

Signs Without Minds

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A *Sign*, or *Representamen*, is a First which stands in such a genuine triadic relation to a Second, called its *Object*, as to be capable of determining a Third, called its *Interpretant*, to assume the same triadic relation to its Object in which it stands itself to the same Object. The triadic relation is *genuine*, that is its three members are bound together by it in a way that does not consist in any complexus of dyadic relations. That is the reason the Interpretant, or Third, cannot stand in a mere dyadic relation to the Object, but must stand in such a relation to it as the Representamen itself does. Nor can the triadic relation in which the Third stands be merely similar to that in which the First stands, for this would make the relation of the Third to the First a degenerate Secondness merely. The Third must indeed stand in such a relation, and thus must be capable of determining a Third of its own; but besides that, it must have a second triadic relation in which the Representamen, or rather the relation thereof to its Object, shall be its own (the Third's) Object, and must be capable of determining a Third to this relation. All this must equally be true of the Third's Thirds and so on endlessly; and this, and more, is involved in the familiar idea of a Sign; and as the term Representamen is here used, nothing more is implied. A *Sign* is a Representamen with a mental Interpretant. Possibly there may be Representamens that are not Signs. Thus, if a sunflower, in turning towards the sun, becomes by that very act fully capable, without further condition, of reproducing a sunflower which turns in precisely corresponding ways toward the sun, and of doing so with the same reproductive power, the sunflower would become a Representamen of the sun. But *thought* is the chief, if not the only, mode of representation. (CP 2.274, 1897)

Introduction

In a number of places, such as in the above quote, Peirce argues that anything with the necessary triadic structure of sign, object and interpretant can be a proper sign, even if there is no mental representation involved, though he says in the same passage that signs usually, if not always, have a mental interpretant (Peirce 1940, p. 100). He notes that the notion of interpretant does not logically require consciousness, but since we have no clear cases that do not, so we must at least fix our understanding of semiosis with these clear cases (1940, p. 282). The advent of biosemiotics has extended the notion of semiosis well into the non-mental sphere.

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In some cases in biosemiotics the signs are similar to human cognitive signs by involving perceptions and possibly even deliberate action, but many proposed cases within biosemiotics do not involve anything that might be considered to be mental, especially within endobiosemiotics, which involves at its lowest level chemical processes. If these extensions of Peircean semiotics are sound we need a clear idea of what it is to be a sign when minds are not involved. Peirce gives us some hints about how the notion of semiosis might be extended, and what the limits of its extension might be. These come from both his paradigmatically mental signs as well as what he says about non-mental signs, including signs in biological systems.

It is useful to make a number of distinctions in order to get a grip on increasingly difficult aspects of the problem of delimiting non-mental signs. First, we have to distinguish between non-mental things that are signs for some mind or minds and non-mental things that are signs for non-mental things. Each case further breaks down into cases that involve communication (or some sort of transmission of information between bearers and receivers of the signs) and those that do not, in which any transmission and interpretation is internal. In the latter case there is a logically possible distinction between cases that require some sort of internal transmission, and those that do not. The purpose of this chapter is to explore and explain each of these cases. The internal cases are especially important to endobiosemiotics, whose Peircean version has been derided as “unscientific.” By examining the stronger cases in order to see what is essential to their being semiotic, the understanding gleaned can be extended to the more questionable cases. This will allow us to put some limits on what can be understood semiotically, contrary to movements towards pan-semioticism according to which semiotics pervades the entire Universe.

Peirce’s famous case of the sunflower, and whether it is a sign of the direction of the sun, is a case in point. Since sunflowers face the sun reliably, they can serve as a sign of the sun for someone that observes them. Peirce, though was interested in whether the sunflower’s facing the sun could serve as a sign for the sunflower itself. The very fact that he considered the possibility indicates that Peirce did not rule out the possibility. However, he thought that facing the sun did not serve as a sign for the sunflower itself. Looking at this and other examples, this chapter will try to determine what properties something non-mental must have in order to serve as a sign for its bearer. The answer lies in teleology, specifically in functionality. I will argue that candidate non-mental signs must be functional for their bearer, and that the grounds of functionality ensure that there is a Peircean interpretant, which completes the triad, which becomes a sign with a further interpretant, and so on, much as is the case for minds.

Signs with Minds

Peirce clearly thought that mental signs were the paradigmatic case (Peirce 1940, p. 100). If we are going to look at signs without minds, it is best to look at this case so that we can then subtract the mental aspect and see if we have enough left to fit

a semiotic model. First of all, mental signs have meaning. They are interpreted to at least some degree, though it is quite possible that some representation we have is puzzling, and we don't know how to identify it. Consider, for example, a glimpse of movement in the shadows late at dusk. It might be a large animal, or a person, or even an illusion of the lighting. We are unsure of what the sign indicates, let alone what it means. However the very fact that we have the sign within our experience implies that taken as it is, it is definite. This "as it is" is an iconic aspect of representation (Firstness). But the glimpse is more than this. It is an indication that something is going on in our visual sensory apparatus: it is a visual experience. This takes us beyond the experience in itself to the kind of experience that produces it, an index of visual goings on (Secondness). But it is more than that. The glimpse is a particular kind of visual experience that we habitually (Thirdness) connect to a range of possible interpretations, as well as to certain emotions (surprise, edginess, perhaps startle). This is the meaning of the glimpse as we experience it. These make the three components of anything that could be a sign: icon, index and interpretant. However there is something else lurking in the background, which is the reference of the sign. As described, the reference of the glimpse is nothing but itself; however we know that it might be a sign of something else, perhaps outside the mind (whence much of the emotional component). This uncertainty gives the sign, the glimpse, a meaning beyond itself, leaving it open, but only in certain ways compatible with its nature. It couldn't be a sign of a bright light, for example. It is the character of most signs to be open in this respect; their connection to other signs that might enhance their meaning is not fully circumscribed by the sign itself. Closing part of this openness produces new signs with a broader (beyond the sign itself) but at the same time more specific interpretant. It is important to recognize that the reference of a sign is not part of the sign itself, but the result of an abductive hypothesis of something which the sign is of (the exception being purely iconic signs, called qualisigns, like the bare glimpse itself, whose object and interpretant is themselves, allowing no external reference).

A glimpse is first of all a mental experience, a visual experience. Its interpretant is also mental. In order to get to the external world we need to hypothesize first that there is such a world, and that some experiences are signs of it. Peirce thought that we came to realize that there was a world outside of ourselves as very young children, when some things did not go as we expected or wished (CP 5.51). He thought that we distinguish a certain set (revisable) of experiences as being of the external world. In particular, these would include sensory experiences. Barring some defeater, a glimpse is of something external. This then raises a further question of what the glimpse refers to, what it is of. Experience, and thus its signs, has two aspects, internal and external. Only the latter involves reference, where a sign indicates something outside of our immediate thoughts. This external part is not required; thoughts can be interpreted internally, and related to other thoughts, and so on, without specific end. Of course, we may be mistaken about any part of this (CP 1.171), except for the brute experience itself (CP 6.454).

Peirce's pragmatic theory of meaning comes in a number of different versions, but one of his latest, from his *Harvard Lectures* is:

For the maxim of pragmatism is that a conception can have no logical effect or import differing from that of a second conception except so far as, taken in connection with other conceptions and intentions, it might conceivably modify our practical conduct differently from that second conception. (CP 5.196)

In other words, any difference in meaning entails a difference in some conceivable difference in our practical conduct. The last requires (if we are to be conceived as the least bit rational) a difference in our possible expectations about the world. These are given by our possible expected set of signs within the (revisable) set that we take to be of the external world.

In Peirce's pragmatic view of meaning a mere correlation or correspondence between a sign and its reference does not in itself produce a meaning. Meaning requires an irreducibly triadic production of what Peirce calls the *interpretant*, a relation in which the sign (*representamen*) bears some variety of correspondence to its reference through the immediate object of the sign (*ground*), which is an "idea" corresponding to the object not in all its respects, but only under certain considerations (Peirce CP 2:228, 1940 p. 275). A sign must be taken as a sign in a context supporting interpretation in order to be interpreted. Mere function is not sufficient (Peirce argues) since, for example, a

... thermometer dynamically [...] connected to a heating and cooling apparatus, so as to check either effect, we do not, in ordinary parlance, speak of there being any *semiosis*, [...], but, on the contrary, say that there is an 'automatic regulation', an idea opposed, in our minds, to that of *semiosis*. (Peirce 1940, p. 275, italics in original)

We should, in parallel, say the same thing about automatic elements of thought. Sensations and feelings, inasmuch as they are brute experiences, are not in themselves semiotic, though they can be classified in semiotic terms. They are pure firsts, not existing in themselves, but only in relation to (seconds) other thoughts, and interpreted through (thirds) the way they are integrated into our thought. Likewise pure mimicry, a causal process (second), the only pure form of memes, is not in itself semiotic. If integrated into thought, say we wear jeans to fit in with our crowd, this is not merely mimicry, but connected to other thoughts, desires and actions.

Semiosis proper, then, has four elements: the sign (*representamen*), reference, object and the essentially triadic *interpretant*, the reference being something external (extensional in the language of modern logic, which is perhaps determined by the dynamical *interpretant*—see below) determined only indirectly through the mediation of the full triadic sign. It is the last which is irreducibly pragmatic and contextual in nature, involving anticipated (expected) behavior of the object in open-ended (and possibly frustrated) interactions with the world. It should be noted that the mediation through signs is typically through a network of signs, in which each sign serves as an icon for another, so that the *interpretant* of a particular sign, say a glimpse, is mediated by this network. The reference of the glimpse, though very vague because of its nature, is the hypothesized product of this network, which becomes increasingly sophisticated and refined as we learn more about both the world and how our mind works.

One of the peculiarities of the human mind is that we are able to partially consider (as Peirce says, "prescind") aspects of full blown signs, so we can con-

sider just the interpretation in the form of a proposition or thing or other sign, or the raw experience, or the connection to other thoughts, or some combination of these. Each of these possible combinations presents a semiotic category within Peirce's thinking. However in a full sign all of the elements are present equally, whether we are focusing on them or not. Peirce called such a "perfect sign." As T. Short (2007, p. 227) remarks, it is not entirely clear what Peirce meant by this, with CP 4.448 suggesting that it bears on what the fullest function of a sign is. Later (EP 2:545n25) Peirce says that a perfect sign is one that "involves the present existence of no other sign except that are ingredients of itself" (quoted in Short 2007, p. 227). Peirce is clear in the cited passages and context that the perfect sign is dynamic, it ages, but is being constantly renewed by its object; in a sense it grows. Peirce calls this, therefore, a "quasi-mind" though his complete meaning is unclear. What does seem clear is that the perfect sign is self-generating (he says "spontaneous") and has a susceptibility to determination. It is therefore not closed, but open, growing or evolving as it tracks its object. Some observers (Lyris 2006) have suggested that this is related to *entelechy* (the actualization of form-giving or final cause, that which makes actual what is merely potential), identifying the perfect sign with *entelechy* in Peirce. If this is correct, then perfect signs are not merely functional or even merely meaningful, but they are the realization of function and meaning. I will return to this later when I deal with signs without minds. I should mention before going on, however, that the notion in this paragraph suggests that a sign can change. This is a tricky issue. As generals we can talk about the same sign over time and space, but it seems to me that if the interpretant changes, then the sign itself must change, but then it is not clear that it is the same sign any more. I think it is safer to refer to temporal lineages of signs, in which later versions inherit some properties of their predecessors. This would be analogous to the way we talk about genes and inherited traits. Perhaps it is more than an analogy.

How do we get from a specific sign in our mind to the external world? As indicated above but worth repeating, there must be a chain of interpretations leading to a set of expectations of possible behaviour within our set of signs of the external world. Each sign in the chain can be a sign for another sign (with the sign, especially its interpretant playing the role of an icon for the next sign), forming a net of signs that includes expectations of the results of possible behavior. Following the pragmatic maxim this gives our meaning for the sign, so the sign of a glimpse, for example, means that we have expectations of possible experiences (that given the vagueness of a glimpse would be vague themselves) that might follow if certain further events should occur, or, importantly, if we were to follow certain actions, like shining a light in the direction associated with the glimpse, or approaching closer.

Peirce's overall approach to semiotics matured and changed somewhat with time, and became more articulated, with many finer divisions. I won't have space to go into all the details here, especially since much of this is at its best arcane (see Marty and Lang 2012). The important elements of Peirce's classification of signs, grounded in the logic of signs, are (1) as mentioned above all signs are irreducibly triadic, with representamen, object and interpretant being the three *relata*, (2) signs

must be of something; in the mind they are of signs, giving 27 possible combinations which are given by the crossproduct of icon, index and symbol, so that we can have an icon of an icon, and so on, of which only 10 can be occupied, so we can, for example, have a common noun or a proposition considered as a symbol, but only proposition can represent a fact (CP2.254–263). These basic kinds of signs are laid out with each aspect as below:

	Phenomenological category	Relation to object	Relation to interpretant	Specificational redundancies in parentheses	Some examples
(I)	Qualisign	Icon	Rheme	(Rhematic Iconic) Qualisign	A feeling of “red”
(II)	Sinsign	Icon	Rheme	(Rhematic Iconic) Sinsign	An individual diagram
(III)		Index	Rheme	Rhematic Indexical Sinsign	A spontaneous cry
(IV)			Dicisign	Dicent (Indexical) Sinsign	A weathercock or photograph
(V)	Legisign	Icon	Rheme	(Rhematic Iconic) Legisign	A diagram, apart from its factual individuality
(VI)		Index	Rheme	Rhematic Indexical Legisign	A demonstrative pronoun
(VII)			Dicisign	Dicent Indexical Legisign	A street cry (identifying the individual by tone, theme)
(VIII)		Symbol	Rheme	Rhematic Symbol (-ic Legisign)	A common noun
(IX)			Dicisign	Dicent Symbol (-ic Legisign)	A proposition (in the conventional sense)
(X)			Argument	Argument (-ative Symbolic Legisign)	A syllogism

There are three other aspects of Peirce’s thinking about mental signs that need to be considered before going on.

First, repeatability: from the discussion of perfect signs above, it is evident that at least these are self-producing. However, this is a property of all signs, if not in quite the same way, since in general the production is not spontaneous. It is the nature of signs that they are general. A single instance of an isolated relation between an icon and an object could not be a sign as there would be no basis for connecting the two. Furthermore, there needs to be some way of associating the two according to some habit. In order for smoke to be a sign of fire either there must be some experience of the association of the two, or else one must have background knowledge that the two should be associated. It is the very generality of signs that requires that being a sign is ensured if the correct triadic relation between icon, index and interpretant holds. Being a sign implies repeatability, and the nature of the sign itself implies

its reproduction, if the conditions for it hold. That holds not only for the icon-index aspect of a sign, but also for the other possible combinations.

Second, reference: Peirce is clear that signs have a physical basis. Even an icon in the form of a glimpse has a material basis that must be compatible with its iconic nature, even if we cannot be directly aware of this. This applies equally for indexical relations (with typically some sort of causal material basis, whether in the present or the past) and interpretants. Knowing the causal properties alone, however, does not give the semiotic properties. The brief explanation is that full signs are irreducible triadic relations, whereas all causal relations are either binary or composable from binary relations. The interpretant in particular, necessary for meaning, cannot be recovered from binary relations and their composition because meaning requires integration of immediate sensation, thoughts and the interpretive context. Any full sign is an irreducible triad of icon, index and interpretant. These are not separate entities but are aspects of a sign being a sign. The physical embodiment of a sign, then, will also have an irreducible triadic form, compatible with each aspect of the sign. It would be a mistake to assume, for example, that because a weathervane is a sign of the direction of the wind that as a sign it is nothing but the material that makes up the weathervane. This would be to ignore its interpretant, and it would be deficient as a full sign (though we can talk about the aspects in the abstract). For mental signs, with our power of abstraction (*prescission*) it is possible for us to not only consider aspects of signs independently and in various incomplete combinations, but also in complete negligence of their material embodiment. In fact much mental activity ignores physicality, which is only required when we interact with the world. This connection is given only as a hypothesis, or abduction, as described above.

Signs may also have a referent outside of themselves, but this is not necessary. If they do, and the referent is physical (as opposed, say, to mathematical objects), then there must be some causal connection between the referent and the sign, and this must be of a general nature to ensure the reproducibility of the sign. This causal relation is not sufficient for reference, though, as causal relations are dyadic, and a sign gets reference only through its interpretation, which is triadic. This is not to say that reference cannot be given a causal basis, just that this cannot be the whole story, as it is in theories of perception originating with John Locke and popular within analytic philosophy (Grice 1961; Goldman 1967; Dretske 1981).

Third, finality: The third and last aspect that needs consideration is the evolution of signs towards greater accuracy (clarity). Peirce discusses this in detail in his earlier work (Peirce 1878), but it is only later that he gives the projected end result of this process the name ‘final interpretant’. In a letter to William James in 1909 (EP 2:496-7) he says, “...there is certainly a third kind of Interpretant, which I call the Final Interpretant, because it is that which would finally be decided to be the true interpretation if consideration of the matter were carried so far that an ultimate opinion were reached.” (italics in original). He goes on to refer to his 1878 work. Earlier (1906) he admitted that the idea was a bit unclear, and he gave a somewhat different interpretation:

In regard to the Interpretant we have [...] to distinguish, in the first place, the Immediate Interpretant, which is the interpretant as it is revealed in the right understanding of the Sign itself, and is ordinarily called the meaning of the sign; while in the second place, we have to

take note of the Dynamical Interpretant which is the actual effect which the Sign, as a Sign, really determines. Finally there is what I provisionally term the Final Interpretant, which refers to the manner in which the Sign tends to represent itself to be related to its Object. I confess that my own conception of this third interpretant is not yet quite free from mist. (CP 4.536)

I will not try to explain in any detail what he meant in the mental case, since it involves his views about convergence on the truth, the communal nature of inquiry, and idealist aspects of his metaphysics, not to mention his views on universal love and evolution that are “not yet quite free from mist.” However it is clear that any account of sign will need to give an account of either its final interpretant, or else of why the idea is not relevant. I will argue later that the idea is relevant to biosemiotics in a fairly straight-forward and fundamental way.

The essential elements of mental signs, then, are (1) an icon, index and interpretant in an irreducible triadic relation, best symbolized by a centered triple, somewhat like this: Δ . As it is symmetrical, the labels can be any of the three points. The symbol indicates that the three meet together, and cannot be broken into dyadic relations. It is, however, possible for our minds to abstract or prescind aspects of signs, and consider them separately as further signs, just as a whole or perfect sign can be sign of something else, taking the role of an icon for the further sign, and so on. (2) Meaning arises through the interpretant and through its connections to other signs, determined by expectations about what differences meanings would make to the world, according to the Pragmatic Maxim. Our connection to the world is through a (revisable) class of signs that we can call experiences of the external world. We know the external world to exist because our signs do not always meet our expectations. This last is an important aspect of representations in general; they are fallible. If not I think it does not make sense to call them representations. Because we can be mistaken about what our signs represent we must distinguish between the immediate interpretant and the dynamical interpretant, which is “the actual effect that the sign determines.” Our immediate interpretant is corrigible as we learn more what effect(s) it actually determines. This gives a connection to the physical embodiment of signs for signs of the external, and derivatively for internal signs. As described above simpler signs are interpreted through a chain or network of signs grounded in expectations of possible experiences. Lastly, (3) signs reproduce themselves, and they can grow (improve in clarity) as we are corrected; signs evolve. This should not be taken as implying that the same sign persists through changes in its interpretant, but that there is a lineage of signs (perhaps splitting) that inherit some properties of earlier signs, but are clearer in the sense that Peirce discusses in his paper “How to make our ideas clear” (Peirce 1878). In the process of inquiry, which is a mind dependent process, the final interpretant not only represents its object, but represents it as related to its object, if I read him right. As Peirce says, this is a bit misty. Provisionally I would say that a final interpretant for mental signs is an ideal state (that may or may not be achieved in finite time) in which there are no expectations of the object of the sign that are to be contradicted by experience. Of course we cannot know for certain that we have achieved a final interpretant for a sign (more properly, of a sign lineage). The world can always surprise in ways that we might not even be able to understand fully unless it happens (Collier 1990).

In summary, if there are signs without minds they must, if mental signs are a paradigm, have irreducible triadicity, something equivalent to meaning, and reproduction leading to some sort of improvement or at the very least directional change. They must show the properties of repeatability, reference and finality in achieving these properties.

Signs Without Minds

If there are signs without minds, then there is no partial consideration, no prescinding or abstracting, no expectations, and no meaning in the usual sense. We need to find satisfactory analogues for these, or at least show why they are not required. Furthermore, we need to do this in a way that satisfies the triadicity, meaning, and reproduction requirements, while embodying the repeatability, reference and finality properties.

The idea that there are signs without minds is belied by the following quote:

A Representamen is the First Correlate of a triadic relation, the Second Correlate being termed its Object, and the possible Third Correlate being termed its Interpretant, by which triadic relation the possible Interpretant is determined to be the First Correlate of the same triadic relation to the same Object, and for some possible Interpretant. A Sign is a representamen of which some interpretant is a cognition of a mind. Signs are the only representamens that have been much studied. (2.242–Syllabus, 1902)

This implies that there are triadic relations that are not signs because their interpretant is not a cognition. However it also implies that all signs must involve cognitions, and hence minds. If so, there are no signs without minds even if we can satisfy (or explain away) the three requirements and three properties.

On the other hand, Peirce sometimes appears to say (as in EP:455)¹ that there are thoughts without minds, which would require signs without minds, since, at first glance at least, thoughts are signs. Peirce certainly toyed with objective idealism, according to which the world is made up only of mind. If this were correct, it would solve a problem for him, which is that he thought that signs could be related only to other signs (e.g., Peirce 1868).

If the world is made up of signs, then a weathervane can itself be a sign of the direction of the wind independently of our thoughts. This would make our internal signs continuous with signs in the world. When we become conscious of it, and understand its reliability (if not how it works) then we can use it as a sign through the manipulation of our internal signs. But in itself it is a sign, we might say, composed of the icon of the shape of the weathervane, the index of the wind direction, and the interpretant which is the thought that the wind is in the direction in which it is pointing. This gives triadicity, meaning and reproduction, with the properties of repeatability and, perhaps, reference. Finality, however, seems to be lacking. It might be suggested that a weathervane can be better or worse in indicating the direction of the wind, and some might not do so well at all. However there is no inevitable

¹ See full quotation on page 118 of this volume.

progress towards better indication of wind direction (in fact, without external maintenance they get steadily worse at this function). Furthermore, and relevantly, it is only through the needs of someone who uses the weathervane that the difference between accuracy and inaccuracy matters. It seems then that the weathervane, as Peirce said of the thermostat in the quote above, is not fully a sign. Its action is automatic, necessitated by its nature, and there is nothing in it itself to determine whether or not it is successful. Because of this, it is not really clear that the weathervane even represents anything. The basic problem is that the weathervane is not a sign for itself or anything else unless minds that use it as a sign are invoked.

As part of our built environment, our extended phenotype, weathervanes do, like thermostats, perform a function. We might then argue that they are constructed by us as semiotic entities, and that they are therefore in themselves signs. I have my doubts, though. We could just as easily use the direction in which smoke, dust or leaves blow, all natural objects, to determine wind direction. But these would not be artefacts, part of our built environment, part of our extended phenotype. I don't see that the difference of being built should affect their intrinsic nature as signs. Their being signs depends on our thinking in certain ways about them. They are signs only with minds.

There are some approaches to pansemiosis that try to resolve these problems through evolutionary ideas of natural laws as fixations of some sort of material habit, making them things that in some sense interpret the indicating activity of, for example, weathervanes. Whether or not this can be successful I will not pursue here. I am not sympathetic to the idealism that makes it possible, and I am unclear what value it would have even if it could be worked out adequately. If we except the Peirce quote about palaeontologists, this would leave us with cognitions without signs. But this would be consistent with the first quote in this section. In biology, however, there are non-cognitive things that do appear to have finality and the properties of representations. They use signs for their own purposes, but not through conscious activity. I will turn to these next.

Biosemiotics

Jesper Hoffmeyer states:

In the biological world, certainly, signs incite the generation of interpretants in the form of actions which are future-oriented, inasmuch as living beings always seek signs for survival and for reproduction. (Hoffmeyer 2008, p. 65).

In other words in the biological world there are signs that contribute to biological function, i.e., to biological fitness. Fitness implies function, and this implies finality. Understanding the nature of biological function is nontrivial. I have argued elsewhere that we can go only so far with information theory (Collier 2003, 2008) and control theory (Collier 2011), arguing that we need to look to biosemiotics to give a complete account of function. As Terrence Deacon (2012b) has argued, function,

like intention, has the peculiar character of invoking something that can be absent. He uses the neutral term “ententional” to refer to this property, presumably on analogy to intentional. In order for there to be reference of some sort to something absent, we need something like representation, so we need at least an analogue to meaning in the mental case. There is also a sense of finality involved, since function can be better or worse. If the other aspects of mental semiosis are required, then we have a good case for full semiosis in biological systems.

Some biological systems use external signs in much the same way as conscious minds do. In some cases similar enough to human cases we can assume that these signs are conscious. However in other cases it is not so clear. It is also too easy to mistake who the sign serves. I noted:

Brooks and McLennan [8–9] discussed this issue with respect to biological signaling. They concluded that most signaling done by organisms is signaling to oneself, both about itself and about its conditions. Whether this is intentional or not is moot. Some of this self-conversation may produce changes in the organism detectable by other organisms. The meaning that those other organisms place on the “signaler” is not caused by the intentions of the signaler, relieving us of the burden of having to postulate a causal link between intention and meaning, or function of the sign. Breaking this link permits signals and meanings to evolve in a purely Darwinian manner (i.e., accidentally, with both costs and benefits, so long as the benefits outweigh the costs by at least a tiny bit). So, for example, a male stickleback turns red as a result of biochemical changes related to testosterone levels. The color change is a by-product of an internal chemical signal from the animal to itself, telling it that it is ready to breed. In that sense, the color change is completely unintentional. However, the color change does occur and as a sign may have different functions for different receivers in the environment (“mate” to a female stickleback, “dinner” to a heron). And so long as “mate” benefits are slightly greater than “dinner” costs, the system will continue. (Collier 2003, p. 74–75)

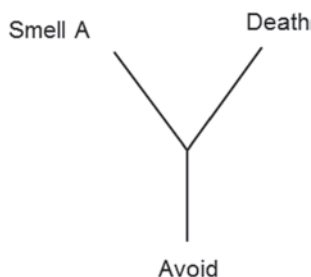
The point here is that the “sign” produced by the male is not immediately a sign for the male, though it serves an evolutionary purpose for the male. It is a side-effect of other processes. It is only because the female can recognize it as a sign that it becomes a sign for the male as well. But it is not a conscious sign for the male. Nonetheless, it serves an evolutionary function for the male by making it attractive to the female. It seems then, that it is a sign without a mind. I would assume that humans also have many unconscious external signs. The stickleback case is interesting because although the female may be conscious of the sign, the male is not, and there is no reason that both sides in such a relation need be conscious. There also seems to be no reason to deny the sign aspect of the relation merely because there is no conscious experience. So it seems that there may be functional biological signs without minds.

From the above it is evident that there can be external signs in biological systems that are not conscious. Are there internal signs? There has been a developing split between exobiosemitics and endobiosemitics, with some holding that endobiosemitics can be understood entirely in terms of codes, e.g., Marcello Barbieri. I will not go into this dispute in depth here, though I have taken the side that endobiosemitics can be Peircean, and that codes are not sufficient (Collier 2008, 2012). Hoffmeyer points out that there is no clear distinction between endo and exobios-

emiotics (Hoffmeyer 2008, p. 213 ff.). I think that functionality in biosemiotics applies equally internally as externally, and if the reasons for applying it externally are sound, then it is also reasonable to apply it internally. This argument is made in some detail with examples in (Arnellos et al. 2012),² and I will not repeat it here. Instead I would like to look in more detail at the implications of the Peircean view, as developed in (Collier 2011, 2012).

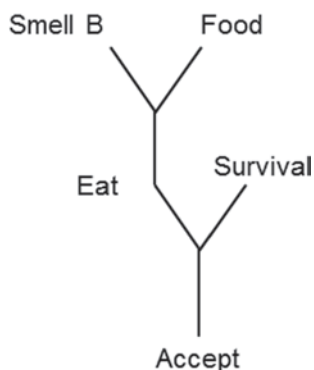
I think the differences between the Peircean and the code only views are obscured when focusing on details of individual signs and sign systems. Peirce's semiotics allows for systems of signs in which one sign can serve as an icon for another sign, which gives a further interpretant. This implies a network of signs, as described for the mental case above, with interpretation becoming more general as we move upwards and outwards. A Peircean sign is an indecomposable triad of icon, object and interpretant. The icon is the "bare feel," or presentation; the object is picked indexically, and the interpretant brings them together in a unified context. This triad can then be an icon for a further sign that is more general. Several signs together can provide the presentation for an even more general sign. This regress (or recursion) comes to an end in some most general sign, with its interpretant being ultimate.

What are the ultimate interpretants in biology? Suppose we have smell A (icon) of something dangerous (interpretant), then it is incumbent to avoid (object).



For good biological reasons, this sort of interpretation has very short chains. Chains related to survival are typically longer. A slightly longer chain: Suppose we have smell B (icon) that indicates food (interpretant) that can be eaten (object). This itself is a sign (icon) that falls under survival (interpretant) indicating it should be accepted (object).

² Although we used 'meaning' in a paper on anticipatory functions (Arnellos et al. 2012), I was never happy with the term, thinking it was not quite the correct concept, and was potentially misleading. However there was no available term to invoke, so I went along with our use of 'meaning' in our discussion of endobiosemitics. Deacon's term 'ententional' is better due to its neutrality, though the idea is analogous to concepts of intentionality and meaning.



Typically there will be longer chains both for the interpretant and often the icon. Often these will involve chemical processes that can act as signs. What gives them their semiotic quality, ultimately, is their interpretation in terms of survival. This is not an accidental property, but one that is central to biology, especially the biological autonomy of organisms and their reproductive lineages. I suppose that there could be biosemiotic conditions that don't contribute to survival, but they are very likely to be weeded out by evolution, so they would be rare and temporary at best. This justifies the quote from Hoffmeyer that opened this section (Collier 2012).

There are a few things to clear up at this point. On the surface it seems that there is nothing like the capacity to prescind without the abstracting ability of consciousness. If so, then the table of Peircean signs in the second section are not filled out. Each sign can only be taken as an icon by another biological sign without mind, which might seem to limit us to class I in the diagram. We can infer other sign classes abstractly, but these, it might be argued, are not in the organism itself. I think this would be a mistake. It is the whole triadic sign that is taken as a sign for the next sign in line, which is also produced in its fullness. In other words, all three parts of the triad are there equally in each biological sign. The inability to prescind does not reduce the complexity to just iconic aspects, but ensures that every biological sign is a perfect sign in Peirce's sense. This means that every non-mental biological sign is an entelechy, which is directly commensurate with its necessarily being functional. It further means that we can make sense of each biological sign as any of the ten categories. It conveys an icon, an index and a proposition, in the role of a feeling, an indicator and a reason, each being part of its functionality together.

One last issue that should be addressed (there are many ramifications to be worked out, but I focus on just the barest outlines, details to be filled in) is finality. What is the final interpretant of biological signs, if any? The idea of functionality suggests that there can be better or worse function, which suggests that the final interpretant would be the best function possible. According to the widely adopted optimality theory in neo-Darwinism, every trait is already optimally adapted, so it could not be better. On this account every biological sign except those involving minds is already at its final interpretant. The problem with this view is that it assumes that genetic

and environmental changes are slow enough to allow selection to produce optimal adaptation. Biologists I work with tell me that this is seldom the case. If genetic and environmental changes are too fast, then there is room for self-organization within the genetic and trait space and the information of adaptation can increase indefinitely (Collier 1998). This is still a controversial area, with traditional neo-Darwinists holding that progress in evolution is a mistaken idea, whereas self-organization theorists see it as both possible and actual. If the latter are correct, then the idea of a better interpretant is on the table. But since the target is always moving, it seems that final interpretant is not, unless there is some ideal evolved being, analogous to the ideal theory of the world. I will leave the issue there.

Further Remarks on Differences Between Mental and Bio-Semiotics

Unless we favor some version of pansemiosis and the accompanying objective idealism, non-mental signs without function seem to be implausible. The main things lacking are not triadicity, repeatability and reproduction, but reference and finality. These, however, are found in biology, and are characteristic of biology. Repeatability and reproduction are a given in biology, so the only missing element is triadicity, which is essential for Peircean signs. I have argued that we can tie together aspects of exo and endobiosemiotics by assuming a similar sign process in both cases, and that there is no clear place where functional traits used for passing information in biological systems cease to be signs. So the Peircean account of signs fills in the story, giving us genuine signs without minds. This is an abductive argument of some complexity, and one could resist it at any particular step. I would argue that there is no good reason or boundary at which this resistance would be reasonable.

Conclusions

Biological systems are capable of having signs in the Peircean sense. This is obvious in cases in which we have conscious minds, but there is no clear place where the application of Peircean semiotics fails to be explanatory where we have functional information transfer. There are analogues to all of the properties and conditions for signs with minds, with intentionality being taken over by the weaker notion of ententionality, characteristic of functionality, which is manifest throughout biology. Finality is guaranteed by the same conditions. Once we have introduced Peircean semiotics to fill a very obvious place in this biological story, reference is determined for each sign by way of its object. Essential to being a sign is the possibility of the absence of an actual referent, but this is just a consequence of the possibility of function going wrong. Most importantly, perhaps, biological signs are signs for those that have them.

On the other hand, non-biological non-mental things do not exhibit reference or finality, and consequently they do not have signs that are signs for them. I think then that it is proper to say that they do not have signs as such, but only derivatively from things that have signs for themselves.

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