

What is actually essential in biosemiotics?

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Review: Favareau, Donald (ed.) 2010. *Essential Readings in Biosemiotics: Anthology and Commentary*. Springer.

Sometimes coincidences are really evocative. In the context of a close criticism to the culture of the time and aiming at a radical transformation of our conception of reality, F. Nietzsche maintained that “one has to *learn to see*, one has to learn to think, one has to learn to speak and write: the end in all three is a noble culture” (Nietzsche 1968: 6; my emphasis). Almost a century later, explaining his theory of how scientific revolutions occur, T. Kuhn pointed out that “during revolutions scientists *see new and different things* when looking with familiar instruments in places they have looked before [...] [and] paradigm changes do cause scientists to *see the world of their research-engagement differently*” (Kuhn 1970: 111; my emphasis). Finally, this is how a biosemiotician exemplarily summarizes the fundamental problem called into question by such visual metaphors: “You won’t look for something if you don’t believe it’s even there” (Favareau 2010: 63). Indeed, biosemiotics arises by explicitly conceiving of itself as a paradigm of knowledge which has a new way of seeing, critically situated within the scientific and humanistic traditions of Western thought.

The narrative that underlies D. Favareau’s *Essential Readings in Biosemiotics* can be seen as a theoretical struggle to formulate a better

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understanding of life.² Hence, this collection focuses upon how some past scholars have been *overlooked* and successively rediscovered in their significance for the present meditations on biology; how others have continuously *casted light* upon both the links among different disciplines studying living nature and culture and the possible paths of inquiry able to cross the gap between them, to acknowledge eventually that such a discontinuity might not exist at all; finally, how still others presently pursue this overall project by adopting particular and original *viewpoints*, in so doing opening up new *perspectives* and *foreseeing* further developments. And among these scholars there is of course the editor of the book.

The title of the book — *Essential Readings in Biosemiotics. Anthology and Commentary*³ — clearly suggests by itself that we are facing a restricted collection of different materials, extracted from the work of several authors and organized in chapters, each accompanied by some introductory and biographical remarks. Two parts are particularly important for understanding the overall sense of such a design.

The *Preface* provides the reader with basic advice about the conceptual origin of biosemiotics, the definition of what it is and why the editor himself was eventually led to embrace its project. It all started when a “diverse group of molecular biologists, neuroscientists, zoologists, anthropologists, psychologists and philosophers [felt] a growing discontent with what was being offered as (or in lieu of) ‘explanation’ regarding the nature of empirically observed, real-world sign processes in their respective fields of origin” (ER: v). On the basis of this lack, they converged towards the interdisciplinary research agenda of biosemiotics:

the study of the myriad forms of communication and signification observable both within and between living systems. It is thus the study of representation, meaning, sense, and the biological significance of sign processes — from

² See also other reviews of the book — Alexander (2011), Aragno (2011), Augustyn (2011), Cannizzaro (2011), Fernández (2011), Guddemi (2011), Harries-Jones, P. (2011), Kilov (2011), Prinz (2011), Swan (2011).

³ Hereafter referred to as ER.

intercellular signaling processes to animal display behaviour to human semiotic artifacts such as language and abstract symbolic thought. (ER: v)

Moreover, the preface states explicitly the aim of the collection and the criteria of selection. These readings are meant “to provide an introductory overview only” and have been organized “as both a teaching tool and as an adventure in thinking” (viii). Since any such anthology cannot pretend to completeness and therefore some key figures have been inevitably excluded from it, “selection for inclusion in the volume was limited to those interdisciplinary thinkers who self-identify as ‘biosemioticians,’ as well as those ‘biosemiotic precursors’ who have been retrospectively adopted by the community as such (that is, Peirce, Uexküll and Bateson)” (ER: viii). To tell the truth, a fascinating and scientifically stimulating aspect is that so far biosemiotics itself must be said to be incomplete and at an early stage of development (ER: xiii–ix). For the author this is by no means a shortcoming. First of all, the fact of passing through a phase of systematic uncertainty belongs to the nature of scientific development as such; secondly, this calls for an effort of further meditation, not only for those directly and currently involved in the project, but even for the reader of the anthology (ER: ix).

The *Introduction* chapter — “Introduction: An Evolutionary History of Biosemiotics” — is meant to provide “the necessary grounding in both the history of biosemiotics as well as in its theory, allowing for a richer understanding of the subsequent texts” (ER: ix). Understanding the development of biosemiotics means essentially “contextualizing that history within and against the larger currents of philosophical and scientific thinking from which it has emerged” (ER: 1). But what exactly is at stake in this history and in the need both to see differently and to change the way of questioning? What is it that must be illuminated from a different perspective and from which we are waiting for alternative answers regarding the intercourse between nature and culture?

The history of biosemiotics is the *history of the concept of sign*, “how the ‘sign’ concept appeared, was lost, and now must be painstakingly rediscovered and refined in science” (ER: 1). Hence, the *Introduction* is articulated on the basis of three chronological phases (with an

additional section in between the first two on the relational nature of signs): the cultural and epistemological shift represented by the investigations of those *natural philosophers* who were retrospectively called pre-Socratics; another influential change in Western thought, namely the meditation of R. Descartes; the final decisive theoretical step, namely T. Sebeok's joint between sign science and life science, "without whom the current interdisciplinary of biosemiotics would not have taken shape in its present form" (ER: 34). What is important to realize is that, since these historical epochs in the development of Western scientific thought coincide with different ways of understanding and shaping the notion of sign and since biosemiotics claims to take on a more adequate comprehension of this notion, then "the goal of biosemiotics is to *extend* and to *broaden* modern science", not to oppose it but "to continue and to develop it" (ER: 3). Since "those scientists who are working in long-established fields where the defining and fundamental articulations have already been settled [...] are not disposable to see] the current status of the 'sign' as a legitimate 'unit of analysis' in biology" (ER: 64), "the job of biosemiotics right now is to articulate its intuitions about sign processes in biology such that they become accepted as legitimate scientific to ask [...]" (ER: 64).

From the *Preface* and the *Introduction* we can then summarize the editor's main argument, which can be stated by means of his own words and sketched as follows: firstly, there is a "primordial scientific question: *What is the relation between mental experience, biological organization, and the law-like processes of inanimate matter?*" (ER: VI). Secondly, for historical reasons this problem has come to be pursued by formulating rather a different kind of question: *How does the human brain produce the mind?*" (*ibidem*). Thirdly, with this setting "many interesting analyses were made, hypotheses proposed and theories advanced — though none proved fully satisfactory, even on the theoretical level" (*ibidem*). Eventually, since such a reformulation of the fundamental question and its disappointing answers have gone along with a misinterpretation of the concept of sign, therefore

a potentially more viable approach to the conventional mind-brain question might be to *not* begin that study by using the uniquely human manifestation of mental experience as the archetypal example of the system needing explanation, as if it — alone among the products of the natural world — somehow arose *ex nihilo* and persists today *sui generis* — but to inquire first, instead, into the far more fundamental relationship of all purposive organisms to subjective experience. (ER: VII)

The editor has supplied each chapter with a biography on the author of the text and a comment on both his work and the following reading, mostly pointing out its significance with regard to either the history, or the development, or the practice of biosemiotics.

The first part deals with those forerunners who have significantly broadened the contemporary understanding of signs and semiotic processes: J. von Uexküll, the biologist whose theory of biological meaning and whose T. Sebeok's semiotic interpretation and revival have been essential to the birth of biosemiotics; C. S. Peirce, whose evolutionary "sign logic" stands at the core of an adequate comprehension of natural processes as semiotic processes; C. Morris, biosemiotically relevant for his attempt to develop both a "science of signs" and a scientific semiotic vocabulary; and J. M. Lotman, with his notion of *semiosphere*, meant to describe and model cultural phenomena, but explicitly drawn on the basis of concepts coming from natural and complexity sciences.

The second part exposes the process of conscious setting of the biosemiotic agenda, along with its inner articulation in different sub-fields of inquiry according to the areas of localization of the semiotic processes. It is dedicated to T. A. Sebeok and focuses on his efforts to promote the founding of the interdisciplinary project of biosemiotics. The authors treated are: H. Hediger, whose studies on animal communication and non-verbal signs were essential to the development of *zoosemiotics*; M. Krampen, who further expanded the understanding of the semiotic relationships among living beings and introduced the sub-field of inquiry which goes by the name of *phytosemiotics*; T. von Uexküll, W. Geiggis and J. Herrmann, whose excerpt is centred onto the research area of *endosemiotics*, namely the semiotic processes occurring within the body of an organism; G. Prodi, who was credited by Sebeok to be

one of the three main founders of contemporary biosemiotics with his *natural semiotics*; R. Thom, whose place in this collection is justified by his attempt to elevate the doctrine of signs to the status of a science and by his intrinsic biological comprehension of the notion of meaning. The last chapter, finally, refers to the programmatic manifesto — on the possibility for semiotics to provide a framework able to overcome the ontological and methodological gap between nature and culture — collectively written by M. Anderson, J. Deely, M. Krampen, J. Ransdell, T. A. Sebeok and T. von Uexküll.

The third part takes into account those meditations that, although developed outside Sebeok's legacy, have come to be recognized as conceptual predecessors and indispensable sources of insights for the present practice of the discipline. The authors referred to are: K. Kull, with his several theoretical, organizational and academic contributions to the development and institutionalization of biosemiotics; F. S. Rothschild, whose attempt to develop a biosemiotic theory of biology, despite different in respect to many tenets of the discipline as it is today conceived and practiced, nevertheless anticipated many ideas of its predecessors and current practitioners; M. Florin, one of the founders of biochemistry, who is pertinent for his development of a "biosemiotic theory" of biochemical interactions; G. Bateson, whose multiplicity of perspectives of research and *relational* characterization of the learning processes constitute the antecedents of biosemiotics' interdisciplinarity and its sign-based approach to living organisms knowledge; H. H. Pattee, with his wide influence upon the present works of many biosemioticians, for instance J. Hoffmeyer and C. Emmeche; and, finally, T. Deacon and his independent application of Peircean theory, meant to better explain the biological world and to characterize the human specificity within it as due to the *symbolic* nature of its semiotic endowment.

The forth and last part deals with those scholars and approaches who are currently carrying on the biosemiotic research from different perspectives, sometimes even at odds with each others. The editor has selected the following: J. Hoffmeyer, with an excerpt taken from his most recent monograph on biosemiotics and focused on the fundamental

notion of “code duality”, which explains the processes of any biological level as occurring by means of an ongoing information exchange between analog and digital coding surfaces; C. Emmeche, J. Queiroz and C. El-Hani, whose treatment of the concept of information in biology in Peircean semiotic terms leads to an account of genes as signs and genetic information as semiosis; A. Markoš and his *biohermeneutics*, an approach which draws on the philosophical meditations of M. Heidegger and H. G. Gadamer to develop a theory of natural knowledge based on the notion of *hermeneutic reading* as the key process of meaning creation; S. Brier and his discipline of *cybersemiotics*, namely a five-levelled multidisciplinary conceptual platform able to account for the emergence of meaning within and across the several spheres of biological existence; G. Witzany, with his “three-levelled biosemiotics” and the distinctive insistence upon the centrality of pragmatics and contextual relations in the determination of semiotic biological meaning; and, finally, M. Barbieri, whose chapter introduces the reader to his *semantic biology* and the theory of “organic codes”, a mechanist and molecular account which aims to scientifically and experimentally investigate the reality of sign processes in life.

The book concludes with an extensive bibliography both of primary literature, useful for obtaining an introductory knowledge of each author’s main ideas, and of secondary literature, meant to contextualize the excerpts and their significance.

As suggested by the editor himself, the anthology is meant to be a general introduction to the topic addressed both to students and non-students, in general to all those academic professionals, researchers or simply amateurs, coming from different scientific and humanist fields of inquiry and interest, who demand a different approach to biology. In respect to this and just because of being situated at the intersection between natural and cultural sciences, these *Essential Readings* — dealing with *essential* questions regarding human beings’ self-comprehension of their relationship with living nature — are actually *essential* for everybody and not exclusively intended for a particular audience.

As such, on one hand this book is the spiritual heir of past general semiotic selections and thus follows in the wake of works such as *Semiotics: An Introductory Anthology* (1985) by R. E. Innis, and *Semiotics* (2003) by M. Gottdiener, K. Boklund-Lagopoulou and A. Ph. Lagopoulos (eds.). On the other hand, it is part of the increasing number of anthologies with a peculiar focus on semiotics of non-human sign systems: see, for instance, volume IV of *Semiotics* (2010), edited by F. Stjernfelt and P. F. Bundgaard; and *Readings in Zoosemiotics (Semiotics, Communication and Cognition)* (2011), edited by T. Maran, D. Martinelli and A. Turovski.

Critical assessment

The strengths of Favareau's *Essential Readings in Biosemiotics* can be summarized quite precisely. The editor states an explicit thesis with respect to the mind/body problem, displays its historical background in the *Introduction* and, by relying on the excerpts of the following chapters, tries to provide a solution. The latter consists in a broader reformulation of the theoretical assumptions about the nature of the living and in the consequent adoption of a semiotic method. Since this is an attempt to contribute to a discussion intersecting with many other disciplines and indeed biosemiotics conceives itself primarily as a multidisciplinary research project, the readings selected by the editor are useful for scholars coming from biological and brain sciences, zoology, animal and human ethology, psychology, anthropology, philosophy, or semiotics.

Though the book is conceived essentially as an anthology, the materials and forms of exposition adopted are quite sundry: primary references, personal observations and explicative comments, biographical introductions and historical-contextual remarks. The excerpts have not been chosen and arranged randomly, but follow a precise logic: they have differently anticipated, grounded or opened to new directions and further developments the biosemiotic inquiry.

Favareau does maintain implicitly that there could be alternative ways of arguing from the same material and manifests a deep critical-epistemological awareness about the difficulties inherent to the kind of knowledge biosemiotics claims to be, or at least to become. In his words:

the biosemiotic proposals that you will find in this book are intended, like all such proposals in natural science, as hypotheses [...] So, too, is the reader of this volume encouraged to look upon its contents [...] as suggestions made in good faith and in full awareness of the enormity of the undertaking, regarding how one might profitably go about starting to develop a scientifically accountable framework for the explanation and investigation of the ubiquitous presence of sign relations in the organization and interaction of biological systems. (ER: ix)

On the other hand and above all, Favareau's choice to take an excerpt focused upon Lotman's notion of *semiosphere* proves to be extremely pertinent regarding the historical development of a broader and biologically oriented semiotic approach. I think it is by no means by accident that both J. Hoffmeyer, the author of the first monograph dedicated to biosemiotics, and J. Lotman coined independently the concept of *semiosphere*. Both are representatives of that change of vision I referred to in the introduction and that is required every time one begins a new scientific and cultural enterprise. The case of Lotman — and therefore Favareau's choice — is paradigmatic under several respects. Firstly, he belonged to that host of prominent semioticians who not only concurred in the foundation of a discipline, but even anticipated its next developments in a way to some extent not so far from biosemiotics, as though its germs were contained in the discipline of semiotics from the very beginning and thus the former was the consequential unfolding of the latter. In a very exemplar way, Lotman's thought as such took part in the transformation process of the past century semiotics.

Finally, every alternative approach in a field of inquiry includes within it those who propose new models of explanation and those who fully use, develop and interpret them. Doubtless, Lotman belongs to the former and therefore Favareau could not help but place him in the anthology. I have chosen this author to support the appropriateness of the editor's selection, but the same would have held for other precursors, such as C. S. Peirce or J. von Uexküll. They shaped concepts and tools

that, though at first sight inadequate to the way biosemiotics conceives itself within the scientific panorama, nonetheless have been assimilated and applied according to the current needs. As for Uexküll, for instance, despite the fact that “his early acceptance of Darwin’s then-new theory was eventually replaced by his principled (if perhaps too entire) rejection of it” (ER: 88), the work of several biosemioticians has shown that his theory, “when wedded with an equally expanded understanding of post-Darwinian evolution, offers us a scientific way of understanding that the “subjective experience” of organisms [...] is, as such, an organizing principle in the ongoing co-development, co-evolution and co-maintenance of interdependent living systems” (ER: 88). In a word, the reader of this collection should not rely too much on the surface contradictions he or she might seem to detect, but instead try to keep an eye on the very different traditions of thought on which it draws, as it is the case of any multidisciplinary approach.

That is also to say, from another perspective, that if Lotman had had the chance to carry on his meditation, he himself would probably have ended up acknowledging the necessity of biosemiotics and participating in its development. Indeed, the following passage fully reflects its spirit:

In such a way I would speak about the semiotics of mammals, which to me seems real. This is another semiotics, another type of language — but we are not only humans, we are also mammals, and therefore we also have mastery of that language. It could be suppressed, or more dynamic, or less dynamic.

The appearance of language in our sense of the word was an upheaval, perhaps a tragic one, but a groundbreaking upheaval which created a fundamentally new situation. This is one aspect of the approach of semiotics to animals, which allows us to penetrate into the world of semiotic constants, invariable situations and inheritable behavior. On the whole, I think that zoo-semiotics should become part of linguistics, or linguistics part of zoosemiotics; let us not argue about the priority, but it seems to me that a zoologist ought to be a linguist, and maybe a linguist ought to be a zoologist. (quoted from Kull 1999: 126–125)

Conclusions

If biosemiotics has to struggle against the resistance of the scientific community, suspicious of notions such as *intention*, *meaning*, *interpretation*, *anticipation* (and the like) as applied to biology, I would maintain this is happening ‘on the other side of the river’ as well. For instance, I personally talked with students of semiotics and philosophy who, being acquainted with the traditional phenomenological concept of intentionality, could not get through the biosemiotic idea of an *intentional* agency of living organisms. Therefore, there seems to be a parallel resistance or at least a difficulty within the humanistic community to overcome the gap.

With respect to this point and among other things, the present anthology was meant to be a teaching or self-educating tool; therefore, one of Favareau’s main regrets is that “limitations of space have precluded the inclusion of a number of important works by such “second-generation” younger biosemioticians [...], *as well as by the more “humanities-based” biosemioticians*” (ER: VIII; italics mine). In fact, the *Introduction* describes quite openly the heavy philosophical legacy that biosemiotics calls to question; if, on the contrary, the *Preface* and the excerpts might appear to support primarily its scientific aspect, I do not see this as a contradiction, but rather it implies a deep complementarity between the two points.

If this holds and the biosemiotic target is thus both to broaden and extend modern science and to reject the illusionary separation between mind and body, or nature and culture, the effort of the current anthology to frame a (bio)semiotic account of animal and biological knowledge must be conversely integrated by a corresponding (semio) biological treatment of human knowledge and culture. Semiotics has crossed the threshold “down” to the natural realm, but now it is time to proceed in the opposite direction as well.

My idea is that, on the basis of the current anthology as a model, a stimulus to this further study might be obtained with a selection of excerpts belonging to semioticians, anthropologists and philosophers

currently involved in research connected to a semiotic natural science, such as for instance P. Cogley, M. Danesi, J. Deely, F. Stjernfelt, W. Wheeler, S. Petrilli, A. Ponzio and F. Cimatti. I do think that the political, linguistic, anthropological, phenomenological and ethical implications of biosemiotics we can gain from these scholars should be gathered and proposed as a second possible volume of essential readings on the deep human and not only biological significance of this research program. Basically, I see this point in a coherent line with the historical-philosophical-scientific perspective exposed in the *Introduction* and the learning-educational purposes maintained in the *Preface* by the editor himself.

Looking forward to hearing about such a realization, let me conclude and give a little personal suggestion. The occasion for this is provided by the way Favareau himself presses the reader for a further development of the discipline:

Accordingly, the most important selection lacking inclusion in this book is the one that the reader should afterwards feel compelled to write.

[...] And therefore I ask the reader once again not to approach this volume passively, but to actively develop what one finds worthwhile in a given analysis in one's own scientific work and understanding and to improve upon the inevitable shortcomings that one will by necessity find in here as well. (ER: IX)

What biosemiotics calls for is an appropriate understanding of the notions of meaning and subjective experience in the biological realm: in a word, it suggests a broadening of our common conception of *knowledge*. Indeed this anthology brings out the way semiotics has also been used to develop a theory of natural knowledge and, accordingly, to set the basis for a natural history of knowledge. If we wish now to proceed the other way round, showing how this perspective might be useful for a natural (and semiotic) theory of human knowledge, we could not help but acknowledge the notable historical, theoretical and methodological coincidences that biosemiotics shares with other twentieth century attempts to explain the nature of the human. In this case, I wish the editor had at least recognized and quoted them in the *Introduction*, since they can be put in a mutually fertile relation with the project described here.

Instead of talking in abstract terms, let me make a precise example. We have to recall that both Peirce and Uexküll characterized their approaches to the issue of knowledge by critically questioning I. Kant's transcendental philosophy. A key notion of the German philosopher, as well as of Peirce (in the context of his theory of continuity) and Uexküll (with respect to the phenomenological aspects of animals' *umwelten*), was that of *space*. Now, in which sense these *Essential Readings* in particular and biosemiotics in general might be useful, once compared to other epistemological theories, to account for this notion? Or better, how can biosemiotics pursue differently the issue of its *origin*? One of the main conclusions that can be drawn from reading the excerpts is the hierarchical nature of knowledge; a remarkable application of this principle is made by Kull (2009) in his article on the semiotic threshold zones, whose abstract perfectly synthesizes the question I am addressing here:

We also argue that indexical semiosis is responsible for *spatial representations* and symbolic semiosis for temporal representations, which means that the vegetative *umwelten* are both non-spatial and not-temporal, the animal *umwelten* being *spatial* but non-temporal, and the cultural *umwelten* (*Lebenswelten*) being both *spatial* and temporal. (Kull 2009: 8; italics mine)

If Kull brings out the importance “to describe and understand the events that enable a system in its evolution to cross the threshold between the levels, and also at the same time to maintain it”, how can this biosemiotic insight about the evolutionary origin of the human concept of space be profitably applied and exploited elsewhere? I think it might be fecund at least within three conceptual frameworks which have already attempted to solve the problem from different angles. First of all, the origin of the concept of space can be tackled ontogenetically thanks to the *Genetic Epistemology* of J. Piaget (1967). Above all, T. von Uexküll (1986) has already paved the way to the possibility of a biosemiotic interpretation of the process of mental development by means of which the child progressively and constructively reaches a full cognitive and perceptual dominance of the spatial knowledge.

Secondly, our capacity of spatial perception has been phylogenetically studied by *Evolutionary Epistemology*. Here I am not referring exclusively to its former formulations, namely to D. T. Campbell (1966), K. R. Popper (1972) and K. Lorenz (1973), which have been subjected to harsh criticism in some respects, but even to its further developments towards less adaptationist and more constructivist and systemic forms, as can be found for instance in the works of R. Riedl (1980) and E. Oeser (1987). In this case, the post-Darwinian and semiotic concerns of biosemiotics can be considered useful corrections or integrations of a theory that, at least as far as Lorenz is concerned, directly stems from the original Uexküll's revision of Kantian transcendental aesthetics and his distinctive attention to the phenomenological worlds of animals.

Thirdly, as a multidisciplinary project that includes an understanding of the specific semiotic endowment possessed by human beings, biosemiotics gets in touch with *Philosophical Anthropology* and the works of M. Scheler (1928), H. Plessner (1928) and A. Gehlen (1940). On one hand, these thinkers have used or referred to the theories of biologists particularly dear to the authors of the present anthology and especially to the critics of classic neo-Darwinism, such as for instance Uexküll himself and A. Portmann. On the other hand, if their biologically oriented investigations on the nature of man's *Welttoffenheit*, as his distinctive feature, can be critically integrated with M. Heidegger's concept of *Sein*, despite the criticism of the latter towards the approach of the former, and if it holds true that, according to P. Sloterdijk (2001), Heidegger's meditation implies a potentially revolutionary theory not so much of time, but rather of *space*, then the whole thematic becomes of immediate biosemiotic interest. Let me just quote a striking footnote by a leading "humanities-based" biosemiotician, namely J. Deely:

So we have from semiotics the answer to the question posed by Heidegger on the last page of *Being and Time* (1963: 437): "Why does Being get 'conceived' 'proximally' in terms of the present-at-hand and not in terms of the ready-to-hand, which indeed lies closer to us? Why does this reifying always keep coming back to exercise its dominion?" For Ready-to-hand is the manner in which objects exist within an animal Umwelt. Human beings are animals first

of all, but they have one species-specifically distinct feature of their Innenwelt or modeling system brought to light in the postmodern context of semiotics Professor Sebeok, namely, the ability to model objects as things. Thus the human modeling system or Innenwelt includes the ability to undertake the discrimination within objects of the difference between what of the objects belongs to the order of physical subjectivity (“ens reale”) and what belongs wholly to the order of objects simply as terminating our awareness of them (“ens rationis”). (Deely 2004: 21)

Coming to the end, Favareau’s *Essential Readings in Biosemiotics* is undoubtedly a book worthy to be read and studied carefully, useful for different disciplinary approaches, ranging from natural sciences to humanities, but the reader has to bear in mind the scientific cutting that it has been given and the commitment to which he is called in order to further develop the “working hypothesis” therein contained. As I have tried to show, this commitment should be also addressed, to say, *forwards* (from biology to semiotics and philosophy) and not only *backwards* (from semiotics to biology).

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