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How to Make Peirce's Ideas Clear
(First in an inexhaustible series)

Donald Favareau
University Scholars Programme
National University of Singapore
favareau@biosemiotics.org

ABSTRACT

Having failed within his own lifetime in making his own ideas "clear" – in the sense of immediately self-evident, absolutely unmistakable and easily understood to the general public – Charles Peirce left behind in his manuscripts an extraordinarily complicated notion of "sign" that is only rivaled in its complexity, perhaps, by his extraordinarily complicated notion of "mind." But the fact that both these small words, much like the word "time," already have everyday connotations that are internally incoherent yet manage to do a lot of useful work in the world as placeholders, should not deter the serious inquirer from attempting the kind of higher-order definitions from which the everyday uses can then be understood as specific cases. Therefore, those of us who feel that Peirce's explanations of these terms may at least be leading us in the right direction as we attempt to develop our own understandings of biosemiotic processes, simultaneously find that we have to try to make clear for our audiences what it takes Peirce literally thousands of pages to make clear to us. In this short talk, I will attempt to convey an *initial working understanding* of Peirce's notions of "sign" and "sign interpretant" as those terms may be understood within a biosemiotic framework.

Introduction:

Long before most people in what is now the "biosemiotic community" had ever read Peirce, they were encountering in their own fields of study (whether immunology, genetics, neurobiology or ethology) the steadily undeniable recognition that almost all biological processes are ultimately both: (1) triadic – which is to say that we rarely encounter isomorphic relations such as "Ca^{2+} *always* functions as a promoter molecule for cell X" but instead, we overwhelmingly discover that even the simplest of biological relations are always both highly context-dependant and consequentially context-creating, and (2) that such relations are very often deeply "representative" of other biological states and processes in a non-eliminable manner – meaning, again, there is no property intrinsic to Ca^{2+} itself that "stands for" anything – nor is there anything in the depolarization of any neuron at any time, anywhere *per se* that "contains information." Rather, such events and relations become genuinely "meaningful" to systems (such as brains, lymphoid organs, and organisms) as the result of their placement in a larger system of communicative interactions.

It will be useful at the outset to notice the semantically loaded terms "meaningful" and "communicative" here. We will have much to say about the need to more carefully unpack these terms presently. For the present, though, it will be worth dwelling for a moment on the pervasive use of these terms in almost all areas of biological study. Apparently, it is quite simply impossible for biologists to avoid describing much of the situated interaction within and between biological systems in such "quasi-intentional" terms due to the simple fact that biological systems are *not* deterministic single-cause to single-effect machines; rather they are self-organizing, self-maintaining and self-informing. This is why even the most diehard material-reductionist scientists cannot yet avoid using the terms "signal" "message" "communicates" "stands for" "represents" "messenger" "sign of" etc in their explanations. It is not a case of metaphor or language poverty - science abjures sloppiness in expression, and if there was any other way to accurately describe these

functions and phenomena, scientists would do so. But the fact of the matter is that scientists have to use terms such as "sign of" and "communicates" when speaking about these processes because those, in fact, denote precisely the relationships that are being instantiated – once one is clear about exactly what those relations do and do not entail. Is it linguistic communication, then, and "mental" signs that we are talking about at the level of intercellular communication? Of course not! Such higher-order sign relations only become possible (and only among a small subset of species, and most probably, one) because of the lower-order iconic and indexical processes that all organisms must use to successfully negotiate an external world of physical transactions taking place outside of the world of internal physical transactions that it must keep in balance in order to remain alive.

For almost two decades now, the case that even the simplest animals are genuinely semiotic agents in the world (in a non-linguistic, wholly non-anthropomorphic, yet nonetheless genuine and non-eliminable way) has been convincingly demonstrated by biosemioticians (e.g., von Uexküll, Hoffmeyer, Turovski, Sebeok, Emmeche and Kull). And even among more "mainstream" biologists, it is widely acknowledged that one of the things that differentiates living organisms from machines is just this aspect of "non-isomorphic, non-determinism" in the negotiation of one's external surround. Animals are not *wholly* constituted such that the presence of X must always and directly cause response Y. There are in all animals (ourselves included), of course, evolutionarily in-built biological "biases" and some of these biases are literally "hard-wired" into the system, giving rise to a range of corresponding biological possibilities and constraints. But a *fully* "mechanistically causal" system could never survive the vagaries of ongoing environmental change. Instead, merely in order to survive and to *evolve*, animals have to be complex, adaptive, novelly responding systems (at least to some degree) both at the level of the individual, as well as at the level of the lineage, as Darwinian evolution makes evident.

The biosemiotic argument is that this same principle of "non-isomorphic, non-determinist response to singularly causal stimuli" appears not only on the level of the individual (ie – the organism's actions as a whole) but similarly, within the internal interactions of organisms themselves (along with, of course, the more canalized, strictly catalytic process). For on the internal system level, too - whether in gene expression and its "induction', or in neuronal transmission and its "response" – what we find consistently is not switches deterministically flipping other switches, but rather: matrices of triadic inter-action wherein the relevant material "x" *substitutes for, represents, is associated with, and/or functions* as not just "x" but "x *as* a sign of y" for some cell or cell group. And organisms are, after all, composed of nothing more than just these cell groups, from the fishes on up to us.

Without belaboring this point too long, then: Science (i.e. - regular, mainstream science, of which biosemiotics hopes someday to be a part) **needs** but **does not yet have** a vocabulary and a "big-picture" way of talking about and of thinking about these processes that it has only recently discovered the ubiquity of in living systems.

For while the dynamics of "self-organizing complexity" *alone* may be necessary to, they are insufficient for, semiosis. Hurricanes, soliton waves, weather systems, etc. are not biological systems and cannot and do not engage in the kind of ubiquitous biological "substitution relations" wherein material element X is used by the system not only as X, but as X "standing for" Y. And in all instances whereby *that* relation becomes the basis of self-generated action, *semiosis* – the actions of signs and the using of system-informing "meaning" relations – is taking place.

This presents our currently constituted science with a problem, however: For if the word "meaning" is to have any utility at all in explanation (as I think it must when discussing animal behavior) – it cannot *proceed from* the highest-level cognitive capabilities of one of the very newest buds on the evolutionary bush, for that would amount to a grossly

anthropomorphic view of nature and "revisionist re-writing of the evolutionary past in terms of the present, inverting evolutionary cause and effect" (Deacon 1997).

Conversely: If one tries to describe "representational" events merely by describing the material constituents that are necessary to (but again, insufficient for) the relation whereby "X stands for Y to Z" what one then winds up leaving unexplained is exactly that semiotic relation whereby X is acted upon by a system not only as X but simultaneously as "X as a *sign* of Y." Or as Terrence Deacon himself realized over thirty years ago: "No explanatory system based on phenomena limited to the realm of Secondness (e.g. determinate mechanical analysis) can ever hope to include relationships of significance, representation, meaning, function, purpose, value, or experience (phenomena of Thirdness)" (Deacon 1976).

Rather, we need some way of talking about how actual, discretely existing material things (e.g., these words, that ion exchange) come to "stand for" and to be acted as "signs" *of something other than themselves* by some living system. What we need, then, is a framework for understanding and explaining the sign relations that occur naturally in the biological world that do *not* require a human mind for their accomplishment. And one that must, in addition, be capable of explaining in a naturalistic, scientifically verifiable way how the human mind itself may be *the product of* (and not the producer) of by such processes.

This does *not* entail any Cartesian ghost in the machine, or recourse to vitalism or (worse yet) supernaturalism – but rather, just a scientifically grounded re-thinking and re-defining of certain ideas and concepts in order to better "capture" what is going on in certain kinds of complex interactions between and within organisms.

Traditional accounts from both cognitive science and philosophy of mind have failed to develop coherent answers to this question – and thus the neuroscience and behavioral psychology that underlie those projects proceed along with a "hole" in the center of their explanations of the natural world (as is frequently admitted, especially in the cognitive neurosciences). Indeed this is the central puzzle here: How can *matter* come to "mean" something – or to make meaning itself? That is the question that biosemiotics attempts to answer in a scientifically coherent, absolutely non-mystical and non-supernatural way.

And one of the things that distinguishes biosemiotics from many previous approaches to this problem is that biosemiotics does not believe that the answer to the central question of: "How can physical processes function as sign processes in organisms?" can be arrived at *without* a comprehensive understanding of the internal logic of "sign processes" – or semiotic relations – *per se*. Rather, biosemiotics argues that one must *first* have some overarching explanatory paradigm defining what exactly a "sign process" *is* before one can even begin to make sense of these questions in any scientifically legitimate way.

It is for this reason alone that many biosemioticians (myself included) find the conceptual "tools" found in the semiotic logic of American philosopher Charles Sanders Peirce (1839-1914) helpful as we begin our own "backwoodsman work" of clearing preliminary pathways through the blind faith in mechanical reductionism that – though dying and having already been given its death sentence by mainstream science itself – is still "blocking the way of inquiry" to the understanding of sign processes in biology today.

In this talk, then, I want to briefly outline just two of Peirce's more important ideas – his notion of "sign" as a triadic relation (and not a "thing") and his use of the technical term "interpretant" to denote a localizable effect in a representative cascade – so as to clarify to those unfamiliar with Peirce's ideas exactly what biosemioticians are, and are not, saying when they employ these terms to an understanding of biological processes. Such newcomers can then either adopt or reject these ideas for use in their own investigations, as they see fit. To proceed, then:

Sign and Interpretant

The most straightforward way into this discussion – and the only one that we will have time for in this short presentation – will be to try to translate into biological terms these two ideas tightly-related from Peirce:

"I define a Sign as anything which is so *determined by something else*, called its Object, and so *determines an effect* upon a [system], which effect I call its Interpretant, that the latter is thereby mediately determined by the former" (CP SS 80-81, 1908)

"That determination of which *the immediate cause, or determinant, is the Sign*, and of which *the mediate cause is the Object*, may be termed the Interpretant" (CP 6.347, 1909)"

The use of a specialized technical terminology here, as everywhere, threatens a retreat from understanding right from the start. And yet the goal that we claimed biosemiotics to be aiming for was not to devise a vocabulary that is obscure and complex, but to accurately describe some actually existing state of affairs in the world that is, while complex, not at all obscure. Rather, such processes are ubiquitous – and they are processes that we see going on everywhere in the living world but that we still don't have the tools to scientifically talk about. These processes are the active *ordering of things into relations of association and of substitution* by living organisms. For again, we must have some principled way of describing what is happening when we observe an organism acting upon X as if X is both itself still X (for this must be so for it to be recognized), and simultaneously as if X is sign for something not at all itself, y (for this is how it is reliably oriented to and/or acted upon by the organism). We can say that the organism is "processing information" – but is it really accurate to say that or are we papering over one gap in our knowledge with another? Because things aren't "information" per se – and "information" is not the name of any physical entity in the world of things. Moreover, we seem to have at least two processes – recognition and use – conflated into one here. Especially if these two processes are complexly related, shouldn't we have separate terms of describing them that yet allow their recursive integration?

What then changes if, instead of saying that organisms are "processing information," we say instead that that organisms are using signs? Well, here is where Peirce can help us a bit, because unlike the term "information," the term "**sign**" does not claim to name of any physical entity (or intrinsic property of a physical entity) in the world of things. Rather, like "gravity" and "daughterhood" *information* (or in Peirce's term *semiosis*) here is defined as always nothing less than *a multipart relation* – and a particular kind of multipart relation, as Pierce goes to great length to precisely specify. And just as gravity and daughterhood are both: (1) really existing relations in the world, having material consequences though the relations themselves are not material, but exist between material things, and (2) are always therefore always and exclusively brought into relation by two material things, whose actions vis-à-vis each other manifest in a third immaterial relation, Peirce's concept of the *sign relation* is likewise really existing and materially consequential, though the relation is recursive in that the action of an agent vis-s-vis a material sign vehicle and a material sign object manifests in a relation whose product, the sign interpretant, itself serves as a sign vehicle for the next act of semiosis.

If the above explanation is still to arcane, try re-reading it again in light of the deliberately over-simplified diagram below, beginning at the bottom right, with "object"):

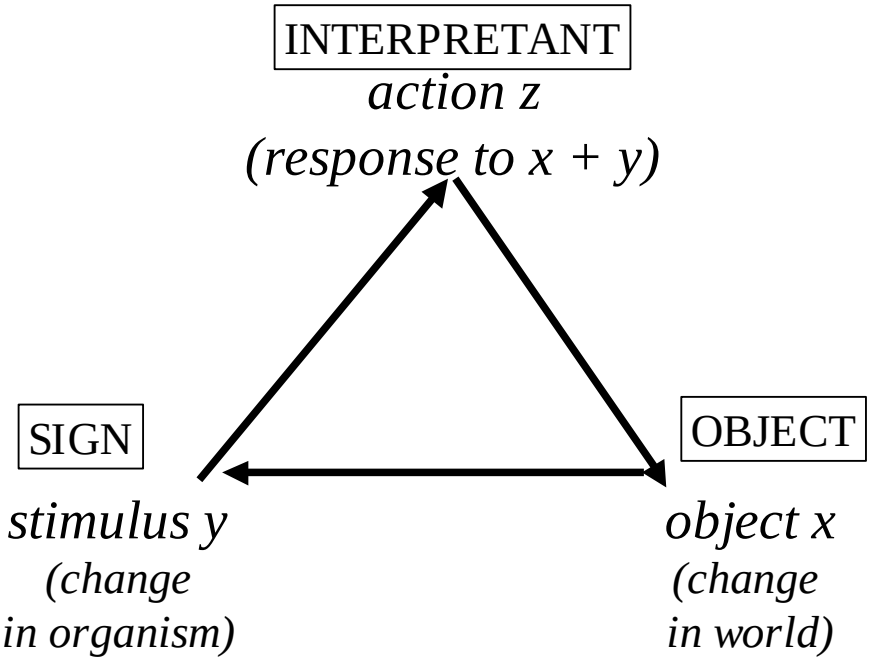

FIGURE 1:
Simplified schematic diagram of the consubstantial relations that together constitute the Peircean "sign" relation.

Notice how this diagram is generic enough to depict, say, the defensive reaction of a sessile marine animal upon the registration of the touch of a motile predator; the initiation of a limbic-system generated "emotional" response resulting from neuronal activation originating as the result of some external event; or as the evolutionary adaptation of a species in response to environmental change (indeed, I have argued elsewhere that it is precisely this relation that is what gets "selected for" in evolution). Note, too, that there is absolutely nothing along the lines of a human-like mind or Cartesian "mental interpret*er*" necessary to this process ("interpretant" being a technical term denoting merely a situatedly produced response, as we shall discuss shortly) – only physical things happening in a physical world.

But note further that what is being depicted here is *not* merely a "billiard ball" schematic of efficient causation. Rather, the transformation from "object" to "stimulus" is already one that is massively mediated by the internal biology of the organism. For if, indeed, that biology allows for the perception of the object as a stimulus at all, both the mechanics of that transformation, as well as its products, will be manifested differently across species of biological organization. In other words, its very impact upon the system – even as "an impact" – is already mediated, even *prior* to its becoming embedded in the subsequent set of system-specific contextual transformations that will shape the nature of the organism's "response."

Too, since for Peirce a "sign" relation is by necessity all three of these relations in triadic interaction, the diagram shows that attempting to examine just the "system-internal" reactions is insufficient for explaining how that action "stands for" something *other than itself* to an organism. For to explain that, one needs to look at the triadic relationship of: (1) that element of the world impinging upon the organism (2) the relations of that element to the rest of the larger system of "externality" that it is in (the world), and (3) the relation of that element to the larger system of "internality" (the biological body) to which it has now been introduced. This gives us the relation of (1) *as a sign of* (2) for (3) [or X as "standing for" Y

to Z], or in Peircean terms: Sign Vehicle, Sign Object and Interpretant (simplifying the many sub-details significantly, of course).

To take an everyday example: For me to have a "thought" about my grandmother does of course demand the internal material relations that we can gloss for our purposes as: "depolarization cascade X taking place at rate T within neuron cluster Z" to take place. Of seemingly less importance to those studying cognitive neuroscience, this same "thought" *also demands* the wholly extra-mental grandmother (Y) as well as the triadic and *representative* relations between Y and Z (which are themselves embedded in two different systems of relations, i.e., the internal body and the external world) *in order for* X through Z to "stand for" Y to me (or to be fully explained by an analyst observing the situation).

And so what is so in the "X standing for Y through Z" relation above is likewise so, *mutadis mutandis*, for the ant and its pheromone trail, the elephant and its infrasound, the wolf and its display behavior…*none* of which need be accompanied by the kind of linguaform symbolic mental experience that is the evolutionarily late embellishment of human thought, but *all* of which constitute genuinely *semiotic* relations in the Peircean sense.

Now, obviously, it would not make sense nor be accurate to say that some centralized, homuncular "interpreter" is somewhere in the system "directing the semiosis and making sense" out of what is happening at each and every one of these points. Rather: the *evolved system as a whole* acts so as to establish the internal/external relations that result in the chain of **agent-object-action triads** that are here called **interpretants**. In fact, one of the central tenets of biosemiotics is that, in order to survive and evolve, living systems cannot *but* establish these kinds of relations if they are to co-ordinate the demands of their own systemic maintenance with the demands of the external system of transformations that constitute that living system's surround.

Infradian rhythms in grass-eating ungulates, for example, regulate a hormone release for the initiation of rut that is "backwards timed" to take the gestation period of each sub-species into account so as to result in spring births, when sufficient grazeland is available. Is there a *relation* between the availability of grass in the external world and mechanism regulating the timing of the release of this hormone within the adapted biological organization of the organism? Undoubtedly there is – yet it is by no means a "straightforward" one. Nor is it one that even the phenomenon of "natural selection" can account for without reference to the kind of biologically instantiated semiotic relations taking the form of the diagram above.

Rather, a consideration of this type of evolved organization (of which the Dead Horse Arum in my pre-programme talk was yet another example) shows us that rather than assuming that only self-conscious interpreters (ie – linguistically minded knowers) can join appropriate action to the ever-shifting circumstances of the world, we must admit that such activity has been happening in living systems long before anything that we would recognize as such an "interpreter" evolved. What there *has* been all along, apparently, are chains of substitution relations – Peirce's "sign processes" – making possible the ability of organisms to adapt their internal biological relations so as to effectively negotiate a world of entities other than and external to the system of the organism itself.

The resulting empirical work thus called for is that of trying to establish how these chains of physico-chemical processes reliably manage to "map onto" relations in the outside world. Between the reality of the individual ungulate's hormone release and the very different reality of the approximate cyclicity resulting in spring growth, many intermediate relations must mediate in order for the relations of the external world to be reliably "re-presented" in the internal biological organization of the organism, and for that organization to be "adapted" to the reality of an external world that it will never *directly* interact with. Only in this very very primitive way, I think, can we build up to the idea of the whole organism that, when

smelling urine, "knows" (or at least acts upon) it as a "sign" to mate, or to flee, or that a conspecific has just passed by, or whatever the case may (reliably but fallibly) be.

Such "knowing" cannot come – at any point in the process – from some ghostly homunculus, but only from the actual biological interactions within a system that have been calibrated to the reality of an external world. This calibration – in all its fine-grained detail – is composed of a network of agent-object-action triads that not only has recursive causal efficacy within the system (the product of each triad establishing the substrate upon which the next triad can be established, and the emergent patterns of the aggregate exerting systemic downward pressure on the whole), but and most critically, maintains an ever-complexifying but reality-grounded *continuity* of representation throughout.

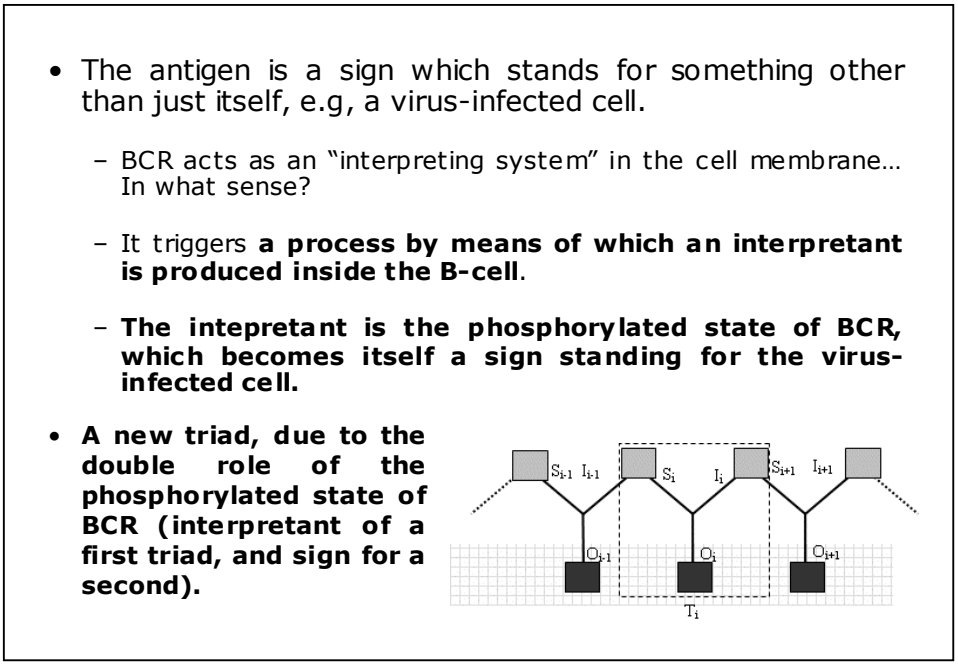

FIGURE 2:
An application of the relations depicted in Figure 1, as the manifest recursively in the biological phenomenon of "signal transduction." Diagram courtesy of Charbel El-Hani and Joao Quierez..

Again, a diagram of this process may prove easiest to understand, so here I have, with kind permission, reprinted a diagram from the work of Charbel El-Hani and Joao Quierez (Figure 2) illustrating how it is the "information" about the *prior relation* instantiated at each node in the semiotic process that each *interpretant* in the cascade literally but *generatively* "re-presents" – and in so doing, guarantees statistically reliable correspondence with the the relations of the outside world in the way that these relations are then relevant to the current internal relations of the organism, as immanently instantiated in the represented triad.

Here, as in our original diagram, we should note that the technical term "interpretant" (Z) is a system state (a "determination" in Peirce's terms) that is not a direct consequence of either X or Y alone or in mere combination, but one that is mediated by the organisms' internal dynamics when given X (as tokens of X have evolved to function in the system in relation to tokens of Y); the "interpretant" in this sense is nothing other than the way in which those particular system-internal dynamics rearrange themselves in reaction to X

(which itself is evolutionarily coupled into a dynamic with Y that serves as an interface between the internal and external worlds).

In fact, we can say that X "signifies" Y to the system only because and in the sense that Z rearranges itself in this particular fashion in reaction to X (and thus to the XY relation), bring a newly informative and new potentially causal relationship of "XYZ in the world" into existence. And again: this same relation will hold on the level of the cell, the tissue, the organism or the society of organism. For this, then, is where "signification" in an organism begins: not in thought or consciousness, but in any instance of a system-internally mediated action upon some non intrinsically meaningful "thing" i.e., one that does not *in itself* "represent" anything, i.e. - one that, ontologically speaking is "X and only X" and not: "X, which when present, is a reliable sign of Y"), when it is used within some end-directed system to function *as* not just X, but "X as a sign of Y"). Such relations constitute the naturalistic but ontologically unique category of "subjective experience" in organisms (whether or not such experience is apprehended 'mentally' by the agent in which it is realized) – it both constrains and affords the agent its range of possibly efficacious actions, and the effects of those actions upon the world and upon other organisms constitutes one of the great underheralded organizing principles in nature: Life on earth is the way it is today largely as the result of innumerable acts of subjectively grounded action and its irreversibly consequential effects.

Thus, like so many other phenomena in the biological world, then, the Peircean "interpretant" is both real and causal, but it is not a self-subsisting entity or thing – it is, rather, a crucial node of realization in an interdependant process. That process is called *semiosis*, and when X is brought into a relation with Y this way, the *product* of that joining is the Peircean interpretant – a last context-formed and next context-creating response that can then be embedded into upwardly ascending and downwardly causal chains that we call, colloquially and with good reason, "knowing about" and "acting upon" the world, respectively.

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