004).

This is not true: animals do not pass on their genes from one generation to the next, they pass on their *sex cells* (that contain genes) from one generation to the next, and here a horizontal element is involved: namely, two members of the same species, of the opposite sexes, mate and if all goes well a sperm cell penetrates an egg cell, resulting in the formation of a cell with diploid chromosomes.

“Zoologists, those who professionally study animals, have imposed a distinct concept of species, which they call the ‘biological species concept’. Coyotes and dogs in nature do not mate to produce fully fertile offspring. They are ‘reproductively isolated’. The *zoological definition of species refers to organisms that can hybridize* that can mate and produce fertile offspring. Thus organisms that interbreed (like people, or like bulls and cows) belong to the same species. Botanists, who study plants, also find this definition useful (Margulis and Sagan, 2002: 4–5, my emphasis).”

There is more to it than a mere definition process. This crucial horizontal step is taken for granted and even ignored by Neo-Darwinian theory, because of their focus on genes. Every mating process, however, is a crucial horizontal (temporary merging) process of the parents, and every fertilization is a permanent merging and recombining of different cells that contain (mostly already existing) genes.

Since it mostly only involves the passing on or recombining of existing genes, I prefer to call this a form of horizontal evolution contrary to regarding this as part of the process of individual variation that occurs because of vertical genetic recombinations without there actually being vertical evolution (because no species evolves or goes extinct). Vertical evolution carries connotations of speciation, mutations (the introduction of new genetic material) and branching, which leads to the idea that all animals that belong to the same species, carry the same genes and that these genes are the essential characteristics of that species.

Horizontal evolution emphasizes the coming together and spreading of already existing genetic material and involves a process worth studying on its own. Only *prokaryotes* (bacteria, viruses) are able to pass on their genes, immediately and directly, within one generation or from one generation to the next. Bacteria, who happen to bump into each other, can exchange and donate genetic material: they form a bridge (literally, made from proteins) and exchange genetic material in a direct way. A process that can be understood by the following analogy:

Imagine that in a coffee house you brush up against a guy with green hair. In so doing, you acquire that part of his genetic endowment, along with perhaps a few more novel items. Not only can you now transmit the gene for green hair to your children, but you yourself leave the coffee shop with green hair. Bacteria indulge in this sort of casual, quick gene acquisition all the time. Bathing, they release their genes into the surrounding liquid. If the standard definition of species, a group of organisms that interbreed only among themselves, is applied to bacteria, then all bacteria belong worldwide to a single species. (Margulis and Sagan, 2000: 93)

In contrast, all *eukaryotic* organisms (protists, plants, animals and fungi) pass on their sex cells (with genetic material) from one generation to the next.

### 2.2.1. *Horizontal evolution by symbiogenesis*

Although Darwin entitled his magnum opus *On the Origin of Species*, the appearance of new species is scarcely even discussed in his book. Symbiosis [. . .] is crucial to an understanding of evolutionary novelty and the origin of species. Indeed, I believe the idea of species itself requires

symbiosis. Bacteria do not have species. No species existed before bacteria merged to form larger cells including ancestors to both plants and animals. [. . .] [L]ong-standing symbiosis led first to the evolution of complex cells with nuclei and from there on to other organisms such as fungi, plants, and animals. (Margulis, 1999: 8)

As Margulis (1999; Margulis and Sagan, 2000, 2002) shows, all life can be divided into organisms with two basic cell types: prokaryotic organisms and eukaryotic organisms. Prokaryotes are all (Archae) bacteria (the first kingdom), quantitatively the most common form of life. Typical of these bacteria is the fact that they carry genetic material in their cells and that these genes encode for the proteins present in these cells. However, this genetic material is not organized on chromosomes, nor is it encapsulated within a nucleus. As said, these bacteria can exchange genetic material freely in a horizontal fashion.

Eukaryotes are all organisms that are part of the other four kingdoms of life: protists, animals, plants and fungi (mushrooms and yeast). The cells that make up these eukaryotic organisms, all contain genetic material that is organized on chromosomes, and encapsulated in a protecting nucleus. Animals, plants and fungi cells, beside their nucleus, also contain organelles, little bodies in the cell that are enclosed by their own membrane, and contain their own genetic material. What is interesting about this genetic material is that, when compared with the genetic material from the nucleus, it shows little to no resemblance to it. However, when the genetic material that is present in all organelles of eukaryotic cells is compared with the genetic material of today's independently existing bacteria (that is, prokaryotes) they show a very high resemblance, so high, that we have to conclude that the organelles that are part of all eukaryotic cells, used to be bacteria that lived independently. Somehow, 2 billion years ago, bacteria merged: instead of just exchanging genetic material, whole bodies fused together, they penetrated each other and literally started living in each other, as a form of permanent parasitism. These merged beings evolved into protists and multicellular organisms, ending with the evolution of the fungi, plant and animal kingdoms (Figure 2). And, the types of bacteria that fused, still exist today, on their own, thereby excluding any deterministic process: the mergings that occurred, occurred randomly, otherwise we would not see members of these different types alive and on their own today. Bacteria fused literally, by cannibalism or enforced parasitism.

Another interesting aspect of these organelles is that they are passed on from one generation to the next, in a non-Mendelian fashion. Only eggs contain mitochondria or chloroplasts, sperm cells lack these. So every eukaryotic organism, male or female, receives its organelles with their specific genetic



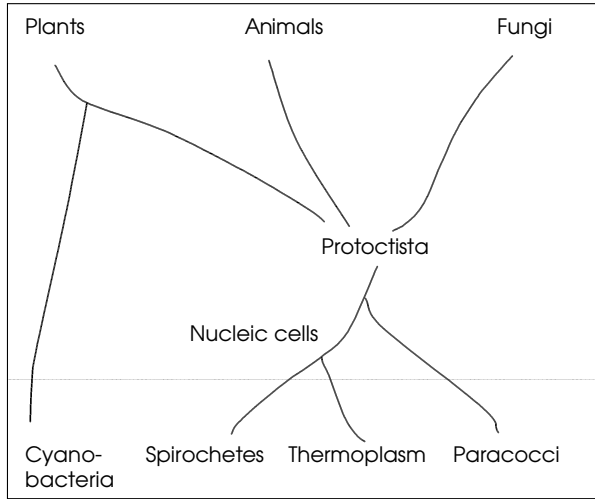


Figure 2. The symbiotic mergers that took place between different prokaryotic organisms (all bacteria beneath the dotted line) that lead to the evolution of eukaryotic organisms (everything above the dotted line). Important are the evolutionary lineages, that instead of forming a splitting pattern, merge (based on Margulis, 1999:41).

material, from the mother. It is hence not true that we receive half of our genetic material from our mother and half of our father.<sup>5</sup>

According to Margulis' theory, we can only talk about 'species' at the level of eukaryotic organisms, where cell fusions are the driving forces of evolution, while bacteria can't be distinguished into species, rather they are classified into different types (that belong to one single species). Mitosis and meiosis always occurs at the level of the cell or between cells. Hence according to Margulis' view, all eukaryotic evolution, even today, during the reproduction of organisms belonging to these four eukaryotic kingdoms, requires a certain form of symbiogenesis. Therefore, this horizontal process needs to be distinguished from a vertical evolution process.

### 2.2.2. Horizontal evolution by plant hybridization

Plant hybridization is another form of horizontal symbiotic evolution and plants also by far outnumber animals. Plant species that evolved independently from one another can cross-fertilize and produce fertile offspring. This is not a mere vertical process either because what we call incest is a

<sup>5</sup> Exactly because of this can we trace evolutionary lineages by studying Mitochondrial DNA that is only passed on by the mother. The Y-chromosome, on the other hand, is only passed on by the father.



Figure 3. A hypothetical example of how hybridization within plants occurs.

rather common phenomena in hybridizing plants. P1 can be the result of the hybridization of two different plants species, and F1 hybrids can possibly cross-fertilize again with P1. Hybridization can also occur when for instance these F1 hybrids cross-fertilize with yet another plant species and their offspring, for the sake of argument, called F2 hybrids (although they are F1 hybrids of the crossings of F1 with yet another species) and these F2 hybrids can potentially cross-fertilize with P1 or F1 (Figure 3). It is a common thing in plants and indeed these symbiotic mergers are also a form of symbiogenesis, because they always involve the fertilization of whole cells, not merely or solely the passing on of genes.

### 2.2.3. Inter- and intraspecific horizontal evolution

Bacteria today still donate genes regularly. That is why for instance certain infectious bacteria become immune to antibiotics. Even if bacteria die from a certain antibiotic, suppose that they develop a resistant gene, bacteria that are alive can snap these genes from those dead bacteria.

Horizontal evolution however does not only occur at the prokaryotic level or within the evolution of eukaryotic plants. It can also occur at the intra- and interspecific level within the evolution of eukaryotic life in general, also within the evolution of animals.

SARS (Severe Acute Respiratory Syndrome)-, HIV- and Ebola-viruses for instance (Kahn, 2004) are viruses that are passed on not only between members of the same species (intraspecifically) but also between members of different species (interspecifically).

The recently evolved SARS-virus is a virus that humans caught as a result of eating or being around the masked palm civet, a cat-sized animal. SARS is a variant of a common corona-virus of these masked palm civets. Once one human catches this virus, it can spread very rapidly within the human population at an intra-specific level. It can also be passed on from one generation to the next, not because the virus contaminates the sex cells. Rather this occurs because when there is no external intervention like putting contaminated

individuals in quarantine, the population as a whole ‘carries’ the virus. New-born babies can catch the disease because their grandparents have it, or grandparents can catch the disease because their grandchildren have it.

The same goes for the HIV-virus which humans caught eating the brains of primates, and primates in turn got the virus eating monkey brains that were infected with the SIV-virus. “*HIV itself has been isolated from common chimpanzees, which are believed to be the original source of the AIDS pandemic after hunters killed and ate them. Ironically, [...] chimpanzees acquired their SIV from monkeys they killed and eaten.*” (Kahn, 2004: 58). Once the HIV-virus developed and was passed on interspecifically, it remains in a population, because it is passed on intraspecifically. And Ebola for instance, is now killing great apes, while humans eating these apes, can again infect the human population with Ebola.

Neo-Darwinians do not explain these phenomena as evolution because most viruses do not infect the sex cells and as mentioned above, the researchers only understand two processes to be relevant for the study of evolution: the genes that get passed on sexually, and how these get passed on (mutated or not).

However, ontogenetically, the HIV-virus can get passed on through the blood line (when for instance cutting the navel cord, or drinking the mother’s milk). Immunological processes of resistance against certain viruses, for instance, are also passed on through the mother’s milk. Infants who are breast-fed are more immune to the development of certain diseases that are caught by viruses or bacteria. This is because through the mother’s milk, children receive antibodies (indeed again whole cells) that the mother already made when she, for example, caught this year’s flu.

So intraspecifically, there is a lot more going on than the mere transmission of genetic material from one generation to the next because of sexual recombination. Viruses and bacteria which contain their own genetic material can also be passed on in a horizontal ontological fashion. Neo-Darwinian theory is not able to account for, or to formalize these sorts of evolution because of their excessive focus on the sex cells with the subsequent genetic variations and possible mutations.

These forms of contamination as said, can happen at the inter- and intraspecific level, but horizontal evolution, by means of cross-fertilization can also happen at the level of animals.

We of course all know the mule that is the result of cross-breeding with a donkey and a horse. However the mule is infertile and hence Neo-Darwinians define species as those individuals that, when mating with members of the opposite sex, can produce fertile offspring.

However, the Giant Panda (O’Brien and Menotti-Raymond, 1999) is also the result of cross-breeding between the brown bear and other bear species.

Their chromosomes reveal these crossings and most importantly, the Giant Panda is fertile. It is threatened with extinction (because of its vanishing niche but also perhaps because of this genetic load that the animal carries), but the Giant Panda is nevertheless up until this day, fertile.

Neo-Darwinian theory cannot cope with these different, everyday phenomena. Therefore, a horizontal evolutionary concept that can cope is absolutely necessary. That is not to say that Neo-Darwinian theory is wrong, far from it, all that is being said is that there are different phenomena going on within the evolution of life which can very optimistically be explained from within other evolutionary theories.

### **3. HORIZONTAL VERSUS VERTICAL EVOLUTION IN LANGUAGE RESEARCH**

Within the study of language (its origin, evolution and use), both evolutionary concepts are explicitly or implicitly put to use. Most especially a vertical evolution concept is used, explicitly within the study of language, while a horizontal evolution concept is used implicitly.

#### *3.1. Vertical Evolution and Language Research*

A vertical evolutionary concept can be distinguished within the disciplines of historical and theoretical linguistics, structuralism and within the Darwinization of language (Croft, 2002) and today takes on the form of the 'language-as-species metaphor' (Mufwene, 2001).

##### *3.1.1. Historical and theoretical linguistics*

Although historical and theoretical linguistics are separate disciplines today, both can be understood as part of, and the result of, the sociological systems theory movement described in Gontier (this volume), for they adhere to the view that language needs to be studied synchronically, as a closed, self-explaining and self-encapsulating system.

Language is understood as a static, unevolving entity (Croft, 2002: 75–78) which leads to the entification and reification of language. This essentialism in turn implicitly subscribes to the idea that there is only one (ideal) language or one (grammatical) language structure understood as a Platonic archetype which takes on different manifestations. So the idea arises that there is only one ideal language, that diversifies into different languages. Essentialist thinking is always about distinguishing the accidental from the essential. De Saussure for example developed his three laws. These state that the primary concern of linguistics is about coming to terms with the following three dichotomous

relations within language: (a) the relation between lexicon and grammar; (b) the relation between form and meaning and (c) the relation between *langue* and *parole*. These dichotomous relations indeed are instruments to distinguish the accidental from the essential and hence are used to discover the core of 'the' language. This has four major consequences:

- (1) Although language can have different manifestations (there are different languages belonging to different language families, there are dialects, and even child language is different from adult language), all these languages belong to the same 'universal' language, because all share the essential properties. The goal of linguistics, according to these theoretical linguists, is hence to distinguish the accidental from the essential and thus to answer the what-is-language question, thereby introducing a functionalistic approach.
- (2) Since all languages are different manifestations of one language, all languages are uniform, meaning that there is no directionality to language change (Newmeyer, 2003: 64). If there were directionality, language(s) would evolve and there would be 'lesser' and 'more' languages, but the essential, reified, ideal, universal language is, once evolved, evolutionless.
- (3) The principle of uniformity adhered to by theoretical and historical linguists, implicitly implies that, since all languages are essentially the same, but different because of contingent and arbitrary elements such as culture and so on, the essential properties of language transcend everyday language use, and indeed the individual itself, which again leads to an entification and reification of language *outside* an individual organism. This entified structure, which obeys laws of its own, and is not part of the individual members of the species, forms its own structures and behaves on its own.
- (4) So when we want to understand language evolution, we need to study this structure on its own, using, for example, the internal reconstruction method and search for the point where this one language started to diversify and have different manifestations, in other words: we need to search for 'the' proto-language, because this will show the essential properties of language.

This by no means implies that today historical linguists adhere to the idea that it is possible to reconstruct 'the' proto-language or that they believe that there was a proto-language from where all languages developed. Newmeyer (2003: 63) gives credible evidence for the fact that we do not know whether there is one language from where all languages developed, but then again we cannot prove that two languages are unrelated either.

And neither does this imply that these historical linguists themselves believe that their internal reconstruction or their use of the comparative method can

shed light on the origin of language (Newmeyer, 2003: 71–72). Nevertheless, answering the questions whether all languages share a common descent and whether this gives clues as to how language evolved, used to be one of the goals of historical linguistics, and these goals are the ones under review in this article, for biologists have interpreted them in different ways which has given rise to the general academic climate which will be discussed in the next section of this paper (under Sections 3.1.3 and 3.2).

### 3.1.2. Chomsky's linguistics

Structuralism evolved out of historical linguistics and here Chomsky (1965) makes his entrée. Chomsky's main goal was to criticize behaviourism which stated that language can be understood without entering the black box that our brain is. Chomsky never denied that we need to understand language from within biology or cognition, on the contrary, this was his main goal. However, he denied that language needs to be studied diachronically, that is, amongst other disciplines making use of evolutionary biology. Because language was uniquely human, the evolution of non-linguistic species in itself could not help the study of human language.

Basically, developing de Saussure's ideas further, Chomsky distinguished between *competence* and *performance*, arguing that only the competence part is relevant for linguistics. This linguistic competence of individuals was believed to be universal: all human beings have access to a universal grammar, a language organ in the brain called the Language Acquisition Device (LAD). Because performance can vary greatly, competence is what needs attention. Therefore, he stated that: "*Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogenous speech-community, who knows its language perfectly.*" (Chomsky in Croft, 2002: 76)

And hence here too the primary concern of linguists is to distinguish the accidental from the essential, that is, to search for the proper functions of language and to answer the what-question: "*Hence the logically prior task of elucidating precisely what evolved has taken research priority over elucidating how it evolved.*" (Newmeyer, 2003: 60).

Essentialistic thinking is always associated with asking the 'what-question' (Gontier, 2004). In a very real sense, it was Chomsky who brought the 'what-question' into (biological) linguistics. According to Plato, the archetypes which he talked about, were part of a transcendental reality. One of his students, Aristotle, internalized these archetypes in human and other beings and elements, saying that the 'ideal form' that the Platonic archetype is, is not part of a transcendental reality, but is potentially part of things. This potential needs to be actualized by a process of becoming. In exactly this way, did Chomsky internalize language, saying that the ideal form is part of the brain and that this potential only needs actualization. The point however, is that the actualization

process, is not a kind of evolution, it needs to be understood as a process of actualizing what was already inherently there (understood as an unfolding).

The result of this thinking is of course that language again gets reified and entified, language in its idealized form (the universal grammar of the LAD) once evolved does not evolve anymore and hence is essentially evolution-less. Different from his predecessors, Chomsky states that the ideal entified structure is not somewhere out there, rather it is part of the individual, for it forms an organ in the brain. Universal grammar is supposed to be part of the brain, where presumably a module is formed, where these universal grammatical structures are somehow stored, hot-wired, without these being able to undergo change.

Since natural selection does not work in a manner where something this complex can evolve all at once, without evolutionary intermediates, Chomsky denied any role to natural selection and assumed a qualitative emergent evolutionary step, leading, at one leap, to this language faculty.

It is, however, one thing to assume that we can deduce ideal grammatical structures or rules from a language, and quite another to adhere to the view that these structures actually are somehow part of our brain. We have not yet been able to localize one grammatical rule within that big brain of ours.

### 3.1.3. *Neo-Darwinism*

As we have seen, historical and theoretical linguists entified and reified language. Problem then was to locate this reified structure. Contrary to his predecessors, Chomsky localized the entified structure in the human brain, calling it the LAD that took on the form of a module. Basically, Chomsky hence internalized language and combined this view with the principle of uniformity: after all, the Universal Grammar present in all humans which forms the basis for the competence of these humans, is biologically the same. This in turn again implies that all languages share a 'common descent', for all language performances are manifestations of this ideal internal structure.

When battling against behaviourism, the next logical step was to replace instructionist models (that evolved out of behaviourism and stressed the relation between the language structure out there (in a community) and the learning of that structure by individuals) with selectionist models (where natural selection is internalized (Gontier, this volume)).

The first problem to be tackled when interested in a biological, evolutionary study of language is to search for evidence of common descent (in the true sense of the words), that is, to search for commonalities between different languages, and to investigate whether these commonalities are the result of random events, or whether they can be explained in a homologue fashion. *"A biologist interested in exploring the evolution of some structural property of some species will first of all avail himself or herself of the comparative method,*

*which involves the identification of homologues to the relevant property in the same species.*" (Newmeyer, 2003: 61).

What is common to all languages was already a problem posed by essentialist theoretical linguists, while what is homologous is a question studied by historical linguists. Although the above mentioned scientists never intended to use these theories when tackling questions about language origins, they nevertheless were interpreted in this way by different biologists.

Pinker and Bloom (1990) developed Chomsky's ideas further, thereby emphasizing the need for diachronic study of language as well. Their main objective is to synthesize Neo-Darwinian theory with modularity theory and the theory of generative grammar. Their idea: "*No single mutation or recombination could have led to an entire universal grammar, but it could have led a parent with an  $n$ -rule grammar to have an offspring with an  $n+1$  rule grammar, or a parent with an  $m$ -symbol rule to have an offspring with an  $m+1$  symbol rule.*" (Pinker and Bloom, 1990: 753)

This of course is obviously problematic: EE is being applied to fictitious models developed within historical, theoretical and structural linguistics. First of all, there is still no evidence of the existence of a universal grammar that statically is part of our brain. This is still only a hypothesis for we can neither pinpoint a module nor some part or neuron in the brain that contains a grammatical or all universal grammatical rules. It is of course useful to develop this idea further and to look into possible evidence for this theory, but it is another thing altogether to speculate upon a speculation or to assume upon an assumption.

The position taken by Pinker and Bloom is an evolutionary epistemological one: given that organisms evolved by natural selection, and given that certain organisms evolved language which is the result of brain activity and other elements, language itself probably evolved by natural selection and is to be understood as an algorithmic process. No problem up until now, what they take for granted, however, is that natural selection evolved a grammar module, as it evolved other modules (Cosmides and Tooby, 1994; Sperber, 1996) and that these modules are encoded for by genes. This is problematic, for it combines modularity theory, but no module up until this day has been found within the brain; it assumes that there are genes, that encode for such modules, but no gene that encodes for a module has been found; and it takes universal grammar for granted, although we have not been able to locate this either. All these speculations are useful for the development of scientific theories, but speculations alone cannot form the basis of a theory.

### *3.2. Problems and Shortcomings of a Vertical Evolution Concept in Language*

In the analysis above we fully see the merits of EE. EE is not a one-directional discipline that from within biology seeks to develop a normative framework



that can be put to use to study other evolutionary phenomena. It is, at a minimum, a two-way process, because difficulties or problems that are obvious in one discipline (for example linguistics), can point to a less obvious but analogical problem within other disciplines where one uses or obtains the general framework from (biology).

That a vertical evolution concept is being used by Pinker and Bloom is obvious, and it will be shown that historical linguists as well make use of such a concept. As Hull (2002: 18) observes: “*In the second half of the 19<sup>th</sup> century, some exchange took place between historical linguists and evolutionary biologists with respect to the methods that they used [...]*.” What is crucial is that both linguists and biologists use tree models to classify languages and species, and even more importantly: at the beginning these tree models were not used to portray historical sequences showing common descent, rather they were a-historical sequences of Platonic (and hence essentialist) archetypes. “*The transformation from archetypes to ancestors turned out to be much more complicated than anyone at the time expected. The transition is still far from complete. The Linnaean hierarchy was devised for a-temporal, abstract relations, not historical sequences.*” (Hull, 2002: 24) Theoretical linguistics implicitly took over these observations and methods from historical linguistics, when they implemented sociological, synchronic methods to study language.

The language-as-species metaphor is a direct result of essentialist thinking: languages are entified structures that are either part of the community, or part of the brain. They obey their own laws. Turner (this volume) already showed that the biological species concept is still basically essentialist. Hull (2002: 25) observes that “[...] *linguists can be found joining biologists to argue that languages are as much historical entities as are species [...]. They come into being, split, merge, go extinct, etc.*”

The definition of language given by Chomsky equals the way biology looks at ‘species’. Some members of a species are regarded as ideal representatives of the gene-pool (in technical terms called the ‘wild type’), and it is presumed that all organisms share essentially all important genes within a perfectly homogenous population. Hence within biology this is an essentialist view of species (Gontier, 2004; Turner, this volume) and species are still distinguished from one another by dividing accidental from essentialist properties. The wild type is an abstract concept and an objective measure to discover what the essential properties of a species are. All other organisms that are part of that species are regarded as varieties of that wild type.

The language-as-species metaphor (Mufwene, 2001) makes exactly the same mistakes as biologists make: adhering to the view that there is one (abstract) ideal type of language that equals a brain structure that is common to all humans and lies at the basis of the competence, while all acts of performance

are regarded as accidental variation, different manifestations from that ideal grammatical structure (the linguistic wild type).<sup>6</sup>

The family tree models used by historical linguists also emphasize speciation. These speciation models imply that at the origin of language, lies one language from wherein all other languages evolved. Just as in biology where it is generally presumed that life arose from one urcell, called the Last Common Ancestor (Gontier, 2004), so it is presumed that language evolved from one proto-language (Bickerton, 2002). Here one can take two directions: (a) One can either, within historical linguistics, try to reconstruct this proto-language, which is regarded as an idealized language, using the comparative and internal reconstruction methods or; (b) one can assume that this proto-language really existed, as biologically inspired scientists like Bickerton (2002) propose.

This idea, again just as in biology, leads to the assumption that older organisms, or older languages, are less complex and hence more primitive than later developed organisms or languages. Hence ideas like the ladder of cone, where organisms are portrayed as evolving towards ever increasing complexity which is obviously false.

This in turn means that if older 'primitive' or 'first' languages are viewed as less evolved, than younger languages are less complex: therefore, Pidgin and Creole languages or child language (Aitchison, 1995) for that matter are explained as a form of proto-language comparable with the first languages ever spoken by human beings.

In other words, these ideas contradict the principle of uniformity which states that all human languages are equally complex. A way out of this is found when one assumes that proto-language differs from human language, because proto-language is not human-bound, rather it is presumed to be a characteristic of the *Homo Habilis*, *Erectus* and *Neanderthalensis* (Mellars, 1998; Bickerton, 2002).

An essentialist view of languages, or species for that matter, implies that one needs to distinguish essential from accidental properties, which in turn leads, for example, to de Saussure who develops three laws to explain what is essential to language.

Languages and (as) species are thus regarded as static entities that cannot mix nor influence each other because they follow rigid evolutionary lines. Language mixing or hybridization cannot be explained using speciation models

<sup>6</sup> The term 'manifestations' here is to be taken literally. Although I cannot go into this argument any further, mutations, 'quasi-species', are always mutations from the wild type: because the wild type is the dominant genetic sequence in a population, and hence the most reproductively successful, it accidentally mutates the most (just the law of great numbers here), mutations always resemble the wild type, and hence are different manifestation of that wild type (Gontier, 2004).

alone, a point also mentioned by Hull (2002: 19): “*The metaphor of a tree of life seems just right for both species and languages, but it can also be misleading. As trees are commonly depicted, they are totally a matter of splitting, splitting and more splitting. Merger never takes place.*”

Hence species or languages ‘die’ when essential characteristics disappear, and are replaced: it is stated that these species or languages go extinct, rather than that they evolved into something new, with different properties. What evolved is regarded to be a totally new language or species.

Turning to the Darwinization of linguistics, again we encounter problems. Today Neo-Darwinian theory tends to reduce the evolutionary process to the process of adaptation. Adaptation strictu sensu means: being able to survive in an environment long enough to reproduce. The emphasis here lies on the survival part. Later on, with the development of the Modern Synthesis, adaptation was defined as being able to reproduce fertile offspring, which in turn was narrowed down to being able to reproduce at maximal speed (fitness). Hence adaptation and fitness today are almost synonymous. More so, the ‘being able to reproduce’ part which still assumes organisms who reproduce today is being replaced with the idea that being adaptive is being able to pass on his/her genes to the next generation, or more abstractly in the gene pool, at a maximum rate (Gontier, 2004).

Popular biological scientists such as Dawkins for instance, also introduce theological elements into evolutionary biology, although they claim to do the contrary. Just as Chomsky introduced functionalistic, Aristotelian methodology into linguistics, Dawkins introduces Aristotelian thinking into biology. Dawkins (2000) defends the idea that it is the task of every biologist to answer the question of why organisms show design. Here it is presumed that there is such thing in nature as design: hands are for grasping, eyes are for seeing, legs are for walking, . . . . Methodologically, when searching for design features, we need to answer the question of what a certain characteristic is for. The whole point, however, is that in Aristotle’s philosophy, the ‘what’-question and the ‘what for’ question are related (Gontier, 2004). Answering the ‘what’-question is equal to distinguishing between the essential and the accidental and hence equal to defining the proper functions. Since in Aristotle’s philosophy, every final form is potentially present—it just needs to be actualized by a working agent (related to the how question)—the ‘what for’-question is related to the ‘what’-question. The ‘essence’ of a thing or organism (what is it, what is the function) is the same as its ‘final goal’ (what is it for).

So when introducing the what-for question, we need an answer to the what question, and when both question are combined, a teleological point of view is taken.

Given this, let us take Dawkins’ argument a bit further: are hands also made for colouring, for typing, are our mouths and vocal cord and tongue made for

shouting (anti)-governmental slogans? Obviously a category mistake is being made here.

In evolutionary biology the ‘how’-question is and should also be the most important question raised, instead of trying to give functionalistic accounts based upon concepts like adaptivity with respect to what language evolved for. Needless to say, there are numerous accounts of maladaptive and neutral characteristics of animals (Kimura, 1976; Gould, 1980; Gould and Vrba, 1982). Since we do not know how most things evolved, how can we even begin to answer the question of *why* they evolved, particularly, in a scientific and non-speculative manner? Neo-Darwinians have worked long and hard as well as fruitfully to ban all kinds of theological/teleological thinking within biology. Why on earth should we undo this job?

Pinker and Bloom follow the same road pointed out by Dawkins: language shows design and, therefore, it should have and must have evolved by natural selection, because somehow natural selection gets understood as the designer: the blind watchmaker (Dawkins, 2000). Since natural selection works slowly, grammar (under which form exactly: a module, a gene, an inherited brain structure, is not clear in their work) evolved stepwise as well, leading to a child with an  $n + 1$  grammar rule, while his parents got stuck with an  $n$  rule grammar. How can this advanced and more complex child make itself comprehensible to his less complex parents?

### 3.3. *Horizontal Evolution and Language Research*

As mentioned in Gontier (this volume), EE is about developing a normative framework, based upon evolutionary thinking that can explain all of phylogenetic evolution, but also all of ontogenetic evolution. EE studies the cognitive capacities of organisms from within evolutionary biology (Bradie’s and Harms’ (2001) EEM programme) and it studies how theoretic evolutionary models can be put to use to study the products of these cognitive capacities such as language and culture (Bradie’s and Harms’ (2001) EET programme).

#### 3.3.1. *Taking Darwin seriously, EE and universal selection mechanisms*

In practice this means that EE gets reduced to finding mechanisms and universal frameworks analogous to Neo-Darwinian thinking. The blind–variation–selective–retention scheme of Campbell (1987), the generate–test–regenerate scheme of Plotkin (1995), the replication–variation–environmental interaction scheme introduced by Hull (see Hull et al., 2001, for the most up to date account), all base their universal schemes upon the evolution of genes by natural selection.

Blind variation refers to the random mutations genes can undergo which leads to variation; the selective retention phase is about the selection of the advantageous random mutations that are heritably retained and spread within the species through time. The same goes for Plotkin's scheme: the genetic material that is generated in the next generation because of sexual reproduction (mutated or not) needs to be tested (by the environment) in order to see whether they are suited for that environment: If the organism carrying these genes is able to survive long enough to reproduce; through reproduction, the genes are regenerated. Hull emphasizes that the level where natural selection acts is the environment which interacts with a phenotype, instead of a replicator (a selfish gene); Plotkin emphasizes the randomness of the testing phase; and Campbell emphasizes the need for retention. However, all these researchers base their models upon the evolution of genetic material by natural selection and extrapolate from hereon to processes like science, culture or language.

So all of them take Darwin seriously, or to be more precise: they take Ruse (1985) seriously, who states that we should take Darwin seriously, although Darwin himself has little to do with Neo-Darwinian theory (Gontier, 2004). Darwin talked about gemules that can blend, while Neo-Darwinians talk about genes that are impenetrable.

These frameworks surely have their merits, and have helped different disciplines within biology and also throughout the study of complex phenomena within the life sciences; there is no question about that.

Croft (2000), for example, is the first one to actually use one of these normative frameworks introduced by evolutionary epistemologists. He develops a framework of language variation using Hull's replication-variation-environmental interaction scheme. The replicator (the unit of selection) is his view is the *lingueme*: grammatical structures that are replicated in the utterances of people. Variation arises because of phonological and semantic differences that occur in these utterances; and the environmental interaction (the level of selection) refers to the population of utterances (analogous to the gene pool) of people which interact with other such utterances within a language community.

The merit of Croft is that he takes the individual organism as the actor: language is not part of some superorganic structure, it is not out there in the community: language is part of a human being who in his utterances produces grammatical structures.

However, here arise two problems: although Croft is a fearsome critic of Chomskyan linguistics, he does not seem to be able to completely abandon Chomsky's view on language: the universal grammatical rules are unchangeable, perfectly and idealistically part of a brain, and these structures are

replicated in an imperfect way within the utterances of individuals. So here he is ambivalent, not using Chomsky while he is using his ideas.

Another problem arises with respect to his idea of a lingueme pool that is analogous to a gene pool, an ambivalence that can also be read in the works of Hull where Croft obtains his evolutionary framework from: although the level of selection is the environment and the unit of selection is the entire organism, that through his genes that make up a phenotype interacts with that environment, ultimately genes or linguemes are all that counts.

Because of these extraordinary developments and the progress made within EE, the time has come to go one step further and to apply evolutionary thinking there where even natural selection, that has been so helpful, fails. Natural selection cannot explain all of life's phenomena (if it were able to do this, then and only then it would be unscientific, for a theory that can explain everything, explains nothing). As said in Gontier (this volume), it is difficult to apply these rigid schemes to language or culture, because it is difficult to pinpoint one unit or level of selection within the evolution of language and culture. Therefore, it is proposed in this article that a symbiogenetic view can complement the study of language from within Neo-Darwinian theory.

### 3.3.2. *Taking symbiogenesis seriously, EE and universal symbiogenesis*

Just as the above schemes are generalizations made from evolution by natural selection, so can we develop a general framework using symbiogenesis. Freeman Dyson (1998) was the first to develop a 'universal symbiogenesis theory' that he applied to the evolution of universes and stars, within cosmology. His definition, however, only needs a few adjustments (between brackets), to be useful for the purpose of this article: "*Universal symbiogenesis is the [re]attachment of two [or more] structures, after they have been detached from each other and have evolved along separate paths for a long time, so as to form a combined structure with behaviour not seen in the separate components.*" (Dyson, 1998: 121)

Symbiogenesis thus falls into place as a form of emergent evolution, known by the catchy phrase 'the whole is more than the sum of its parts'. Within universal symbiogenesis, different elements (neither numbered in advance, nor defined in advance, not implying that these elements need to be replicated faithfully, or have longevity or fecundity) that evolved along separate lines (after they got split off from each other or even when they never showed signs of common descent) somehow are combined and this new combination (a structure, element) has new properties, that cannot be reduced to the parts that form the new structure.

This universal symbiogenetic process can be implemented in the study of language evolution in at least three ways: in the study of language variation

(Section 4); language genes (Section 5) and within the study of conceptual blending (Section 6).

#### **4. UNIVERSAL SYMBIOGENESIS AND HORIZONTAL EVOLUTION PROCESSES OF LANGUAGE**

Implicitly, sociolinguistics (also called socio-historical linguistics) and anthropological linguistics use a horizontal symbiogenetic concept of language evolution. Sociolinguists and social anthropologists study language variation or language change within a community or a subpopulation of that community and most importantly, they focus on the performance level: they study language as it is actually used by real speakers (Croft, 2002).

They broaden the linguistic synchronic view that states that language can only be understood from within language, and use diachronic studies as well. Hence they contextualize language, using and searching for political, economical, social and cultural factors that influence, effect or even cause certain types of language behaviour.

Typical research topics include language contact, language borrowing, language mixing, language death, bi- and plurilingualism, personal and/or group attitudes towards certain forms of language use (see for instance Crystal, 2002; Nettle and Romaine, 2002; Thomason, 2001) and they find answers as to why these aspects are part of language. Explanations are not reduced to linguistic structures (for example the relations between lexicon and grammar), rather these elements are regarded as being influenced by warfare, trade, colonialism, hegemonic cultural factors, cultural or social markers.

Pidgin and Creole languages, in this view, are not comprehended as static manifestations of a proto-language, but as those languages that give us the best examples of how languages change and vary because of cultural, political, social and economic influences.

These processes are already well and often described by sociolinguists but we should also be able to explain these phenomena in the long run, and form predictions. Therefore, a normative framework is required and symbiogenesis can provide that framework.

First of all, the processes of language variation and language contact resemble the processes involved in contaminations of viruses or bacteria, that are at work at the level of the population. As said: most viruses do not infect the sex cells, but nevertheless stay 'alive' within the population from one generation to the next. During colonial times for example thousands of natives were killed because they got the measles from their Western colonizers. Those who survived grew resistant to these infections and now the measles are childhood diseases just as they are in Western countries. These are not

the result of genetic adaptations towards the measles. Viruses and bacteria do not form species, but are distinguishable into different types, so within this view there is no need for a language-as-species metaphor. Because when one regards language as a species, one gets into trouble relating this species in itself with the human species.

Secondly, language variation and language mixing also resemble plant hybridization processes. Croft, therefore, introduced the ‘plantish approach’ to language contact and language change: “*The zoöcentric view of phylogeny corresponds to the family tree model of language families in linguistics.*” (Croft, 2000: 196) “*In biology there are very similar phenomena to language contact once one leaves the animal kingdom, moving no further than to the plant kingdom.*” (Croft, 2000: 198)

Thirdly, as symbiogenesis can occur very rapidly (from one generation to the next: bacteria penetrated each other through cannibalism or enforced parasitism leading at once to eukaryotic beings), so language variation and language contact is something that can occur very rapidly within different members of the same population. The Creolization of Pidgin languages mostly happens very quickly, especially when children learn the Pidgin language as their first language (Bickerton, 2002); but when we for instance look at certain dialects or different uses of language as a result of different ages, we too find that they adhere to rapid changes: as a teenager it is popular to use ‘slang’. These teenagers also know how to use their language ‘properly’ and when they work on the weekend or go to school they use this proper form; while going out with their friends they use slang. New words get introduced very rapidly; who used the word computer before 1950 and who did not know this word after 1960?

Fourthly, Neo-Darwinian theory cannot cope with these different aspects of language variation or language change. That for instance [a] gets pronounced as [ae] by one subgroup and as [e] by another, would be comprehended as individual variation (as opposed to mutation that can introduce novelty: what would be translated to linguistics, the introduction of a whole new vowel).

The mechanisms at the base of language variation, however, can get comprehended as a form of horizontal evolution: just as bacteria can exchange genetic material freely within one generation, so languages can exchange grammatical structures, vowels, phonological elements freely. Languages, therefore, show more resemblance to bacterial types than to rigid species. We can leave a coffee shop saying we are going to a [pàrtee] instead of a party.

Freely of course has to be taken with a grain of salt: bacteria, even though they donate and receive genetic bacteria, cannot change from type (spirochetes will never become cyanobacteria). That is why it is important, not so much to study the potential, but the constraints of these organisms. The same goes for



language: rather than applying an adaptationist, functionalistic approach to language (the what-for question that automatically and teleologically directs itself to the future), one should study the constraints language has and ask how and when-questions that direct the quest to the past, which is more appropriate when studying origins and evolutions.

## 5. UNIVERSAL SYMBOGENESIS AND LANGUAGE GENES

Hurst et al. (1990) was the first to report on the KE-family, a British family where half of the family members suffer from a severe speech disorder (at that time diagnosed as articulatory dyspraxia) that affects their language skills. This pathology was later on diagnosed as Specific Language Impairment (SLI), because besides their overall orofacial and oromotor dyspraxia, the pathology of the affected KE-family members is also noticeable in nonverbal orofacial movements (Vargha-Khadem et al., 1995; Alcock et al., 2000), in their receptive language skills (Vargha-Khadem et al., 1995, 1998; Watkins et al., 2002) and in their brain structures (Vargha-Khadem, 1998; Liégeois, 2003).

In 2000, Lai et al. narrowed the search for the gene responsible down to a specific region on chromosome 7 called the SPCH1 region and finally the gene presumed responsible was identified, called the *FOXP2* gene (Forkhead Box, P2). Within the affected family members, this gene has undergone a point mutation (Lai et al., 2000; Lai et al., 2001).

The *FOXP2* gene is a regulatory gene that can be divided into two parts: one part contains a large polyglutamine tract; the other part contains a forkhead DNA binding domain, meaning that part of the gene produces helix-turn-helix proteins that are able to (dis)activate other genes, thereby influencing and regulating development.

Enard's team (2002) showed that the human *FOXP2* protein has undergone two amino acid sequence substitutes that occurred solely within the human lineage and are fixed within the human population. This fixation converges with the emergence of anatomically modern humans (presumed 200,000 years old) (Enard et al., 2002: 869–870). The *FOXP2* gene, however, is an old gene and is very well conserved throughout evolution: since the diversification between the lineages of the mouse and the lineage that would evolve humans, 70 million years ago, there has been only one amino acid substitution, which makes the *FOXP2* gene one of the 5% most conserved genes in evolution.

The *FOXP2* gene cannot, however, be called a specific language gene, because it is also activated during the development of the heart, the lungs and the gut, nor is it specifically human (given that language is uniquely human, one would assume that language genes would be as well).

This, however, is typical for regulatory genes. Regulatory genes differ from structural genes (genes that encode for proteins that make tissue that eventually leads to the formation of an organism) in that they produce proteins that return to the helix. These have the amazing property of being able to switch other genes on or off, thereby influencing development.

Regulatory genes were first discovered in 1975 by King and Wilson (1975). Ten years ago, a Homeobox of genes was found in our genome (Robertis et al., 1990; Melton, 1991; Wolpert, 1991, 1998; McGinnis and Kuziora, 1994; Gehring, 1998; Davidson, 2001). We share with almost all eukaryotic organisms a Homeobox of genes (called HOX genes) that regulates the development of our anatomical body plans. Even more interesting is that the same regulatory genes contribute to the development of different species, because of the (dis)activation, elongation of these genes, during different times at different regions during development. The same gene that for instance lies at the basis of the development of a radial symmetrical body plan (such as a sea star), also lies at the basis of bilateral symmetrical animals, such as humans (Schwartz, 1999; Gontier, 2004).

FOX genes, which the FOX2 gene is part of, differ from HOX genes because they are spread throughout the genome, but they share the functional properties of HOX genes, when it comes to switching other genes on or off.

These ontogenetic processes of gene activation or disactivation need to be comprehended from within a universal symbiotic and hence horizontal point of view, because different genes, after they have evolved in different ways, and were (dis)activated in different regions and periods during ontogeny and phylogeny, can start interacting in new ways, which can lead to the development of new structures and even new species. Hence contextualization and emergentism is what matters (Gontier, 2004), because the newly developed features are not reducible to the mere elements that make them up.<sup>7</sup>

Neo-Darwinian theory, which tries to explain vertical evolution using mathematical algorithms (Dennett, 1995) cannot explain these phenomena using merely these algorithms. An algorithm basically is a linear binary system combined with logic: if gene A is activated (1), then amino acid (a) is formed; if gene A is not activated (0) then amino acid (a) is not formed. Eventually we

<sup>7</sup> An observation also made by Adoutte in a somewhat different context: "The new molecular based phylogeny has several important implications. Foremost among them is the disappearance of "intermediate" taxa [...] *We have lost the hope, so common in older evolutionary reasoning, of reconstructing the morphology [...] through a scenario involving successive grades of increasing complexity based on the anatomy of extant "primitive" lineages.* [...] In this respect, the situation is not unlike the new perspective emerging on the phylogeny of eukaryotes as a whole, in which most of the formerly intermediate taxa have been pulled upwards." (Adoutte et al., 2000: 4455, my emphasis)

get a treelike top–down structure that tries to explain how genes encode for features. However, when we look at the activation or disactivation of different regulatory genes, a network develops, where, if some genes are activated during a certain period at a certain region within the individual, than other genes are switched on or off by proteins that are encoded for by these genes. How many proteins are produced depends upon the activation of certain genes, the locus and the time of development. Regulatory genes are characterized by their pleiotropic effects (Gehring, 1998) and these cannot get formalized using mere algorithms alone. At the very least, non-linear dynamics need to be interwoven with Boolean operators.

And even then it is difficult to formalize how genes encode for characteristics, because mostly a 1–1 correspondence between a gene and a trait is lacking. What we find is that genes act more like risk factors. Schrödinger (2000) already pointed out years ago, that genes do not encode for characteristics or behaviours.

It seems neither adequate nor possible to dissect into discrete ‘properties’ the pattern of an organism which is essentially a unity, a ‘whole’. [...] *What we locate in the chromosome is the seat of the difference.* (We call it, in technical language, a ‘locus’, or, if we think of the hypothetical material structure underlying it, a ‘gene’.) Difference of property, to my view is really the fundamental concept rather than property itself, notwithstanding the apparent linguistic and logical contradiction of this statement. The differences of properties actually are discrete, [...]. (Schrödinger, 2000: 28–29, my emphasis)

These differences cannot be explained using only Neo-Darwinian theory, a symbiogenetic view, however, can take this emergentism into account.

## 6. UNIVERSAL SYMBIOGENESIS AND CONCEPTUAL BLENDING

Finally, universal symbiogenesis can incorporate theories such as conceptual blending, developed by Fauconnier and Turner (2002). These scientists understand language as a singularity: there are no gradually evolved grammatical structures and there are no intermediate stages of language, not now, not ever. Language emerged. Emergentism, however, does not imply discontinuity.

They point to two fallacies: the Cause–Effect Isomorphism and the Function–Organ Isomorphism (Fauconnier and Turner, 2002: 175–176). The Cause–Effect Isomorphism is the fallacious idea, widely defended by scholars, that given that the effect is amazing (in this case language), the cause has to be something extraordinary as well.

However, when we look at the development and evolution of regulatory genes, this need not be the case. Far from it: the development of an eye for example is the result of one gene (the PAX6 gene) that switches on 2500 other genes that make an eye. If this gene is not activated, eye development is not triggered (Gehring, 1998). The (dis)activation of this gene, however, is only a tiny step in the process.

The second fallacy put forward by Fauconnier and Turner is the Function-Organ Isomorphism: the idea that with the development of every new function, a new organ is involved. This idea dates back to Aristotle, and is also subscribed to by Chomsky, who presumes the existence of a language organ in the brain. However, nature gives numerous accounts of organs losing functions or gaining new functions (Gould and Vrba, 1982). Hence Fauconnier and Turner (2002: 177) point out that: “*Language is not an organ. The brain is the organ, and language is just a function subserved by it, with the help of various other organs. Language is the surface manifestation of a capacity.*”

This capacity, according to their view, is conceptual blending (the use of metaphorical or analogical thinking) and language is regarded as just one of the products of this blending capacity.

Here again, we encounter a problem because they adhere to the view that there is a deeper lying, once evolved, unchangeable structure in the brain that has different manifestations, some of these structures emerging through blending. So Fauconnier and Turner too cannot seem to transcend a mere essentialist/potentialist view.

However, conceptual blending can also be understood as a form of symbiogenesis, so therefore, I have redefined conceptual blending just to show how symbiotic this view really is: *Conceptual blending is the combining of two or more conceptual frames that results in a new conceptual frame with meaning not seen in the different components.*

It is important to note that in this definition, the components themselves are not static, unchangeable entities.

## 7. CONCLUSION

Universal symbiogenesis can be regarded as a complementation of Neo-Darwinian theory, because it can (at the least) integrate the following:

- (1) Horizontal evolution, as different from vertical evolution, can be put to use to explain language variation and language change, phenomena already well described by sociolinguistics. However, we also need to be able to explain these phenomena and, therefore, a normative framework is urgently needed.

- (2) It can explain ontogenetic and phylogenetic processes concerning regulatory genes such as the FOXP2 gene, by analogy, because the same genes, put in a different context and forming different interactions, lead to new emergent properties.
- (3) It can explain cognitive evolutions such as conceptual blending crucial to language, because symbiogenesis can provide a framework to explain these emergent processes that are the result of blending of conceptual frameworks.

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