The Natural History of Intentionality. A Biosemiotic Approach

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ANTHROPOMORPHISM

In the 1890s the Russian physiologist Ivan Pavlov studied gastric function in dogs when he made the striking observation that his experimental animals began to salivate whenever an assistant entered the doors. Pavlov realized that the salivary response was not due to an automatic physiological process, and started his now famous series of experiments to study this "psychic excretion" as he called it. Pavlov's experiments probably more than any other observations served to corroborate the firm belief held by the scientific society that living beings were in fact 'mere machines'. Nearly a century of behaviorist psychology has helped cementing this conception.

The machine metaphor for organismic life dates back of course to René Descartes' mechanical biology from the 17. century. Descartes' own image of the organism was the clockwork, but as technology developed other machines took its place. In the 19th century the steam engine became the preferred metaphor, and in modern times the computer is the unchallenged candidate. There is indeed a striking likeness between machines and living creatures in that both exhibit goal-directed activity. But as Terrence Deacon has observed, "whereas machines ... exhibit derived functionality and intention by virtue of a kind of teleological parasitism on human teleology, living functions of the body and mind are intrinsically teleological" (Deacon 2007, 2008). Thus the functionality of organisms may well be said to depend on delicate machinery, but this machinery has not been created by human minds and it therefore requires explanation of another sort than the explanation needed for the existence of real machines. In fact, the very popularity among scientists of the machine metaphor paradoxically discloses a strong scientific intuition, that organismic life does indeed exhibit intentionality, even though the machine metaphor was obviously meant to do away with exactly this presumed antiscientific idea.

The opposition among scientists and (most) philosophers to the idea of intentionality in animals - or worse plants, fungi, and bacteria - is probably due to the general taboo against anthropomorphisms in science. The automatic rejection by modern science of all theories carrying even the faintest trace of anthropomorphism (a rejection reminding one of the *horror vacui* of an earlier epoch) is however itself deserving of critical study (see Favareau 2007). As Karl Popper once remarked, if we are talking about the *nose* of a dog, we are also anthropomorphizing the dog, but we are doing so for good reasons, because the nose of the dog and the nose of the human

individual are homologous organs, i.e., their structural and functional similarities are accounted for by the well-established fact of common ancestry. Likewise, claimed Popper, we are well-justified in speaking about *knowledge* in animals to the extent that homology implies that animal brains and human brains are evolutionarily related organs performing related functions (Popper 1990, 30). In fact, any claim to the effect that human beings are the only animals to possess intentionality would require additional theories to explain why other mammals should be so fundamentally different from us. No satisfactory theories pertaining to such an effect is known to this author[1].

Needless to say, the widespread belief - not least among pet owners - in the presence of sophisticated human-like psychological intelligence in animals (and sometimes even in plants) hardly satisfies the slightest critical scrutiny, and anthropomorphism clearly poses a challenge that must be confronted and dealt with in any concrete case. But so does the opposite danger, the danger of anthropocentrism: "the *reading humanness out of nature",* as the American philosopher Maxine Sheets-Johnstone has put it: "By such an act, nonhuman creaturely life is interpreted in ways that consistently exalt the measure of humans: humans become special creations" (Sheets-Johnstone 2009, 125). The religious overtones are hardly accidental in this derogative characterization: considering the rationalist commitments underlying the taboo against anthropomorphism it is indeed remarkable that the godlike status hereby implicitly ascribed to the human being goes unnoticed. Like every other species in the world the human species is a product of evolution, and it is not reasonable to think that a world that has managed to create a human species would be deprived of all and every trace of human faculties. We therefore refuse to let the fear for anthropomorphisms deter us from considering the occurrence of natural intentionality.

[1] There is a third possibility of course, a possibility that has been adopted by philosophers such as Daniel Dennett, who recommended our taking of "the intentional stance" (Dennett 1987). Briefly stated, this view holds that we cannot understand the life of other humans (or of animals) without describing those lives as guided by, or woven into, intentionality. This does not mean that these creatures *possess* intentionality as a real property—rather, the thesis states only that we cannot understand these creatures unless we *pretend* that they do. I must confess that this position reminds me of the evermore complex (and increasingly less likely) sets of epicycles that Ptolemaic astronomers had to introduce into their explanations of the planetary orbits in order to uphold the belief in the geocentric system. Rather than seeking shelter in such powerless conceptions about what, for all of us without exception, is the deepest and most real content of our lives—i.e., the fact that such life is being *experienced*—we shall suggest that it is instead the ingrained belief in animals as machine-like robots that ought to be given up.

SEMIOTIC REALISM

Gregory Bateson in the book "Angels fear" (posthumously edited by his daughter Mary Catherine Bateson) observed that "if we had continual awareness of our image-making process, our images would cease being credible," and he goes on to assert that "The links between sense and motion are indispensable to living, but the links depend always on presuppositions that are commonly either absolutely inaccessible to consciousness, or momentarily left unexamined in the immediacy of action" (Bateson and Bateson 1987, 96-97). Accordingly one might say that living in a very deep sense depends on faith, faith in what our senses tell us - even though we have no idea of how the senses actually managed to tell us this or that; and even though we know quite well, that our senses may be telling us a wrong story. The inaccessibility to consciousness of the brain activities that leads us to perception is obvious alone from the fact that most nerve cells in the brain do not connect to the outside world or even to sense organs. They only "know" the local surround of other brain cells and body fluids. And yet these cells are our only means for grasping the outside world (Roepstorff 2004,149).

The kind of faith we are talking about here might perhaps be called *animal faith*, it is a faith that comes to us unconsciously and is hard to escape. The human species nevertheless is the only species in this world that may - to some degree at least - manage to escape it. We - or most of us - know that we may err; immersed as we are in a *linguistic lebenswelt* we are forced to distinguish between the reality of self-subsisting *things* and the more immediately known and equally real *objects* of our experience (Deely 2001, 8). Our lives cannot but implant the knowledge in our souls that the mind is one thing and the world is another. Language gives us the capacity to reorganize our interior cognitive and affective states in ways that are not tied to the biological constitution of the human organism.

This partial loss, or transcending, of brute "animal faith" is the source for a deep-rooted existential skepticism that clings to the human condition and which makes faith itself, *human faith*, a turning point for much of social life. In the philosophy of science it has caused persistent warnings against naïve realism. As Francis Bacon famously said in 1620: “The human understanding is like a false

mirror, which, receiving rays irregularly, distorts and discolors the nature of things by mingling its own nature with it" (*Novum Organum*).

Yet, if human knowledge did not actually help us - as it helped our remote ancestors - in the everyday dealings with the natural and social conditions of our lives, why would we have evolved brains and language in the first place, and why would we have prospered as a species? The rejection of scientific realism may seem tempting from an intellectual point of view, but it doesn't accord well with empirical evidence, i.e., the success story (at least as seen from an evolutionary point of view) of human civilization on our planet.

Nominalism nevertheless has dominated philosophy of science for centuries, not the least due to the broad acceptance of the Kantian claim that we can never reach an understanding of the *Ding-an-sich* (the thing in itself) but will always only grasp the "Ding-für-mich" (the thing for me). Scientists, accordingly, generally feel justified to understand their work as dealing with 'data', not with reality, a concept that is relegated to "metaphysical speculation." The nominalist doctrine implies that the relation between existing things is not itself part of what exists, but should instead be regarded as a mere construction in the mind of the observer. That a mammalian upper arm bone fits into the shoulder joint of the same animal is, according to this view, not part of reality, for *fits into* is a purely *relational concept*, and relations are not real things in themselves, only things like arm and shoulder bones are. The fitting-in *relation*, correspondingly, does not—to a strict nominalist—refer to any independently existing reality (Deely 1994, Hoffmeyer 2008). The claim in other words is, that our all too human habit of connecting things into relational systems misrepresents a reality that does not contain any such relations.

But again, why, one must ask, has the human species evolved this habit of placing things in relationships? Do we really have to believe in the Kantian dictum on the *Ding-an-sich* and the nominalist skepticism it logically entails? After all, modern philosophy might have led us astray. Perhaps relational order is indeed part of a mind-independent reality that humans do right in emphasizing in their descriptions of the natural order.

This was the position taken by the American scientist and philosopher Charles Sanders Peirce (1839-1914). Peirce developed a *semiotic realism* where knowledge was seen quite generally as based upon sign action, *semiosis*. The way the outside world of an organism and its inside world are connected is not, in this view, by way of

something from the outside entering into the inside, but by the formation in the organism of a sign relation connecting it to the outside world through an interpretative act. We shall return to this philosophy, but we must first recreate the historical context for Peircean semiotics[2] which unfortunately predates the scientific revolution and has therefore by and large become extinguished from the curricula of the educational system[3]. We must, in other words, look back to the Latin thinkers of medieval times, the period of scholasticism characterized by an attempt to reconcile ancient classical philosophy (notably Plato and later Aristotle) with Christianity.

From the point of view of science the most influential figure in this period was the Italian Dominican priest Thomas Aquinas (1225-1275) who held that the study of "the Book of Nature" was a necessary way to understanding "the Book of God", the Bible, and *vice versa*. The metaphor of the book of nature dates back to the church father Augustin (354-430) who saw the created world as a message to us from the Creator. Augustin was also the originator of the general category of a *sign* (signum) to be understood as something awakening us to infer something else (Deely 2001)[4], and for Augustin this meant that God gave us signs to show us his intentions. A storm or a flower was not just a storm or a flower since God would have had a purpose by creating storms and flowers - or idiots for that matter. Our linguistic categories were not then - as the nominalists claimed - just inventions of the human mind, for they served as necessary tools to disclose God's purposes with his creation. Thomas Aquinas' teachings were very influential in the scholastic period and his position on the necessity of studying the Book of Nature was one important stepping stone on the route to the scientific revolutions of the 16th and 17th centuries. Particularly important in this context was also his insistence on God's reliability, that God, in his benevolence, would not have created nature as an unruly and lawless place. Among the nominalists many protested against this theses that might be seen as an undue limitation of God's freedom: God must be free to create whatever kind of world he

[2] Semiotics unfortunately is still best known as a branch of linguistics due to the influential work of the Swiss linguist Ferdinand de Saussure (Saussure 1916). In the Saussurean tradition, which should better be termed *semiology* (Saussure's own original term) to avoid confusing it with Peircean semiotics, human language is taken as the primary model for semiosic activity and if semiosis is admitted to take place in the animal world at all, it is seen as a degenerate version of human semiosis. Modern semiotics, however, following the semiotic understanding of Peirce, considers human language as just one peculiar instantiation of a much broader semiotics pertaining to evolution at large.

[3] History is written by winners.

[4] Augustine defined the sign as "something, that besides the impressions it conveys to the sense, make something else come into cognition" (Bains 2006, 40).

might want, they claimed. But in the end the Thomist understanding prevailed - not the least, one may suspect, because the conception of a capricious and unpredictable God would imply, as Luther and Calvin both saw, that God might choose to punish the pious and reward evildoers. The belief in an orderly nature was of course a necessary precondition for the birth of the natural sciences, for had nature not to some extent been conceived as predictable there would have been no natural laws to study in the first place and the attempt to seek systematic knowledge about nature could hardly be expected to pay off.

For Thomas Aquinas himself and the Thomist tradition there is an emphasis on realism in which there is an immaterial or *intentional direct union* between the knower and the known (Bains 2006). To know about things, e.g. a storm or a flower, implies that these things exist in the mind of the knower as *intentional beings,* and the nature of this kind of being is that of a relation or interface. This understanding is radically different from the cognitive theories that came to dominate in the course of the scientific revolution, where "intentional being" was seen rather as an intermediary "obstacle posited between the knower and the known", an obstacle "*that would first be known reflexively* before the thing was known" (*ibid*, 43, my emphasis). In Aristotle form and matter were seen as different aspects of things, and in cognition the soul or mind would take on the form of the thing perceived without receiving its matter. So, according to Aristotle, when I think about or perceive a flower, my mind receives the form of the flower. Aquinas instead argues that the flower has a different existence in nature (*esse naturale*) and in thought (*esse intentionale*) (Bains 2006, 44).

The crux of the matter is the direct union between knower and known; the concept of intentionality is descriptive of this *relation* between the mind and the things cognized. We are aware not of the idea or concept but rather of that which it represents - its object. The idea or concept does not stand in between the cognizing organism and the thing (physical or mental), rather the idea or the concept is a formal sign, (an interpretant in the later terminology of Peirce), i.e. "that by which - or rather that on the basis of which - we know, ... not that which we know ..." (*ibid, 50).*

The nature of this relation would be the theme of the next several centuries of scholastic thought culminating in the semiotic philosophy of John (João) Poinsot from Coimbra (1589-1644) that has only recently been dug out of near oblivion thanks to the efforts of John Deely (Deely 2007). There is not space to delve upon the subtleties of Poinsot's thinking. Let me here just with Paul Bains summarize: "Poinsot sought to

conserve the possibility of an adequate 'correspondence' or coherence between thought and thing, but he also laid the semiotic foundation for an image of thought that could not be reduced to that perspective. Relations are truly *between* things: rhizomes or *interbeings*, to use Deleuze and Guattari's terms, or the 'Being of the between' to use Heidegger's characterization of Dasein." (*ibid*, 51).

Poinsot was a contemporary of Galileo and at this point of history scholasticism was more or less swept away from center stage by the aggressive new philosophy of the scientific revolution. As Bains remorsefully observes: "modern western philosophy (particularly from Descartes and onwards) chooses to dispense with the doctrine [of intentional being] and embrace the aporias of a 'classical' metaphysics of representation in which what the mind knows directly is its own products, positing a beneficent God to make our 'objective' ideas conform to the world" (*ibid,* 45). Several hundred years had to pass before Charles Peirce in the late 19th Century took up again the line of thought from the Latin thinkers and developed it to a full blown theory of semiotic realism.

"Modern philosophy", writes Bains "began once *the idea* came to be considered the immediate object of knowledge rather than an interface, or relation" (*ibid,* 51). According to Descartes the exterior world is grasped through the mechanical work of the senses, which then required some intermediate entity, a concept or an idea, to stand between the outside world (reality) and the mind. Henceforward the mind lost its direct access to the world. Humans do not usually react automatically upon sense stimuli but “translate” them to a conceptual world, which then serves as the substrate for thoughts and action. What is at stake is the nature of this “translation”: How can a material process be converted into a concept through a purely mechanical processes? It cannot of course, and therefore there is no escape from Descartes’ *res cogitans* in post-Cartesian philosophy, with the implication, that realism was essentially impossible from the very beginning of modern philosophy. For as long as thought is imprisoned in its own solipsistic res cogitans there is no way to measure it against the world. The only way to transcend this dualism, we shall claim, is to see organisms as connected to their world in a relational semiotic network rather than through the mechanics of their sensory organs.

INTENTIONALITY

The modern concept of intentionality in philosophy goes back to the German philosopher Franz Brentano (1838-1917) who in 1874 proposed intentionality as the one "positive attribute" that holds true of all mental phenomena: "Mental phenomena ... are those phenomena which contains an object intentionally within themselves" (Brentano 1874/1973, 88-89, cit. from Short 2007, 6). Brentano was himself, as Deely notes, a Dominican priest and was well read in the literature of scholasticism to which he explicitly refers. (Deely 2007, 4). The problem we are concerned with here is how it can be that some things in this world are "about" some other things. Thoughts, hopes, desires etc. are always about something else, and we distinguish them according to what they are about. Lifeless things, on the other hand, such as stones or clouds are not - to the best of our knowledge - about anything else. The term intentionality was meant to catch this strange property of *aboutness*.

We can summarize the Brentano thesis in three points: 1) Only mental phenomena exhibits intentionality, 2) Intentionality is an irreducible feature of mental phenomena, 3) Since no physical phenomena could exhibit it, mental phenomena could not be a species of physical phenomena. Brentano's pupil Edmund Husserl (1859-1938) saw the identification of intentionality with the mental as a fundamental principle whereupon he founded a new science: *phenomenology*. Phenomenology was the science of the mental and naturalistic explanation was excluded in principle.

From the point of view of analytical philosophy a major problem with Brentano's concept of intentionality is the claim that mental phenomena contains an object inside themselves even when that object does not exist. If for instance we think of a unicorn or of Santa Claus, then in both cases Brentano's thesis implies that our thoughts contains a non-existent object. As Short says: "one fears the unreal and desires the impossible" (Short 2007, 7). But how can something be an object without existing? W. V. O. Quine (1908-2000), for instance, would admit that intentional idioms are irreducible but would claim that they do not denote anything real, and like most contemporary philosophers of mind he held a) that reality is physical, b) that physicalist language is wholly free of intentional idioms (*ibid,* 13).

So, confronting the Brentano/Husserl position, that *mind is real, irreducibly intentional, and inexplicable naturalistically* we have the predominant position of analytical philosohy, that *whatever is real is nonintentional and explicable*

naturalistically. A fruitful discussions between two so fundamentally different positions is hardly possible and yet for decades these are the two positions between which we have had to choose. Unknown to the great majority of contemporary thinkers, however, a third position was suggested more than hundred years ago by Peirce: that *mind is real, irreducibly intentional, and yet explicable naturalistically.*

As the reader will expect by now, this is the position we will take here and explore in the rest of this paper. Peirce was against dualisms of any kind, an option he saw as closing the door for deeper understanding, and he would not accept that mental life should evade naturalistic explanation. But neither could he accept the physicalism of his own time which he saw as constrained by a much too narrow understanding of what is meant by 'the physical'. Instead the way he crossed the mind-body dualism was by extending the concept of intentionality beyond the confines of human cognition, and he did so by grounding intentionality in a very generalized understanding of sign action, *semiosis,* which he explained thus: "by 'semiosis' I mean ... an action, or influence, which is, or involves, a cooperation of *three* subjects, such as a sign, its object, and its interpretant, this tri-relative influence not being in any way resolvable into actions between pairs" (Peirce 1931-1958, 5.484). On the one hand this triadic notion of semiosis, which we shall discuss below in more detail, entails intentionality since to the interpreter (the system in which the interpretant is formed) the sign obviously is "about" something, and on the other hand Peirce did not conceive of the interpreter as being necessarily a human person. Peirce explicitly referred to this point in the following passage, from a letter to Lady Welby, written in 1908: "It is clearly indispensable to start with an accurate and broad analysis of the nature of a Sign. I define a sign as a thing which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its interpretant, that the latter is thereby mediately determined by the former. My insertion of 'upon a person' is a sop to Cerberus, because I despair of making my own broader conception understood.[5]" (Peirce 1908, 80-81).

BIOSEMIOTICS

[5] Peirce had no illusions that his contemporaries would accept his own broader conception whereby nature teemed with beings, for example, bees, that could stand in the place of *persons* as sites for the establishment of interpretants.

Biosemiotics is an approach to the understanding of living systems that takes sign processes or *semiosis* to be constitutive for life. Customarily the field has been divided into two main areas, 1) *endosemiosis*, meaning semiotic processes taking place inside an organism, as for instance in signal transduction (mediating extracellular signals to intracellular activity) or secretion of hormones; 2) *exosemiosis* meaning semiotic processes taking place between organisms, as for instance the dance of cranes or mating rituals of water mites. From a theoretical point of view however such a division is less satisfying since many, if not most, processes in nature connect semiotic processes of both kinds. In sexual reproduction for instance hundreds of endosemiotic processes (e.g. complex schemes of recognition processes between egg and sperm cells, hormonal regulations etc.) are mixed up in the sophisticated exosemiotics of mating behavior.

By making the sign fundamental to living systems biosemiotics undoubtedly will arouse fear of vitalism in the minds of many biologists. Signs do not belong to the habitual tool set of scientific theory and may be felt to allude to uncontrollable subjectivist aspects of life. In biology, vitalism refers to the belief that the functions of living organisms must be explained through the action of peculiar *vital forces*, that do not in any way influence inanimate nature. Biosemiotics rejects appeal to such forces. Sign processes are neither forces nor things; rather, they are processual relations that, as shown below, organize many activities. The causality of signs thus differs from the causality of forces. Indeed, while signs are frequently misunderstood or ignored, forces always exert their power with merciless efficiency. Biosemiotics is not a new version of vitalism (Hoffmeyer 2010).

But the concept of *semiosis* indeed brings a novel element to the scientific tool set for, by definition, a sign-process requires an interpretative agency. This new element, moreover, may be felt to jar with the hegemonic ontology of mainstream science. From a biologist's perspective, however, it can hardly be controversial to attribute agency to living systems. Indeed, the mechanism of natural selection can only work as, in Darwin's terms, organisms "strive" (Darwin 1971 [1859], 71: cf. Swenson 1989, Hoffmeyer 2009a) for resources such as those provided by food, water, shelter, mating partners and escape from predators. Without such strife there could be no competition, and without competition there could be no selection. Although rarely stated, natural selection does not magically provide a mechanistic

explanation the agency of living beings. At a deep level, mainstream biology needs a theory of living agency as much as does biosemiotics.

A promising avenue towards such a theory comes from studying the thermodynamics of irreversible systems and complex system dynamics. These approaches open up a non-deterministic world in which bottom-up processes engage in intricate interactions with their top-down counterparts (Laughlin 2005, Kauffman 2008). The evolutionary roots of agency, function and semiosis may well extend back to the extinct prebiotic systems that, about 4 billion years ago, gave rise to the first life forms. While realistic modeling of such systems may indicate how such a process arose, for our purposes we push back the origin question to a "threshold zone." Under the threshold we find neither semiosis, function or agency and above these properties are indeed exhibited by the system. Important work is presently done in this area by several groups (Kauffman and Clayton 2005, Deacon 2006)).

The first important thing to say about the sign, as understood by modern semiotics, is that the sign is a process: the sign does not exist apart from the process through which it exerts its effect. When we say e.g. that smoke is a sign of fire we think of the sign simply as identical to the smoke itself, but obviously for the sign to have any effect in the world qua sign it must be understood (or misunderstood). A baby sensing smoke would not turn its head to search for something burning, but even the baby might make an *icon*[6] of the smoke to the extent that the smoke reminds her of something like it that she had previously experienced. To adult people the smoke normally acts as an *index,* it indicates the eventual occurrence of a fire even when such a fire cannot be seen. This interpretation may of course be false, as would usually - but not always - be the case in a theater room. *Signs, in other words, refer to something else by eliciting an interpretative process in an organism.*

There is no need in this context to go into the complicated questions of the taxonomy of signs; suffice it to be aware that human language constitutes a very peculiar sign system based on the advanced category of signs called symbols. A few mammalian species may in exceptional cases access the world of symbolicity, but the systematic symbolicity of human language is unique to our species (Deacon 1997). Considering the uniqueness of human language it is perhaps not so strange that

[6] In Peirce's icon, index, symbol trichotomy the icon is a sign that refers to an object because of a supposed "likeness"; an index refers to an object because of a causal or correlative relation; the symbol refers to the object via a convention (often historically based as when the word "cheval" refers to an animal that in the English-speaking world may be referred to by the word "horse").

semiotics has traditionally been conceived as a branch of linguistics. But the belief in a sharp demarcation line between human and prehuman nature, corresponding to the realm of necessity and the realm of free choice respectively, makes no sense in the light of evolutionary theory and our growing understanding of animal cognitive skills (see e.g. Bekoff and Pierce 2009)[7]. And worse yet, it makes us misunderstand what is truly unique about the human being. For we are certainly not alone in the world in being sign users, all organisms must to some limited extent be capable of reading cues in their surroundings in order to survive. In fact, semiosis is exactly what distinguishes life from non-life (Hoffmeyer 2009a). What is unique about human beings is the kind of semiosis we engage in: While we share the capacity for interpreting iconic and indexical signs with all living creatures, we alone are bound to live our lives embedded in a symbolic world, a world of language (Deacon 1997).

Charles Peirce defined the sign as a triadic relation connecting the *sign* vehicle (the smoke in our example above) with an *object* (the fire) through the mediation of an *interpretant* (conscious - or instinctive - sensomotoric activity) (figure 1):

Figure 1 app. here

Figure 1: The Peircean concept of a sign as a triadic relation connecting a sign vehicle with an object through the formation of an interpretant in a receptive system[8]. In the right part is shown how smoke may act as a sign that evoke a sense of fear by making us aware of the risk of burning

Thus, when a deer senses smoke it is immediately "seized by alarm" (the interpretant) and flees away. The deer may or may not understand that smoke signifies fire but it certainly knows that smoke signifies danger (the object). Likewise, when a macrophage (a cell from the immune system) lets HIV virus into its interior, this is caused by the cell falsely interpreting the virus as belonging to the body itself. In achieving this the virus has acted as an *icon* for one of the normal components

[7] According to Peirce “All thinking is by signs, and the brutes use signs. But they perhaps rarely think of them as signs. To do so is manifestly a second step in the use of language. Brutes use language, and seem to exercise some little control over it. But they certainly do not carry this control to anything like the same grade that we do. They do not criticize their thought logically.” (“Consequences of Critical Common-Sensism”, c. 1905, (Peirce 1931-1958, 5.534).

[8] It may seem contradictory that 'sign' is put in as one element in the sign-relation. As explained in the text the sign always presupposes the whole triadic relation and technically speaking the term 'representamen' or at least 'sign vehicle' should have been used instead of sign. However, since everyday language uses the term 'sign' as equivalent to the representamen as such, I have chosen to stick with it.

involved in the immunoresponse reaction chain. Semiotics cannot restrict itself to deal with human language, but must encompass all kinds of sign systems as they unfold in time and space throughout organismic life on our planet.

A sign is not necessarily linked to a communicative context. Most sign processes in this world are not only unconscious but also unintended in the sense that the sign was not produced for the sake of interpretation. Most people for instance don't want to blush when embarrassed but cannot help doing so, and much to our annoyance observers readily interpret the result. All mammalian animals unwittingly emit butyric acid with the sweat, but for the tick the butyric acid acts as a signal that causes her to abandon her post (on top of the blade of grass/bush) and fall blindly downward toward her prey. Or, at another level, an antelope has been hurt and thereby draws the attention of hunting lions that selects it out for its slightly awkward movements.

I have suggested the term *semethic interaction* for this kind of co-evolution whereby "habits become signs" in the sense that individuals of one species have acquired the capacity to interpret certain regular activity patterns (habits) characteristic for individuals of another species, which then eventually may release new kinds of regular behavioral patterns in the first species etc. As an example we can take the case of the large blue butterfly *Maculinea arion* where the female lays her eggs in thyme plants. The larvae spend their first three weeks on thyme flowers on which they feed until they have reached the last larval instar. They then drop to the ground, where they produce a mixture of volatile chemicals that mimics the smell of larvae of the red ant species *Myrmica sabuleti*. The patrolling worker ants mistake the larvae for their own and carry the caterpillars into the ant nests. Once there, the caterpillars change their diet and start feeding on eggs and larvae of the ants until they pupate. They undergo metamorphosis in the ant colony, surfacing as butterflies (Gilbert and Epel 2009, 86). Here the female butterfly profits from the ants' habit of locating their nests on well grazed grassland with plenty of thyme plants so that she will 'know' where to put her eggs (presumably a parameter connected to the thyme plant is interpreted as a sign for oviposition). The caterpillars furthermore are capable of fooling the ants by interfering with the ants' own signaling system. That this is indeed the case is proven by the fact that if the height of the grass exceeds 4 cm *M. sabuleti* will disappear and another ant species, *M. scabrinodis*, will replace it with fatal consequences for the caterpillar, since this ant species will not misinterpret the

volatile chemicals produced by the caterpillar as a message of belonging in the colony.

Now, even if successful the semethic interaction between butterfly and ant may still fall victim to a new kind of dangerous parasitism. As Gilbert and Epel explains: "It seems these caterpillars are the sole food source for the larvae of several species of wasps of the genus *ichneumon.* A female wasp can detect not only the ant colonies but also the presence of butterfly larvae within them. She enters only colonies where caterpillars are present; once there, the wasp emits pheromones that cause the ants to fight among themselves while she goes about laying a single egg in each butterfly larva. Each wasp egg hatches into a larva that eats the caterpillar as it begins pupation. Eleven months later, the pupal case is shed and there emerges not a butterfly but an adult wasp" (*ibid*).

Many more examples on these webs of habits-signs-habits... are given in my book *Biosemiotics. An Examination into the signs of life and the life of signs* (Hoffmeyer 2008). Among biochemists, there is a rule of thumb saying that whenever nature keeps a store of energy (e.g., food) there will also always be a species that makes its living by consuming it. I shall suggest a quite similar rule of thumb by saying that there never occurs a regularity or a habit in nature that has not *become a sign* for some other organism or species. Admittedly, this rule may be less well investigated (so far!) than the biochemical rule, but it does catch an important semiotic aspect of the evolutionary process, for due to the mechanism of semethic interactions, the species of this world have become woven into a fine-meshed global web of semiotic relations. These semiotic relations, more than anything else, are responsible for the ongoing stability of Earth's ecological and biogeographical patterns. At the individual level as well as at the level of ecosystems all interaction patterns are controlled through semiotic relations - more or less in the same way the traffic in a city is controlled through signals. This relational network can be looked upon as an internal semiotic scaffold.

Biosemiotics then is not so much about *communication* as it is about *signification,* the many processes whereby organisms ontogenetically or phylogenetically have learned to ascribe meaning to whatever regularities around them that may be useful as trigger mechanisms. Biosemiosis therefore does not fit into the traditional scheme from communication science of a sender and a receiver connected through a channel, for to the extent there are clear-cut senders and receivers

at all (hardly the normal situation) the channel is itself part of the message as interpreted by the receiving system. Semiotic causation is based on a "trigger-mechanism" whereby the interpreting system creates the interpretive response by its own means, not by any external intervention - apart form whatever "trigger-event" it has learned to select. For this reason *there is no need for physical compatibility between the sign and the activity it releases*, the sound of a bell may get children running, a few molecules hitting the antenna of a wasp may release flying behavior, and the absence of light stimulation of the right eye retina of a kitten during a critical period may cause the cat to be functionally blind on the right eye for the rest of its life. The evolution of a semiotically based regulation of organismic activity opens for a versatility of means and a complexity of interactive entities that had been impossible if the controlling agency relied exclusively on efficient causality, good old biochemistry.

RELATIVE BEING AND SEMIOTIC FREEDOM

A sign is a triadic relation that organizes a process whereby an event or entity inside or outside of an organism (or a lineage seen as a *supraindividual* historical organism) is reacted upon. A bird sees an unexpected shape on the stem of a birch tree, interpret the shape as "food" and changes its flight for the catch. This process is totally different from the case where the moth is smashed into pieces by a falling heavy object. The moth will die in both cases, and also in the last case do we have a causative relation, gravity causing the heavy object and the Earth to approach. But this is a dyadic (cause-and-effect) relation in no need of semiotic explanation; the bird on the other hand is led by an interpretative act, that could not be described or explained in the absence of the particular triadic relation involved. A hardliner reductionist may object that the feeding behavior of the bird is indeed explainable through an 'infinite' web of efficient causative events. Rather than argue about such speculations, I shall point out that for all practical purposes the explanation for the bird's behavior is a triadic relation, and to insist upon explaining it through an infinitely long series of dyadic relations will bring us nowhere.

The point is this: There is no reason to assume that interpretative events are not perfectly physically caused processes. But interpretative processes are special because *they are organized according to semiotic dynamics*. If we try to separate them

out of this context we will just end up having myriads of dyadic (cause-effect) processes without any discernable pattern, and we would not have a chance to elucidate the real dynamics at work in the situation. In reality, though, it may seem as if we manage quite well by describing everything in terms of dyadic processes, but this is because we instinctively understand the intentionality of the organisms we are studying. We are therefore capable, to some extent at least, to 'guess' on what is the real dynamics at play. The success of this strategy may persuade us to think that dyadic relations are all we need, when in reality this need has been "falsely" satisfied through a loan from our own intentionality. Biosemiotics is precisely needed in order "to make explicit those assumptions imported into biology by such unanalyzed teleological concepts as function, adaptation, information, code, signal, cue, etc., and to provide a theoretical grounding for these concepts" (Kull, et al. 2009, 170).

Most relations in this world are of course quite uninteresting, as for instance the relation one might hypothetically draw between my big toe and any of planet Jupiter's 63 moons. We have no reason to believe that any of these particular relations will ever get to have any causative influence upon events on Earth or elsewhere in the universe and have no reason to ascribe any reality to them. Other relations are important enough, as for instance the relation between prolonged day length and approaching summer solstice. This is a purely dyadic relation that may be precisely predicted at any given latitude thousands of years forward in time. The relation is important because - among other things - it assures that trees may 'know' approximately when to burst into leaves. Still, since this biological use of the relation is not intrinsic to the relation it does not count as an ontological relation. The term 'know' here is put inside quotation marks to indicate that this is not knowledge in the human sense of this word, but it *is* knowledge in the sense that trees have 'learned' to use this relation as a sign (actually, degree-days rather than day length is the releasing factor here, but the two are of course closely connected). Each single beech tree that bursts into leaves does not 'know' why it does so, but as a species the beech trees have learned through evolution to size up on the time when this parameter has reached a threshold level.

Knowledge in the biological sense of the term, as we have used it here, necessarily depends on predictability, and the mechanism behind all learning is the creation of a triadic relations on the basis of stable dyadic relations. The predator, for instance, goes for any prey animal that moves awkwardly because it 'knows' that

clumsy behavior signifies easy catch. In other words, the predator converts the dyadic relation between slow-rate flight and clumsiness into a triadic relation in which an interpretant is produced on the top of the simple dyadic relation, and this interpretant makes it hunt the prey animal that moves clumsily. A bird, on the other hand, may predict that if it moves clumsily, e.g. by pretending to have a broken wing, the fox will try to catch it instead of it's youngs. This way the bird may often manage to lure the fox away from the nest only to fly away when the fox has lost trace of the nest itself.

The moment we turn from the physical world to the organic world relations tend to take on a reality of their own. Returning to the already mentioned relation between the shoulder of an animal and the upper arm bone we are dealing with a highly sophisticated version of an ordinary ball and socket relation. But when we follow the evolution of this particular relation in animals since it first occurred hundreds of millions of years ago as fins of fishes, it is obvious that the relation as such has been the focus of natural selection, and not only the bones. Whatever change selection may have favored in the evolution of these two bones, the relation between them would have to remain fit, for if one of the two bones changed without a corresponding change in the other bone the individual would be crippled and could not be expected to leave offspring. The adaptive function of the arm-shoulder joint is an *intrinsic property* of the relation as such and it would be stretching to claim, as the nominalists do, that this relation is not part of reality but only of our own minds. This type of relation has been termed *categorial relations.*

Sign relations, or ontological relations, are different since they do not depend upon the (mind-independent) existence of that which they relate. Thus most people in the western hemisphere will think of Santa Claus if they are shown an image of a white-bearded man dressed in red clothes walking in a snow covered landscape, but this does not mean that these people believe in Santa Claus. As we said above, the sign is a *pure relation*: it is neither material nor mental, it simply consists in the process of producing a connection between events or entities in such a way that one event or entity becomes related to another event or entity according to the needs of an organism. The sign relation is both established and goes extinct in the very action of the sign. Eventually it may endure for some time of course, but this persistence depends on the perpetual repetition of the same - or a similar - sign process.

Anticipation - in the broadest sense of the term - is what living systems do for a living. Contrary to lifeless systems organisms do not passively sit (or flow) and wait for things to happen, they actively search for the resources they need and actively protect themselves against a range of possible dangers[9]. All of this presupposes some kind of anticipation where present cues are used to tell about future conditions in some sense or other.

There are of course many strategies a species can "choose" for coping with the challenge of change and the evolution of increased anticipatory talent is only one among them. It is however a very decisive strategy that may even have changed the dynamics of the later stages of evolution on our planet. This is because such a strategy possess an intrinsic potential to drive forward a growth in the capacity I have called *semiotic freedom,* or *interpretance.* Semiotic freedom may be defined as the capacity of a system (a cell, organism, species etc.) to distinguish relevant sensible parameters in its surroundings or its own interior states and use them to produce signification and meaning[10]. An increase in semiotic freedom implies an increased capacity for responding to a variety of signs through the formation of (locally) 'meaningful' interpretants (Hoffmeyer 2008, Hoffmeyer 2009a). The term freedom in this context should be taken to mean: underdetermined by natural lawfulness.

The appearance on our planet of biosemiosis opened a new agenda for the evolutionary process by providing entities with the agential property presupposed for Darwinian "striving" and thus for natural selection. For billions of years the semiotic freedom of agents remained low, and a bacterium, for instance, cannot itself chose to *not* swim upstream in a nutrient gradient. Therefore, at this stage of evolution semiotic freedom is primarily exhibited at the level of the lineage (the species as an evolving unit)[11]. I suggested the term *evolutionary intentionality* for this kind of intentionality (Hoffmeyer 1996b). Only gradually would emerge a more advanced stage of

[9] Plant movements may not seem of much, but if you increase the time scale it may actually look quite impressive when played at video. Plants move by growth (beneath and above the earth), by off-shoots and runners, and by spreading their seeds.

[10] Originally I defined semiotic freedom as "the depth of meaning that an individual or species is capable of communicating" (Hoffmeyer 1993, 109; 1996a, 61), but the essence of this ability is interpretation rather than communication, although the two aspects are of course closely connected.

[11] Even at this level one cannot rule out individual semiotic freedom right away though. A bacterium is a hugely complex and well tuned system of proteins and other components and although learning processes do probably not directly play a role at this level the bacterium is capable of changing its behavior by the active uptake of foreign DNA from bacteriohages.

biosemiosis, in which semiosic activity was no longer a property of the lineage but also, and importantly so, a property of individual organisms.

This "individualization" of semiotic freedom, i.e., its displacement from the level of the species to the level of the individual, would have initiated a change in the dynamics of the evolutionary process. Patterns of interactive behavior now became increasingly regulated or released by semiotic means, and this would have induced a new kind of flexibility upon inter- and intraspecific interactions. Innovations more and more came to depend on semiotically organized cooperative patterns at all levels from single organisms and species to whole ecological settings. In fact, as I have suggested elsewhere, natural selection from now on would more and more follow directions given by the ecosemiotic interaction patterns (called *ecosemiotic motif*'s in (Hoffmeyer 1997). The more natural systems become scaffolded through semiotic interaction patterns (semiotic scaffolding) the less will be the role played by genetic scaffolding, and the more derivative will the role of natural selection become. Natural selection will now favor such genetic adjustments that might support already established semiotic interaction patterns, but will not itself to the same extent mark out the direction of change. As a consequence the individual rather than its genes become the main evolutionary agent, and the concrete life history of individuals will increasingly determine their behavior. By implication learning, interpretance and semiotic freedom will be more and more important parameters in the games played out in the evolutionary theater. Or, in other words, a self-sustaining dynamics leading to increased semiotic freedom is set in motion.

HUMAN INTENTIONALITY

Very late in organic evolution a further potentiation of semiosic capacity took place through the appearance of human beings that from the first beginnings were embedded in a linguistic Lebenswelt, based on the particular ability of this species to understand symbolic linguistic referencing (Deacon 1997). Due, not the least, to the indefatigable efforts of the late Thomas Sebeok it has now gradually become accepted that human semiotic capacity is only one - although radical - further refinement of a biosemiotic capacity that has unfolded itself on Earth through nearly 4 billion years (Sebeok 1979, Sebeok and Umiker-Sebeok 1992). The semiosic difference between the human animal and other living systems is staggering indeed, but, as John Deely

has repeatedly pointed out, by far the most important dimension of this difference is that humans know the difference between signs and things, while animals don't (Deely 2001). In our attempts to cope with this discomforting knowledge the winning strategy in modern time has been the *de facto* institution of a dualism between mind and body[12], a dualism that left biology and medicine with only half of the human person, the so-called body, and which therefore has not managed to understand what a human being is, or what health is (Hoffmeyer 2010).

Human beings are persons and persons cannot be divided into one part, the body, that must be treated somatically, and another part, the mind, that must be treated psychologically. This is where the biosemiotic approach may help out, because biosemiotics sees meaning and signification (sema) as inherent to the body proper (soma) and not as something separated out to non-descript locations in the brain or mind. Whatever the mind is it is also body, not body in the physical sense this word has got in present day biology or medical science, but body in a semiotic sense of the word, a body that is inherently engaged in communicative processes that serve to coordinate the activities of the cells, tissues and organs inside the body as well as to exchange integrating messages across hierarchically distinct levels. Seen in this light *the mental system or mind is simply the interface through which a human organism manages its coupling up to the surrounding web of things, natural or social*. The mind, thus, is not a thing and has no more distinct location (in the brain?) than has the electronically mediated processes whereby a changing pattern of pixels is at each moment shaped on the TV-screen. The outsourcing of the body-world interface into a distinct disembodied field, the mind, to be studied by a separate science, psychology, was of course a necessary step as a compensation for the imprisonment by natural science of the diseased person into a body that could no longer - qua body - integrate itself into the world in a meaningful way. But not only was this outsourcing based on unequal balance in which the medical expertise was the unquestioned highest authority in matters of therapy. It also forced psychology into an impossible role as caretaker of functions that were neither corporeal nor social but mysteriously suspended in a no-mans-land produced by lack of any substance apart from the unbearable idea of Cartesian res cogitans.

[12] Often unwittingly disguised as materialistic monism which, however, in a deeper analysis can be shown to presuppose dualism (Searle1992).

I must emphasize that this criticism is not directed towards the many excellent practitioners inside the respective areas of medicine and psychology. Ingenious ways have been invented to overcome the absence of a unified theory of the human person, and present day psychological and medical approaches to health are invaluable and absolutely necessary stepping stones for a further development of a healthy health strategy. Nevertheless biology and medicine must reintegrate the body's interface with its external world, the mind, into its core theory of a human organism. And the way to do this is by admitting semiotics into its basic tool set. "A sign is not just something for the mind to interpret, but something for the body to interpret, and the body is itself of the same stuff as dreams are made of, significative biomolecular processes - our dreams are constantly nourished by the semiotic processes going on in the bodymind"$ (Hoffmeyer 2010)[13].

With the birth of this animal, the human being, the natural history of intentionality seems to have reached a threshold level, where the social and cultural environment attained an autonomous kind of creativity that irreducibly interacts with, and largely - but never completely - determines the horizon inside which the personal intentionality of human beings exhibits itself. And unlike biological creativity (organic evolution) the history of cultural creativity is deeply dependent on semiotic scaffolding right from the beginning. Language itself is of course a powerful semiotic scaffolding tool, allowing for oral transmission of cultural experiences in time (from generation to generation) and space (from group to group). But a range of additional and increasingly sophisticated scaffolding devices follows the development of human civilizations, primarily in the form of technical practices and art. Sculptures, paintings and, in time, written texts support the transmission of social skills and the myths that makes the world meaningful to people and serves as a much needed memory store, necessary because most people through most of human history were illiterate and had no access to other kinds of external memory stores.

The cathedrals of the middle ages, the invention of the printing press, the radio, films, TV, computer networks and the internet are some of the major semiotic scaffolding tools that supported the route to the modern world. No need to go in more detail. Let me rather end this little sketch by observing that for each new step in the development of this endless series of still more powerful semiotic scaffolding tools,

[13] The term bodymind was introducced by immunologist Candace Pert and co-workers, (Pert et al. 1985), and discussed in a semiotic context in Hoffmeyer (1996a)

the semiotic freedom of individuals took on new dimensions, because each of these steps trivialized insights that earlier generations had had to spend their cognitive resources to acquire or learn, where now in the new generation semiotic scaffolding made the insight more or less part of an 'inherited' skill (Hoffmeyer 2009b). Air pictures, to take just one example, now instantly show us the geography that earlier generations had spent so much energy in calculating through laboriously acquired techniques. As a result each new generations tend to possess more powerful semiotic scaffolding systems on which to base their own contribution to the changing world, the semiotic freedom get ever greater horizons to work on.

Finally, one may suppose that already from the earliest modest steps on the route to speech its function as a means for semiotic scaffolding would feed back into the development of the human brain itself. The gradual appearance in our remote ancestor's cognitive system of a referencing system based upon sound signs, speech, would have opened a new kind of social intelligence, an intelligence derived from the capacity of the social group as a whole to learn through the exchange of experiences, skills, empathy, sensitivities, fantasy and inventiveness in a public or shared process. In the framework of this new communal functionality it must increasingly have become a criterion for individual success that one could contribute in talented ways to this emerging social intelligence. The establishment of a communal or social intelligence might have further influenced selection of individual intelligence for instance by favoring the development of brains talented for social and linguistic competences. Therefore one might suggest that the very special way the human brain has been organized is as much a result of the social life made possible by speech, as the social life is a result of highly the developed intelligence of humans (cf. Deacon 1997). But most probably the input went both ways: from the social-semiotic level to the genetic level, and from the genetic level to the social-semiotic level.

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