

Uexküll, Peirce, and Other Affinities Between Biosemiotics and Biolinguistics

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Abstract The purpose of this paper is to describe some parallels and theoretical affinities between biosemiotics and biolinguistics. In particular, this paper examines the importance of Uexküll's *Umwelt* and Peircean *abduction* as foundational concepts for Sebeok's biosemiotics and Chomsky's biolinguistic program. Other affinities touched upon in this paper include references to concepts articulated by Immanuel Kant, Konrad Lorenz, Marcel Florkin, François Jacob, C.H. Waddington, D'Arcy Thomson and Ernst Haeckel. While both programs share theoretical influences and historiographical parallels in their mid-century origins continuing throughout the late twentieth century, recent articulations of biosemiotics and biolinguistics privilege different intellectual styles and methods of inquiry that define their future objectives as intellectual movements. The goal of this paper is to show that, in spite of the different scholarly agendas of biosemiotics and biolinguistics, both movements share a theoretical and philosophical core in Peirce and Uexküll.

Keywords Biosemiotics · Biolinguistics · Sebeok · Chomsky · *Umwelt* · Abduction

Linguistics proper is far from me — but I am convinced that you are on the right path towards making it a biological science.

Jakob von Uexküll¹

¹Kull (2001:3) quoted Uexküll writing this in a letter to the linguist Heinrich Junker.

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Introduction

Biosemiotics and Biolinguistics as intellectual movements owe their origin and development to the professional lives of their principal proponents, Thomas Sebeok (1920–2001) and Chomsky (1928–). As linguists, they moved beyond the mid-century structuralist paradigm to explore new theoretical paths for the study of language and thought. Both Sebeok and Chomsky viewed the field of linguistics as a branch of biology, even though they practiced that view within different theoretical frameworks.

Chomsky initiated the *cognitive revolution* of the late 1950's to overcome the behaviorist paradigm and developed his *philosophical grammar* based on the notion that the human language faculty depends on innate capacities. He placed himself in the rationalist tradition early on, revisiting classical questions he considered unresolved since the seventeenth century.

Sebeok moved from the field of Finno-Ugric Studies to semiotics to explore the signifying abilities of all organisms to promote the view that all life depends on semiosis. As Marcel Danesi wrote in his obituary for Sebeok, ‘he uprooted semiotics from the philosophical, linguistic, and hermeneutic terrain in which it has been cultivated for centuries and replanted it into the larger biological domain from where it sprang originally.’ (Danesi 2002 quoted by Favareau 2007:35). A thorough exploration of Sebeok's life-work as a biosemiotist can be found in Petrilli and Ponzio (2008).

Both Sebeok's and Chomsky's theoretical foundations depended on the work of ethologists, and on Jakob von Uexküll's (1864–1944) notion of *Umwelt* in particular. Uexküll's concept of *Umwelt* — the subjective world of an organism — is central to his semiotic approach. “No matter how certain we are of the reality that surrounds us, it only exists in our capacities to perceive it. That is the threshold we have to cross before we can go any further.” (Jakob von Uexküll *Ergebnisse der Physiologie* 1 1902:213 [translation Augustyn]). While Uexküll's work undoubtedly plays a different role in their theoretical amalgam of earlier ideas, recent re-articulations of both movements highlight the importance of Uexküll's *Umwelt* and the necessity to integrate insights in linguistics and semiotics with new biological perspectives (Sebeok 2001a, b; Chomsky 2004a, b, 2005, 2006a, b, 2007).

Clearly, Sebeok's semiotics is firmly anchored in the semeiotic of Charles Sanders Peirce. For Chomsky, it is the Peircean notion of *abduction* that plays an essential role in his *generative grammar*. In his view, analyzing the *deep structures* of abstract operations of formal grammar may help expose the limits and cognitive capacities of human intelligence, a line of research that Chomsky recently called ‘[developing] a Peircean logic of abduction.’ (2006a, b:82)

Both biolinguistics and biosemiotics were animated by findings in molecular biology during the 1970's. Marcel Florkin's ‘pioneering work in intracellular semiotics’ (Kull 1999:387) appropriated concepts from the work of Ferdinand de Saussure in an article on the biosemiotics of biochemistry. Florkin believed ‘that in future development, linguistic semiology will become based on molecular biosemiotics of the activities of the brain.’ (1974:13, quoted in Kull 1999:387) For Chomsky's biolinguistic program, it was the participation of the French molecular biologist François Jacob in the pivotal 1974 conference at MIT, and the affinities between the *Principles and Parameters* (P&P) approach and Jacob's ideas, that solidified the theoretical tenets of biolinguistics.

Both movements have gained momentum in recent years through new configurations of their preeminent practitioners. The first of the *Gatherings in Biosemiotics* was organized in 2001 in Copenhagen by Jesper Hoffmeyer, Claus Emmeche, and Kalevi Kull. After the fourth meeting in Prague in 2004, the *International Society for Biosemiotic Studies* was founded, followed by the inaugural volume of the journal in 2005. If only Sebeok could have witnessed the momentous coming-together of molecular biologists, theoretical biologists, embryologists, immunologists, physicists, philosophers of science, linguists, and information theorists in 2004, following the biosemiotic movement that he had promoted for almost half a century.

The *International Network in Biolinguistics* had its first meeting at the University of Arizona in Tucson in February 2008, organized by Massimo Piatelli-Palmarini. The online Journal *Biolinguistics* published its first volume in 2008.

Noam Chomsky recently rearticulated ‘the biolinguistic approach’ in a series of lectures and essays (Chomsky 2004a, b, 2006a, b, 2007). In the new preface to his collection on *Language and Mind* (2006) he highlights, once again, the *cognitive revolution* of the mid twentieth century as a renewal and further development of the cognitive revolution of the seventeenth century. While the cognitive revolution of the mid-twentieth century is generally associated with Chomsky’s advances in the understanding of language as a generative system and the notion of *universal grammar* as an innate system, he points out that ‘another influential factor in the renewal of the cognitive revolution was the work of ethologists’ (Chomsky 2004a, b: x). In the preface to the third edition of *Language and Mind* (2006a, b), Chomsky writes:

The framework of ethology and comparative psychology could be adapted to the study of human cognitive organs and their genetically determined nature, which constructs experience — the organism’s *Umwelt*, in ethological terminology — and guides the general path of development, just as in all other aspects of growth of organisms. (Chomsky 2006a:x)

The problem of the mechanisms of learning, Chomsky continues, appeared to be similar to what Charles Sanders Peirce had called abduction, in considering the problem of scientific discovery. And as in the case of the sciences, the task is impossible without what Peirce called a “limit on admissible hypotheses” that permits only certain theories to be entertained. (Chomsky 2006a, b:xi)

Sebeok’s last articulations of biosemiotics appeared in the year of his passing in his collection of essays entitled *Global Semiotics* (2001a). He attributes the origin of biosemiotics, his ‘principal contribution to general semiotics’ (Sebeok 2001a:180), to his rediscovery of Uexküll’s *Umweltlehre*, which inspired his definition of ‘[semiosis as] the processual engine which propels organisms to capture “external reality” and thereby come to terms with the cosmos in the shape of species-specific internal modeling systems.’ (Sebeok 2001a, b:15) This non-species-specific terminology is the hallmark of *Modeling Systems Theory* (MST), an approach he articulated in *The Forms of Meaning* together with Marcel Danesi (2000), characterizing biosemiotics or global semiotics, as a comprehensive life science of nature and culture.

It is the objective of this paper to explore some theoretical affinities between biosemiotics and biolinguistics, particularly in their foundational theoretical concepts; and to explore the current orientations of these intellectual movements

as they operate on characteristic metaphors that guide the formulation of their respective scope and mission.

Sebeok drew attention to the growth and development of intellectual movements by exploring the distinction between *domains* and *fields*. He enlisted Csikszentmihalyi's (1996:6) definition of creativity 'as [resulting] from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate innovation' (Sebeok 1998:23). Csikszentmihalyi defined a *domain* as a set of symbolic rules and procedures (e.g. biosemiotics or biolinguistics), while a *field* 'comprises all the individuals who act as gatekeepers to the domain,' and who decide 'whether a new idea should be included in the domain' (Csikszentmihalyi 1997:27–28, quoted in Sebeok 1998:24). Both Sebeok and Chomsky were/are unequivocally the innovators and preeminent gatekeepers of their respective domains; and it may be the consequence of no more than their *style of gatekeeping* that kept their parallel domains apart despite their theoretical affinities.

Uexküll's *Umweltlehre* as Proto-Biosemiotics

For Sebeok, Jakob von Uexküll was the 'chief architect' (2001a, b:70) of biosemiotics. Even for those who have joined the biosemiotic movement from different backgrounds, from a historiographical point of view it is probably acceptable for most biosemioticians to consider Jakob von Uexküll one of the important theoretical fathers of this domain. Sebeok noted that Uexküll's *Umwelt*-research, that is, *Biosemiotics*, 'rooted in no antecedent semiotic theory or practice at all; it was, rather, connected to the thought of Plato, Leibniz, especially Kant, Goethe, and a handful of biologists, such as Johannes Müller and Karl Ernst von Baer.' (cf. Sebeok 1998:32) To understand the importance of Uexküll's *Umweltlehre* for Sebeok's biosemiotics, it is worth quoting Sebeok's personal account of his first encounter with Uexküll's *Theoretical Biology*:

I first came across von Uexküll's name in 1936, when I was still in my teens and he was to have lived for eight more years. I chanced to catch his name on the verso of the half-title page to Ogden and Richard's *The Meaning of Meaning*, the 4th edition of which I purchased when I was an undergraduate at Magdalene College in Cambridge, where Richards was Pepys Librarian at the time and with which Ogden was also associated (according to the same page), and which also listed him as the "General Editor of the International Library of Psychology Philosophy and Scientific Method." This consisted at the time already of some 85 volumes. *Theoretical Biology* was listed as the 34th book from the top, or 52nd from the bottom. The title having caught my attention, I obtained a copy from the library, found that it was a 1926 translation of a German book published in 1920, and that it was beyond doubt over my head. Not until some 30 years later did I come to realize that this judgment was premature as well as very wide off the mark. The English translation had in fact been carried out "wretchedly...under Ogden's eccentric auspices" (Sebeok 1991: 104). In the mid 1960's, when at last I read the authentic German version, I

came to believe that Ogden, the very animator of Anglo semiotics in the 20th century, had either known little or no German or, with all his polymathic gifts, had failed to understand what *Theoretische Biologie* was really about: not biology, not psychology, not physiology, but semiotics. What's more, it unfolded a wholly unprecedented, innovative theory of signs, the scope of which was nothing less than semiosis in life processes in their entirety. It created and established the basis for a comprehensive new domain: we now call it Biosemiotics (Sebeok 2001a: 168).

Sebeok attributes it to the 'wretched' translation of Uexküll's *Theoretische Biologie* (1920) that the notion of *Umwelt* did not reach the Anglo-American and international intellectual community much earlier. When Sebeok read the German original, he found it 'if not pellucid, nonetheless electrifying' (Sebeok 1998:32–34). In 1977, Sebeok presented a paper entitled "Neglected Figures in the History of Semiotic Inquiry: Jakob von Uexküll" (Sebeok 1979, Ch. 10) at the III. Symposium über Semiotik in Vienna. There he connected with Uexküll's son Thure and the domain of biosemiotics had found its principal proponents for the coming decades. Other important figures of that time were the oncologist/polymath Giorgio Prodi and the comparative psychologist Heini Hediger (cf. Sebeok 1998, 2001a, b), and the foundations were in place for a biosemiotics that pertains to all organisms. Thure von Uexküll and Sebeok's meetings in Germany were later attended by the biologists Jesper Hoffmeyer and Kalevi Kull, now two of the leading figures of the biosemiotic movement. The 'prospects' of biosemiotics for Sebeok were clearly inclusive of all signs in the universe and Sebeok called attention to the field of molecular biology in particular when he ended an essay on the future of biosemiotics by emphasizing that 'any biosemiotic theory failing to take into account the multiform data of bacterial semiosis is as flawed as would be one that ignored the complexities of the verbal code in its social ramifications.' (Sebeok 1997:114; reprinted in Sebeok 2001a) *Umwelt* in Sebeok's working definition 'is a model generated by the organism' (2001a, b:vii); a definition that is neither species-specific nor limited to any discipline or scientific domain so as to include into the pantheoretical view of biosemiotics all domains concerned with life.

Linguistics as Theoretical Biology

Noam Chomsky is not the most obvious proponent of Uexküll's ideas in the Anglo-American scholarly world or elsewhere. Yet, Chomsky's interest in ethology began in the early 1950's when, together with his fellow graduate-students at Harvard, Eric Lenneberg and Morris Halle, Chomsky first formulated what became the 'biolinguistic program'. He outlined what he saw as the preferred path in linguistics and the emerging cognitive sciences already in his famous review of B.F. Skinner's *Verbal Behavior* (1959), a piece dedicated to expose the inadequacy of the predominant behavioral approaches to issues of mind in general, and the acquisition of language in particular. He stressed, albeit in a footnote, concerning the 'unknown character and complexity' of the human 'hypothesis formulating ability' — a notion that he later clearly articulated as Peircean *abduction* (see below) — 'the necessity

for carefully analyzing the strategies available to the organism as a complex information-processing system' (Chomsky 1959:57 ft.48).²

In the first of the Beckmann lectures, held at UC Berkeley in 1967, Chomsky articulated 'the creative aspect of language use' in terms of a *new* Cartesian principle, 'which', as Chomsky stressed recently, 'should not be confused with the traditional mind-body problem, which evaporated after Newton.' (Chomsky 2006b:4) The laws and principles of this *philosophical grammar*, he wrote, 'are not formulable in terms of even the most elaborate extension of the concepts proper to the analysis of behavior and interaction of physical bodies, and they are not realizable by even the most complex automaton.' He envisioned

a psychology that begins with the problems of characterizing various systems of human knowledge and belief, the concepts in terms of which they are organized and the principles that underlie them, and that only then turns to the study of how these systems might have developed through some combination of innate structure and *organism-environment interaction*.

(Chomsky 2006a:6 italics mine)

He cautioned psychologists already in 1967 not 'to relate the postulated mental structures and processes to any physiological mechanisms or to interpret mental function in terms of "physical causes"' (2006a:12) and, instead, to explore the creative/generative principles of language use. He regarded the segmentation and classification techniques practiced by the structural linguists of his time as 'at best limited to the phenomena of surface structure [that] cannot reveal the mechanisms that underlie the creative aspect of language use and the expression of semantic content.' (2006a:20)

As in his *Cartesian Linguistics* (Chomsky 1966), he called attention to the fact that linguists and psychologists of the 1960's had lost sight of the 'classical questions' of the seventeenth century while privileging *evidence*, physiological and behavioral, without considering 'how the classical issues may provide direction for contemporary research and study.' (Chomsky [1967] 2006a, b:5) With this conjecture, he foresaw a trend that continues to dominate research in linguistics and psychology to this day.

In the third of the Beckman lectures, Chomsky more clearly explained the role ethology and comparative psychology were to play in the articulation of the biolinguistic program:

[It] seems that most complex organisms have highly specific forms of sensory and perceptual organization that are associated with the *Umwelt* and the manner of life of the organism. There is little reason to doubt that what is true of lower organisms is true of humans as well. Particularly in the case of language, it is natural to expect a close relation between innate properties of the mind and

² Noam Chomsky responded to an e-mail query concerning his use of Uexküll's concept of *Umwelt* in a message from April 2008: 'I came across Uexkuell's work in the early 1950's, when several grad students at Harvard (Eric Lenneberg, Morris Halle, and I) were becoming interested in ethology and trying to formulate what became the "biolinguistic program". There are references to this and related work as a preferred path in linguistics and the emerging cognitive sciences in the last section of my review of Skinner's Verbal Behavior, which appeared in 1959 and has been repeatedly reprinted. I don't recall when I first used the word *Umwelt*.'

features of linguistic structure; for language, after all, has no existence apart from its mental representation. Whatever properties it has must be those that are given to it by the innate mental processes of the organism that has invented it and that invents it anew with each succeeding generation, along with whatever properties are associated with the conditions for its use. Once again, it seems that language should be, for this reason, a most illuminating probe with which to explore the organization of mental processes. (Chomsky 2006a:83)

Chomsky saw his theory of generative grammar complemented most fruitfully by the advances in comparative ethology predicated upon Uexküll's notion of *Umwelt*. His fellow Harvard graduate Eric Lenneberg, in his *Biological Foundations of Language* (1964), refers to Uexküll's *Umwelt und Innenwelt der Tiere* to address the species-specificities of behavior:

The interaction of integrated patterns of all these different potentialities produces the cognitive specificities that have induced von Uexkuell, the forerunner of modern ethology, to propose that every species has its own world-view. The phenomenological implications of this formulation may sound old-fashioned today, but students of animal behavior cannot ignore the fact that the differences in cognitive processes (1) are empirically demonstrable and (2) are the correlates of species-specific behavior. (Lenneberg 1964:372)

In recent lectures, Chomsky characterizes Lenneberg's *Biological Foundations of Language* (1964) as the foundational work for the biolinguistic approach that has found a new focus in the *Minimalist Program*. Based on this 50-year campaign for biolinguistics, the preeminent Minimalists Cedric Boeckx³ and Massimo Piatelli-Palmarini share Chomsky's conclusion, reiterated over the years, that '*Linguistics is really a theoretical biology.*' (Boeckx and Piatelli-Palmarini 2005:449; Sklar 1968:218 italics mine)

Kantian Biology and Cartesian Linguistics

For Chomsky's biolinguistic approach, comparative ethology allowed for the investigation of the a priori of the innate working hypotheses present in other organisms that would ultimately shed light on a priori forms of human thought. Chomsky exemplified this view in the third Beckman lecture with a paper by Konrad Lorenz concerned with the influence of Kantian philosophy on the biology of the early twentieth century. Even though his essay makes reference to an illustrious remark by Jakob von Uexküll (Lorenz 1941:107)⁴, Lorenz does not invoke the notion of *Umwelt* directly. Instead, Chomsky quotes Lorenz (in translation) explaining that

adaptation of the apriori to the real world has no more originated from "experience" than adaptation of the fin of the fish to the properties of water. Just

³ Chomsky refers to Cedric Boeckx's *Islands and Chains* (2003) as a summary of many new ideas and new materials as evidence for the 'considerable progress in moving toward principled explanation that addresses fundamental questions of the biology of language.' (Chomsky 2005:19)

⁴ 'Von Üxküll [sic!] hat einmal so schön gesagt: "Die Amöbe ist weniger Maschine als das Pferd" und hat dabei an körperliche Eigenschaften gedacht.' (Lorenz 1941:107)

as the form of the fin is given a priori, prior to any negotiation of the young fish with the water, and just as it is this form that makes possible this negotiation, so it is also the case with our forms of perception and categories in their relationship to our negotiation with the real external world through experience. (Lorenz 1941, quoted in Chomsky 2006a:84)⁵

With this, Lorenz described the kind of *organism-environment interaction* that is anchored in the philosophy of Kant, a perspective he shared with (if not inherited from) Uexküll, the ‘Kantian biologist’ (Wirth 1928). Sebeok tells us that Konrad Lorenz himself had pointed out that ‘the research programme mapped out [by Uexküll] is pretty nearly identical with that of [his] ethology.’ (1971: 275, cf. Sebeok 1998). And we know from Gudrun von Uexküll that Konrad Lorenz unequivocally owed the foundational insights that informed his famous experiments with greylag geese, jackdaws and dogs to Uexküll (von Uexküll 1964:198; cf. Hoffmeyer 1996:56).

It is not surprising that Sebeok quoted a vignette from that same article by Konrad Lorenz as an introductory quote to a short essay in his *Global Semiotics* that corresponds to the ‘fin of the fish’ in Chomsky’s quote: ‘The form of the horse’s hoof is just as much an image of the steppe it treads as the impression it leaves is an image of the hoof.’ (2001:97)

For Chomsky, Lorenz’ *biological a priori* and Uexküll’s *Umweltlehre* share with Peirce’s notion of abduction ‘a strongly Kantian flavour, and all derive from the rationalist psychology that concerned itself with the forms, the limits, and the principles’ of human intelligence that are the basis for the revival of philosophical grammar. (Chomsky 2006a:84)

The important aspect of ethology for Chomsky’s philosophical grammar ‘is its attempt to explore the innate properties that determine how knowledge is acquired and the character of that knowledge.’ When Lorenz explains the *How* of the acquisition of knowledge through natural selection, Chomsky, once again, looks to Peirce, explaining the problem of evolutionary development ‘rather like that of explaining successful abduction.’ (Chomsky 2006a:84)

In the third Beckman lecture, Chomsky further clarifies his view concerning the acquisition of language as an ideal example of the human *hypothesis-formulating ability* he already pointed out in the Skinner review (1959) by explaining it through *abduction*:

The way in which I have been describing acquisition of knowledge of language calls to mind a very interesting and rather neglected lecture given by Charles Sanders Peirce more than 50 years ago, in which he developed some rather similar notions about acquisition of knowledge in general. Peirce argued that the general limits of human intelligence are much more narrow than might be suggested by romantic assumptions about the limitless perfectibility of man

⁵ ‘Das Passen des Apriorischen auf die reale Welt ist ebensowenig aus “Erfahrung” entstanden wie das Passen der Fischflosse auf die Eigenschaften des Wassers. So wie die Form der Flosse “a priori” gegeben ist, vor jeder individuellen Auseinandersetzung des Jungfisches mit dem Wasser, und so, wie sie diese Auseinandersetzung erst möglich macht, so ist dies auch bei unseren Anschauungsformen und Kategorien in ihrem Verhältnis zu unserer Auseinandersetzung mit der realen Außenwelt durch unsere Erfahrung der Fall.’ (Lorenz 1941:100)

[...]. He held that innate limitations on admissible hypotheses are a precondition for successful theory construction, and that the “guessing instinct” that provides hypotheses makes use of inductive procedures only for “corrective action.” [...] To understand how knowledge is acquired, in the rationalist view that Peirce outlined, we must penetrate the mysteries of what he called “abduction”. (Chomsky 2006a:79–80)

Chomsky is, of course, thinking of the ‘deep structures’ that are manifested in abstract operations of formal grammar when he is cautiously optimistic that ‘it will be possible to undertake a study of the limits and capacities of human intelligence, to develop a Peircean logic of abduction.’ (2006a:82)

The grounding of Chomsky's language theory in ethology may help clarify some anthropocentric misconceptions of his fundamental concepts such as the *language organ* and the new *Cartesian Principle*.⁶

Chomsky articulates the tasks of the biolinguistic framework, first, ‘to construct generative grammars for particular languages that yield the facts about sound and meaning,’ and second, ‘to account for the acquisition of language’ (Chomsky 2007:14).

He excludes from this program questions concerning the evolution of language and the relationship between language and the brain. He is confident that recent work within the Minimalist Program will lead in the right direction so that advances in the biological sciences (i.e. genetics) can be integrated with the biolinguistic approach in the future.

What has been a constant throughout the 50 years of the biolinguistic approach is its anchoring in the concept that language depends on a unique interplay of innate faculties and organism-environment interaction, and a ‘genetically determined

⁶ The language organ has often been misinterpreted as a physical organ in the brain and his *Cartesian Linguistics* has been falsely connected to the perennial ‘mind-body problem.’ In one of his recent lectures, Chomsky uses, once again, Uexküll's *Umwelt* and Bertrand Russell's thought experiment of the *blind physicist* to explain the principles of the biolinguistic approach: ‘The new version of the mind-body problem resurrects some observations of Bertrand Russell's 80 years ago, and recently reinvented. Russell asked us to consider a blind physicist who knows all of physics but doesn't know something we know: what it's like to see the color blue. Russell's conclusion was that the natural sciences seek to discover “the causal skeleton of the world.” Other aspects of the world of experience lie beyond their reach. Recasting Russell's insight in naturalistic terms, we might say that like all animals, our internal cognitive capacities reflexively provide us with a world of experience, largely shared in fundamental properties — the human *Umwelt*, to borrow the term of ethologists. But being reflective creatures, thanks to emergence of the human capacity, we go on to seek to gain a deeper understanding of the phenomena of experience. These exercises are called myth, or magic, or philosophy, or “science” in the sense of that term proposed in the 19th century, distinguishing the pursuit from the rest of philosophy. If humans are part of the organic world, we expect that our capacities of understanding and explanation have fixed scope and limits, like any other natural object a truism that is sometimes thoughtlessly derided as “mysterianism.” It could be that these innate capacities do not lead us beyond some understanding of Russell's causal skeleton of the world — including the principles that enter into determining conscious experience; there is of course no reason to expect that these are even in principle accessible to consciousness. It is always an open question how much of Russell's “causal skeleton of the world” can be attained. These could become topics of empirical inquiry into the nature of what we might call “the science-forming faculty,” another “mental organ.” These are interesting topics, in principle part of normal science, and now the topic of some investigation. They should not be confused with the traditional mind-body problem, which evaporated after Newton.’ (Chomsky 2006a, b) As to the *language organ*, Chomsky adopts the view of C.R. Gallistel, ‘that in all animals, learning is based on specialized mechanisms as “organs within the brain” achieving states in which they perform specific kinds of computation’ (Chomsky 2005:5)

instinct' of formulating hypotheses that Chomsky illustrates with Peircean abduction.

The *Switchboard* and the Language of Genes

While the name biosemiotics appeared already in the 1960's (Stepanov 1971; Rothschild 1962; cf. Kull 1999), the term *biolinguistics* was coined by Massimo Piattelli-Palmarini in 1974 for an international meeting at MIT, in cooperation with the Royaumont Institute in Paris, 'that brought together evolutionary biologists, neuroscientists, linguists, and others concerned with language and biology' (Chomsky 2007:9). One of the initiators of this conference was the French biologist and Nobel Laureate, François Jacob.

Chomsky shared François Jacob's view that answers to questions about evolution can hardly be more than reasonable guesses; this view is expressed in his now familiar comparison of human language and bee communication. Chomsky likes to point out, rather cynically, in recent lectures and essays the abundant literature and confident pronouncements about the evolution of human language at a time when entomologists have declared the principles of bee communication unsolvable (e.g. Chomsky 2006a:177; cf. Chomsky 2004a, b).

Chomsky's *Principles and Parameters* (P&P) approach (often illustrated by a 'switch board' of parameters) found parallels in 'François Jacob's ideas about how slight changes in the timing and hierarchy of regulatory mechanisms might yield great superficial differences' (Chomsky 2007:17). The famous metaphor of the *switchboard* that illustrates the P&P approach to languages explains how a certain number of open parameters are specified when children learn the grammar of a particular language. This explains how language acquisition is a process that involves both a set of naturally available parameters and input in the form of organism-environment interaction that allows the child to select parameter values that can be gathered from the input. François Jacob suggested a similar metaphor concerning the 'problem of biological speciation':

What accounts for the difference between a butterfly and a lion, a chicken and a fly, or a worm and a whale is not their chemical components, but varying distributions of these components [...] specialization and diversification called only for regulatory circuits, which either unleash or restrain the various biochemical activities of the organism, that the genetic program is implemented. (Boeckx and Piattelli-Palmarini 2005:451; Jacob quoted in Chomsky 1980a, b:67).

Another parallel between biosemiotics and biolinguistics in the context of evolutionary and developmental biology are references to the work of C.H. Waddington. When considering the question at what level of organization unique properties emerge, Chomsky employs C.H. Waddington's concept of *canalization* 'referring to processes "adjusted as to bring about one definite end result regardless of minor variations in conditions during the course of the reaction", thus ensuring "the production of the normal, optimal type [.]' To Chomsky that describes the growth of language in the individual, because '[a] core problem of the study of the faculty of language is to discover the mechanisms that limit outcomes to optimal

types.’ (Chomsky 2007:179). Howard Pattee, a collaborator of Waddington as early as the 1960's, has since developed a semiotic approach to living systems that takes an important position in the biosemiotic movement. Pattee addresses the necessity for symbolic control of subject and object (material laws and symbolic measurement) as epistemic distinctions to investigate the origins of life. He explains: ‘What biosemiotics illustrates is that symbolic controls are categorically different from laws and that they are irreducible to physical laws even though their material vehicles obey the laws and have a correct physical description.’ (Barbieri ed. 2007:116)

Kalevi Kull noted C.H. Waddington's (1972) conclusion ‘that the new paradigm for biology should come from general linguistics’; and that the path outlined by Waddington ‘was not so distant from the route to biosemiotics.’ (1999:398) Sebeok shared this view as he saw the mathematical connections between genetics and linguistics best exemplified by the work of Rene Thom. Kull (Kull 1999:399) further quotes Sebeok (1968, cited in Deely 1990:85–86) who was hopeful that ‘[a] mutual appreciation of genetics, animal communication studies, and linguistics may lead to a full understanding of the dynamics of semiosis, and this may, in the last analysis, turn out to be no less than the definition of life.’

Minimalism and Operation Merge

The principal proponents of biolinguistics in the new millenium, Cedric Boeckx and Massimo Piatelli-Palmarini, are convinced that the ‘subtlety, abstractness, and deductive richness’ of the Minimalist Program ‘could not have been achieved without the adoption of an explicitly biological perspective on language’ that considers linguistics a theoretical biology (Boeckx and Piatelli-Palmarini 2005:448; cf. Sklar 1968:217).

The ultimate goal of the Minimalist Program, according to Boeckx and Piatelli-Palmarini, is for the discovery of the points of variation to yield the linguistic equivalent of the periodic table of elements that would ‘bring linguistics closer to the goals and methods of the natural sciences, enriching both linguistics and biology with intimations of deductive power that might 1 day become not too dissimilar from that of physics.’ (Boeckx and Piatelli-Palmarini 2005:462).

The role that Minimalism could play for biology is rooted in its commitment to a Galilean vision of natural phenomena and theory construction and the idea that nature is the realization of the simplest conceivable mathematical ideas, a ‘hopeful gamble’ that things could not be otherwise (Boeckx 2008:8). While linguistics can learn important lessons from immunology (cf. Piatelli-Palmarini 1986), Boeckx and Piatelli-Palmarini quote as an example for what Minimalism can do for biology recent findings concerning the Pax6 patterning gene:

The activation of Pax6, wherever it takes place, organizes the surrounding tissues of the eye. The morphology that emerges can be quite different, from the hundreds of ommatides in an insect eye to the smooth globular structure of a mammalian eye. The pathways of development are remarkably conserved, while the differences reside almost literally in a parametric switch. The transduction of insect master genes into mammals shows that they are still

active as morphogenetic initiators in spite of millions of years of evolution separating these phyla. The idea that the eye was invented by evolution five times in five totally different ways is not tenable anymore. Rather, it seems to be the case that a deeper organizational motif is common to all these instantiations of the eye. (Boeckx and Piatelli-Palmarini 2005 458–459).

In its simplest explanation, the Minimalist program assumes that the language faculty is a system based on a primitive operation called *Merge* ‘that takes objects already constructed, and constructs from them a new object.’ Merge allows for an unbounded system of hierarchically structured expressions. Chomsky is now confident that his universal grammar ‘must at least include the principle of unbounded Merge.’ (Chomsky 2007:20)

A very strong proposal, called “the strong minimalist thesis” is that all phenomena of language have a principled account in this sense, that language is a perfect solution in interface conditions, the conditions must satisfy to some extent if it is to be usable at all. If that thesis were true, *language would be something like a snowflake*, taking the form it does by virtue of natural law, in which case UG [Universal Grammar] would be very limited.

(Chomsky 2007:20 italics mine)

The emergence of Merge as a core principle of language in evolutionary history made possible a language of thought. The creative and coherent ordinary use of language, according to Chomsky, is a ‘central problem of Cartesian science, still scarcely even at the horizon of inquiry.’ (Chomsky 2007:25)

Just like biosemiotics as a new paradigm for biology, the Minimalist view of language and linguistic theory is at odds with the general beliefs held by most mainstream biologists until very recently. Both biosemiotists and biolinguists have pointed out the marginal role played by proponents of a holistic theoretical biology, such as D’Arcy Thomson and Alan Turing. (Kull 1999:394; Boeckx and Piatelli-Palmarini 2005:456; cf. Chomsky 2007) To some biosemiotists, the centrality of Merge for the Minimalist program as a holistic concept that can illuminate problems in biology may seem reminiscent of René Thom’s catastrophe theory (1972).

A comparison between Sebeok’s definition of language as a modeling system and Chomsky’s definition of language as it pertains to the Minimalist Program may even lead to further affinities between the abstract principles of Chomsky’s *Universal Grammar* and Sebeok’s *Systems Analysis* when both are taken as holistic approaches to theoretical biology.

Webs and Snowflakes

Chomsky confidently relates the ‘principles not specific to the faculty of language’ to the Galilean intuition that “nature is perfect”, from the tides to the flight of birds, and that it is the task of the scientist to discover in just what sense that is true.’ In analogy with Newton’s conviction that nature must be “very simple”, Chomsky even invokes ‘however obscure it may be, that intuition about what Ernst Haeckel called “nature’s drive for the beautiful” (“Sinn fuer das Schoene”’, while biologists in

general ‘have adopted Jacob's image of nature as a tinkerer, which does the best it can with the materials at hand — often a pretty poor job, as human intelligence seems to be intent on demonstrating about itself.’ (Chomsky 2006a:1780)

While the relationship between Haeckel and Uexküll is a complex one that cannot be characterized within the confines of this paper, the critical engagement with Haeckel's *Sinn für das Schöne* is another striking parallel between the two movements. To consider Haeckel in the context of Minimalism is indicative of the Galiean-style theory construction that Chomsky sees exemplified in the logic of abduction as the ultimate goal of biolinguistics. Uexküll responded to Haeckel' Darwinist position with the notion of *Planmäßigkeit*, that is likewise in need of Peircean abduction in order to make it ‘reconcilable with a modern non-deterministic understanding’ (Hoffmeyer 2004). Hoffmeyer recently pointed out that ‘[it] lies at the heart of biosemiotics and of Peircean cosmological philosophy that indeterminacy is primary, that “habit taking” or interpretation are real processes in the world, and therefore that belief in the law of necessity is unfounded.’ (Hoffmeyer 2004:73).

Both biolinguists and biosemiotists regard language as an exaptation (Sebeok 2001a:29; Boeckx and Piatelli-Palmarini 2005:460), an insight that came for biolinguistics with the P&P approach. The idea of language as an exaptation and the centrality of Merge as arguments against adaptationism through the P&P approach are intriguingly compatible with Irmengard Rauch's dictum of a “language-inlay in all semiotic modalities” (e.g. Rauch 1999). The notion of *optimal design* in the Minimalist approach, exemplified by the *snowflake* metaphor, can therefore be understood as the central unifying principle that sees language as a natural object (Boeckx and Piatelli-Palmarini 2005:461).

After so many parallels and affinities, one must ask what separates these intellectual currents as they gain momentum and rearticulate their goals for the coming decades. The answer is in their underlying operational metaphors for what Sebeok referred to as the *gatekeepers* of the domains.

Metaphors of *sharpening*, *optimization* and *economy* abound in the recent writings of Noam Chomsky and Cedric Boeckx. Chomsky's 50-year campaign for a narrow spectrum of permissible theoretical concepts is still the guiding principle for the biolinguistic program as it seeks to ‘sharpen the questions of what constitutes a principles explanation for properties of language, and turn to one of the most fundamental questions of the biology of language: to what extent does language approximate an optimal solution to conditions that it must satisfy to be usable at all, given extralinguistic structural architecture?’ (Chomsky 2005:10)

The International Network in Biolinguistics ‘aims to foster research on the biological basis of the language faculty, linking theoretical linguistics, developmental psychology, evolutionary biology and psychology, molecular biology, genetics, and physics.’ Chomsky clearly is the most important gatekeeper of the domain, when the biolinguists make it clear on their inaugural conference website that ‘the presentations aim to explore further the factors that according to Chomsky (2004a, b, 2006a, b, 2007) contribute to the growth of language in the individual, the genetic endowment, experience, and language-independent principles of efficient computation.’⁷

⁷ <http://www.biolinguistics.uqam.ca/>

Founded in 2007, the online journal *Biolinguistics* is described as a ‘journal exploring theoretical linguistics that takes the biological foundations of human language seriously. While the journal seeks to ‘disseminate research globally to theoretically minded linguists, linguistically minded biologists, cognitive scientists in general, and anyone else with an interest in the scientific study of language’, the editors limit the journal's scope to ‘the exploration of issues related to theory formation *within the biolinguistic program of generative grammar* as well as results drawn from experimental studies in psycho- and neurolinguistics or cognition at large.’[emphasis added]⁸ As a scientific theory, biolinguistics is predicated upon the notion that ‘the task is impossible without what Peirce called a “limit on admissible hypotheses” that permits only certain theories to be entertained.’ (Chomsky 2006a:xi)

In contrast with Chomskyan Biolinguistics allowing only for a narrow range of permissible research agendas and approaches, Sebeok's gate to *Global Semiotics* (2001) is wide open. He lists as the intended connotations for his choice of the adjective *global* “all-encompassing,” “comprehensive,” “international,” “limitless,” “pandemic,” “unbounded,” “universal,” and maybe “cosmic.” (Sebeok 2001a:1) The metaphor of the *web* appears in a series of books he edited under the title *The Semiotic Web* (Advances in Semiotics) as well as in the International Association of Semiotic Studies as a ‘lively guild of transnational scholarship’ (2001a:4) as it continued to form a web of connections across the globe under Sebeok's influence. Another important metaphor is “the global organism” inspired by the work of Sorin Sonea (1988) that sees bacterial behaviour as exemplary for ‘a sophisticated grid [that] is in effect the primordial planetary information superhighway’ (Sebeok 2001a:12).

The metaphorical richness of Sebeok's diction is characteristic of his theoretical openness and can be found in the style of recent practitioners, in particular in the work of Jesper Hoffmeyer. Sebeok considered Hoffmeyer's *Signs of Meaning in the Universe* (1996) ‘a pivotal contribution to the field’ (Sebeok 1999:1), because Hoffmeyer recognizes that ‘Uexküll's line of thought is, at heart, semiotic. [...] His whole point was that neither the individual cells nor the organisms are passive pawns in the hands of external forces,’ (Hoffmeyer 1996:56), but that each organism creates its own *Umwelt*. In Hoffmeyer's view, ‘one can never hope to understand the dynamic of the ecosystem without some kind of *umwelt* theory.’ (Hoffmeyer 1996 59)

One of the compelling aspects of Hoffmeyer's writing is that he can elegantly illustrate such concepts as *semiotic causation*, *semiotic emergence*, and *semiotic scaffolding* in evolution with the movement of an *E. coli* cell, a reproductive disorder in amphibians, and the development of the word SPAM in English respectively. (cf. Hoffmeyer 2007) Hoffmeyer's work is representative of the objective of ‘building a bridge between biology, philosophy, linguistics and the communication sciences.’⁹ To be sure, it is no less indicative of this objective that with Jesper Hoffmeyer and Donald Favareau the ISBS had a biologist and a philosopher at the helm of an organization that seeks to unify biology with semiotics.

Unlike the biolinguistic program, biosemiotics is not partial to any particular theoretical approach or discipline, but truly represents an eclectic group of

⁸ www.biolinguistics.eu

⁹ <http://www.springer.com/life+sci/journal/12304>

outstanding scientists and humanistic scholars who are united by their understanding that the most fundamental of all life processes is semiosis. In his history of biosemiotics, Donald Favareau emphasizes the openness of the biosemiotic movement, when he presents biosemiotics as a *proto-science* whose goal is

to extend and broaden modern science, while adhering strictly to its foundational epistemological and methodological commitments — it does not seek in any genuine sense of the term to ‘oppose’ much less ‘supplant’ the scientific enterprise, but, rather, to continue it, re-tooled for the very challenges that the enterprise itself entails, if not demands (Favareau 2007:4).

While biolinguists have clearly delineated the scope of their journal as a forum for a particular kind of theory construction, the proponents of different currents in biosemiotics engage each other with prolific openness. As the current editor of *Biosemiotics* Marcello Barbieri recently pointed out, ‘the problems of biosemiotics were discussed without the constraint of *ideological* principles’ (Barbieri 2007:112) and what unites all the currents within the biosemiotic movement is ‘an entirely new conception of biology: *life as semiosis*.’ (Barbieri 2007:102) Sebeok may have foreseen this development when he wrote in 2001:

The present terminological requirements to subsume a semiotics of culture, or just plain semiotics, under a semiotics of nature, or biosemiotics, might have been obviated decades earlier. As things are going right now, the boundaries between the two are crumbling, giving way to a unified doctrine of signs embedded in a vast, comprehensive life science.

(Sebeok 2001a:159)

As Editor-in-Chief of *Semiotica*, Sebeok was ‘keen to encourage the growth of emerging sub-domains of semiotics’ (Sebeok 1999:1), among which he would doubtlessly count the domain of biolinguistics. Concerning the boundaries between domains and fields, Sebeok quoted Peirce saying that ‘the only natural lines of demarcation between nearly related sciences are the divisions between the social groups of devotees of those sciences.’ (8.342 in Sebeok 1977:184) Even though their paths have crossed many times (e.g. Chomsky in Sebeok and Umiker-Sebeok eds. 1980b), Sebeok and Chomsky inhabited the community of North American linguists without close contact or collaboration.¹⁰ And it is representative both of Chomsky’s fame and Sebeok’s ambitions to unify a vast variety of semiotic perspectives, that one can find frequent references to Chomsky in Sebeok’s work (e.g. 1977:181; 2001a, b: xix, 22), but not vice versa. ‘Complementary domains’, Sebeok wrote, ‘can of course affect each other in a variety of fundamental ways’, but this entails that any aspiring practitioners would have to familiarize themselves with the gatekeepers to the domain. [...] ‘In short, ideas and the personalities who embody and propagate them are, in my view, kept asunder at one’s peril.’ (Sebeok 1998:24)

¹⁰ Noam Chomsky wrote in an e-mail in June 2008: ‘I knew Tom Sebeok for many years, and we often met, though not with really close contact or collaboration.’

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