# Remarks in Response to "A Note on Barbieri's Scientific Biosemiotics"

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The author of this Note has criticized my proposal to describe an alternative to the Peirce model of semiosis in order to provide the basis for a scientific biosemiotics. The main objection of my critic is that the Peirce model does not need any extension because (quote) "What 'extension' could he possibly be talking about, given the model's wide applicability?". As a matter of fact, the extension in question was clearly spelled out in the paper, but let me summarize it here. Better still, let me write down side by side the two models of semiosis that were the object of my paper. They can be expressed in the following way.

(1) The *Interpretation model* states that: "The necessary and sufficient condition for something to be a semiosis is that A interprets B as representing C, where A is the interpretant, B is an object and C is the meaning that A assigns to B" (Posner, Robering and Sebeok 1997).

(2) The *Code model* states that: "The necessary and sufficient condition for something to be a semiosis is that A provides a conventional association between B and C, where A is a set of adaptors and B and C are the objects of two independent worlds (Barbieri 2003, 2006).

Here we are then. We have two models of semiosis, one based on interpretation and one based on coding, and my claim was (a) that they are distinct and (b) that both of them describe real processes of life.

The great revolution of Thomas Sebeok was a two-step extension of semiosis, first from humans to animals (zoosemiosis), and then from animals to all living systems (biosemiosis). I am deeply convinced that semiosis does

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exist in all living creatures, and it is precisely because of my commitment to this Sebeok's principle that I was forced to criticize Sebeok's extension of the Peirce model of semiosis to *all* forms of life. Sebeok was absolutely right in extending it to the animal kingdom because there is ample evidence that all animals are capable of interpreting the world. But there is no evidence that the Peirce model is valid in single cells and we need therefore another model of semiosis in these systems. Let me make a brief summary of the arguments that lead to this conclusion.

The genetic code was discovered because there are adaptors in protein synthesis, and these molecules are the fingerprints of any organic code. Adaptors, however, exist also in many other cellular processes such as splicing, signal transduction, cytoskeleton assembly, vesicle transport etc. That means that single cells have a whole variety of organic codes and this is enough, according to the code model, to prove that they are semiotic systems. It is true therefore that semiosis exists in single cells, but what we find in them is only a semiosis based on coding, not a semiosis based on interpretation.

It is often suggested that single cells are capable of interpretation because their behaviour is context-dependent, but this is not a valid inference. A context-dependent behaviour means a context-dependent expression of genes, and this is obtained simply by linking gene expression to signal transduction, i.e., by coupling the genetic code with a signal transduction code. It takes only two context-free codes, in short, to produce a context-dependent behaviour, so it is no wonder that single cells became capable of extremely sophisticated behaviours when they developed other codes such as cytoskeleton codes, compartment codes, histone codes and the like.

For all their outstanding abilities in coding and decoding, however, single cells do not build internal representations of the world and therefore cannot interpret them. They are sensitive to light, but do not 'see'; they react to sounds but do not 'hear'; they detect hormones but do not 'smell' and do not 'taste' them. It takes the cooperation of many differentiated cells to allow a system to see, hear, smell and taste, so it is only multicellular creatures that have these feelings. Only animals, in short, build representations of the world, and only these representations allow them to *interpret* the world. This is the crucial difference between the two forms of life. Single cells react directly to the signals from the environment, whereas animals react only to representations of the world, not to the world itself.

The interpretation of internal models of the world requires the two types of meaning that Gottlob Frege called 'sense' and 'reference', i.e., internal and external meanings, whereas coding generates only internal meanings. This is

the great difference between coding and interpretation: coding requires only 'sense' whereas interpretation requires 'sense' and 'reference'. They truly are two distinct processes, and we need therefore two distinct models of semiosis.

There is also another important reason for a clear distinction between a semiosis based on coding and one based on interpretation. For a long time it has been assumed that the function of semiosis is to *interpret* the world, but this is only part of the truth. In a recent paper I have shown that some organic codes (for example the genetic code and the splicing codes) allow the cells to manufacture their own components, whereas other codes (such as signal transduction codes and compartment codes) allow them to organize their components into working structures (Barbieri 2009). In addition to *interpretive semiosis*, in other words, living systems have two other types of semiosis that have been referred to as *manufacturing semiosis* and *signalling semiosis*.

Life is essentially about three things: (1) it is about manufacturing its own components, (2) it is about assembling its components into functioning structures, and (3) it is about interpreting the world. The discovery that these are all semiotic processes tells us that life depends on semiosis much more deeply and extensively than we thought on the basis of the interpretive model of Peirce. This model, in other words, is not wrong, it's just not enough. There are three distinct types of semiosis in life and interpretive semiosis is only one of them. The other two come from coding, and we can no longer ignore this fact.

My conclusion was, and still is, that a scientific biosemiotics is within our reach, but that we need to use precise definitions and testable models in this as in any other field of science. The fact that such a simple conclusion has been criticized is neither surprising nor upsetting. What is really out of place in the Note of my critic, is the final warning that scientific biosemiotics is yet another attempt of science to takeover the humanities. Let us be clear about this. Biosemiotics is much more than the union of biology and semiotics. It is the long-awaited reconciliation between the two cultures, and this is an issue that strikes very deep, no doubt about that.

At the end of the day, however, scientific biosemiotics is merely the attempt to find out the truth about semiosis with the imperfect tools of science. How semiosis came into being, how it evolved during the history of life, and how it eventually gave origin to language and culture — that very culture that today we use to look back, to reconstruct what happened, and to understand what made us. Personally I find that the best description of scientific biosemiotics was given not by a scientist but by a poet like T.S. Eliot: "*The end of all our exploring will be to arrive where we started and to know the place for the first time*".

## References

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