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The end of Sebeok's century meets twenty-first century pandemic: modeling through and beyond Sebeok's systems, semiotics, science

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Abstract: Thomas A. Sebeok's name became all but synonymous with semiotics during the last half of the twentieth century. Sebeok located neglected semioticians in antiquity, and convinced many contemporary scholars that they were semioticians. One of his most fruitful encounters was with Juri Lotman of the Tartu–Moscow School of Semiotics, who had published in 1967 an ambitious model of human sign systems in which language would constitute a primary modeling system, and cultural phenomena a secondary modeling system. We inspect how Sebeok amended Lotman's system, inserting another primary modeling system before language. This brings biological precursors to human language as a syntactic and learned faculty that builds on many nonsyntactic and sometimes nonconscious senses, including emotion, affect, and memory. We note how, in Sebeok's final book in 2000 on modeling systems theory, co-authored with Marcel Danesi, there is a suggestion that the three layers of modeling systems may be colored by Peircean notions of firstness, secondness, and thirdness; we clarify how these layers are analogue. Finally, the fundamentals of the primary modeling system leak into languaging, as better understood through post-Sebeok cognitive and neurological sciences, and rendering less mysterious some of the strange effects of the COVID-19 pandemic's proxemics crisis.

Keywords: analogue communications; modeling systems theory; Peircean phenomenology; primary modeling system; systems thinking

1 Semiotics' King Midas

Very seldom will a classic and already sophisticated field of study be adopted and transformed by a single scholar, as happened in the case of semiotics upon the

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embrace by Thomas A. Sebeok (1920–2001). Sebeok’s devotion to semiotics commenced in his youth, and his domination in the field dates from the early 1960s, continuing up to his death in 2001. In 2000, he published his final book of theoretical and pragmatic substance, with Marcel Danesi: *The forms of meaning: Modeling systems theory and semiotic analysis* (Sebeok and Danesi 2000).

That millennium year, Sebeok attended what would be his final visit to the essentially international organization he had forged 25 years earlier (of course with colleagues, including John Deely), the perhaps poorly labeled Semiotic Society of America. The theme of the 2000 conference, aptly minted by Deely, was “Sebeok’s Century.” Deely also attended that conference, held on 28 September to 1 October 2000 at Purdue University in West Lafayette, Indiana, and he very probably recorded Sebeok’s keynote address, “The King of Lydia, the Thane of Cawdor, and the Emperor of Ice-Cream.”¹ For untallied decades, Deely had made a point of taping Sebeok, and perhaps only Sebeok, realizing that history was continuously being unveiled.²

Looking back, however, what a surprise it still is that Sebeok did not speak to that recent book on modeling, published 16 February 2000, and/or about bio-semiotics, another field of study Sebeok successfully launched through his energy, enthusiasm, and transdisciplinary contacts, or/and about any of the other semiotic realms he had established himself or inseminated through other minds, globally, in his role as midwife. Instead, as noted by Paul Cogley: “That Sebeok could confound not only his critics but also his most committed colleagues and admirers is one small clue to his ability to stay at least one step ahead of the intellectual game” (Cogley 2003: 474) to wax instead, not on cabbages and kings, but on a king, a thane, and an emperor. As his audiences, interlocutors, and readers had by then witnessed, all of Sebeok’s ventures turned to gold: he ruled as semiotics’ own King Midas, as noted in one of his obituaries (cf. Anderson 2003).

We two among Sebeok’s numerous mentees now stage an autopsy, as it were, on that 2000 modeling volume. We experienced Sebeok in overlapping times (Anderson from 1983,³ Cannizzaro from 2004⁴), but seldom in overlapping places. We ourselves have also been separated by generation and geography, but joined in our saturation with Sebeok’s global semiotics. This semiotics subsumes all its flavors in a life of the mind – above, below, and beyond the overdrawn twins of

1 Posthumously published (Sebeok 2008 [2000]).

2 These sound tapes of Sebeok’s talks, recorded by Deely, may be in Deely’s archives at Saint Vincent College, Latrobe, Pennsylvania 15650, USA.

3 Culminating in a position paper (Anderson et al. 1984).

4 Reflected in both undergrad dissertation (Cannizzaro 2005) and PhD dissertation (Cannizzaro 2012).

humanities and science; models and modeling pertain to all of the above vantages as indicated in the book's subtitle, *Modeling systems theory and semiotic analysis*, here, MST. We start with definitions, even though, as it clearly states on Anderson's office door: "Nothing interesting can be defined; everything is interesting."

2 Model, modeling, modeler, modelee

Turning to Sebeok and Danesi (2000), the term *model* – like any compelling notion – defies formal definition, not only because it is interesting, but because such a definition would depend on the structure, the history, the function, and the types of uses that the model might have. For instance, there are retrospective descriptive models "of" and prospective generative models "for," the latter having some utility for either understanding or construction or both. No model can afford equal weight to all parts, constituents, angles, or purposes.

The uses of any model could be multifarious, because "models serve many functions in human life. They allow people to recognize patterns in things; they act as predictive guides or plans for taking actions. They serve as exemplars of specific kinds of phenomena" (Sebeok and Danesi 2000: 2). In its most general state, a model is a form, often visualized, that has been externalized through some usually physical medium to stand for referents (or for a class of referents), such as objects, events, feelings (Sebeok and Danesi 2000: 2). In other words, a *model* can be generally understood in relation to its capacity to refer to something other than itself, also known as *referential* capacity. An example would be the map of London's subway (the "Tube," as the Londoners call it), which is a simplified model of the real distances and actual positioning of underground stations on a standard city map. Such a model's value lies in the shorthand way of approaching the shape of the territory, and the value it affords travelers wishing to plan a journey. Of course, a map *of the map* is not the territory, nor is a map the territory either (the latter reminder attributed to Alfred Korzybski (1879–1950) (Korzybski 1994 [1933]: 58).

According to Sebeok and Danesi, the study of models goes hand-in-hand with the study of their functions or use within the ecologies that generate and differentially maintain their relations. They state: "The key concept in semiotics is, in fact, that no single form can bear meaning unless it enters into systematic connections with other forms" (Sebeok and Danesi 2000: 14). We would emphasize that meaning can only emerge along with its contexts, symbiotically as figure and ground.

In introducing models and modeling, Sebeok and Danesi occasionally point to "function," "adaptation," and "survival." These notions were commonplace at the

time of their writing, but now call for nuancing, as they can carry baggage from the just-so logics leaking from positivism that thrive still in many discourse communities. Some of these discourse communities seem saturated with conservative religious beliefs as well, wherein everything “must have a reason.” Functionalism and adaptationism are consonant with such beliefs, and fuel much of the critique in post-Darwinian biological science (cf. Cowles 2020; Gould 2002; Reynolds 2020). That Sebeok anticipated those reservations is evident in the particular scientists, social scientists, and philosophers whom he drew into biosemiotics, these including Jesper Hoffmeyer, Claus Emmeche, Kalevi Kull, Terrence Deacon, Søren Brier, John Deely, and others collected into the anthology by Favareau (2010).

Another and often unstated feature of models is that they differ from their source inspirations primarily in terms of the most emphatic attributes being modeled! Such attributes can be as fundamental as space or time, which are simplified in service of the totalizing task of modeling (cf. Foley 1991). The map of the London underground, for instance, bears no fidelity to space, or even to relations within space, such as angles along the route. Likewise, the stereotype model of an angry woman as a “nag” foregrounds certain features – the act of venting anger – but not the context of patriarchy within which this cultural model is situated. That is, the model of “nag” does not capture that venting anger is an act of self-defense, can subsume fear or sadness, and can also constitute an attempt at rebellion; by excluding all these nuances, this stereotype model deems women’s anger as unacceptable and denigrates it. More profoundly, in biomedical research, a major epiphany in recent decades centers on its reliance on *animal models*, such as mice in experiments being stand-ins for a different species, often ours, *Homo sapiens*, and, it must be added, using human males as models for the species as a whole.

The actual process of generating forms is called *modeling*. This exposes some often obscured relations. In English, *model* is a verb as well as a noun, but as a noun it may pertain to either the source inspiration or the target medium. Our models are of models, and, as Stephen Jay Gould might say, it’s “models all the way down.” Gould (1987) referred to cosmological explanations of some of the deepest of temporal processes. In some folk myths, the known world sits upon a turtle, and that turtle upon another turtle, and so on, hence, turtles all the way down. In evolutionary theory, Gould’s domain, phylogenetic time has been illustrated by tree diagrams, or upside-down roots, often read by following time upwards as the branches proliferate, although the diagrams are equally legible when read from the top down. As everyone learns more from paleontology, genetics, and biological processes, Gould (1987) asserted that the tree image must be replaced with a bush, the model then becoming “bushes all the way down” (or up!) – the actual title of his 1987 article.

Modeling, the gerund form of the verb, while capturing some of the dynamics of process, behaves as a noun, suggesting something that might be set into motion by other processes, or by an agent, a modeler. The *modeled*, which would be an existing actual or imagined phenomenon, once conceptualized itself as a model, might be designated the *modelee*, were the modeled something like a person (but it seldom is), and *modelee* is not accepted in playing Scrabble! In the creative arts, the modeled human is called a model, and the result of the modeling becomes a portrait, or a sculpture, or some other genre of representation – and a model too. Google's Book Ngram viewer registers the incidence of the word *model* taking off with World War II, and peaking around 1990, slacking off somewhat thereafter until 2010. *Modeling* and *modeler* only modestly arise in this database around 1965 and, indistinguishable, very soon level off; the incidence for *modelee* is decidedly minuscule.

Current English discourse, and particularly academic prose, rely heavily on nouns, at the expense of revealing process (cf. Durst-Andersen 2011; Durst-Andersen 2018). Durst-Andersen's linguistic ontological supertypes, suggesting that English is a hearer-oriented language (distinguishing this from, for instance, the speaker-oriented Spanish and the context-oriented Russian, all these in the Indo-European family), was not available to Sebeok and Danesi, but may be inserted in this discussion from time to time. *Model* as a noun takes a verb to ignite a process, since temporal dynamics require more effort to express in English, while the language asserts facts very easily. When more research has been done on the cognitive implications of Durst-Andersen's three communication supertypes (hearer-oriented, speaker-oriented, context-oriented), which are found across all language families, we will be better able to compare and contrast both human behavior and the inferential habits of science in designating and dealing with evidence, across both languages and cultures. Philosophers of science and scientific practitioners have already documented cultural patterns that may or may not be consonant with Durst-Andersen's more recent research (cf. Bolton 2015; Conrad 2019; Cowles 2020; Danchin 2018; Danchin et al. 2018).

3 Tartu–Moscow School semiotic modeling systems

While modeling has been integral to sciencing from ancient time, according to Sebeok (1991b [1988]: 35), the notion of *semiotic* modeling owes much to the Tartu–Moscow School's notion of *modeling system* (Lotman 1967, 1990; Zaliznjak et al. 1977). In Tartu–Moscow semiotics, the notion of semiotic modeling is “the structure

of elements and of rules for combining them that is in a state of fixed analogy to the entire sphere of an object of knowledge” (Lotman 1967 cited in Sebeok 1991b [1988]: 50). The school focused on the *totality* of culture (Broms and Kaufmann 1988), since, as Lotman put it, the smallest functioning mechanism of culture is not the separate language but the whole semiotic space, even *semiosphere*, of the culture in question (Lotman 2001: 125).

Thus, through a spatial and material conception of culture as entailed in his notion of *semiosphere*, Lotman demonstrates his concern with institutions in general and organizations in particular, as systems, particularly in relation to both structure and time. With such an emphasis on structural understanding and broad applicability, semiotic modeling is the quintessence of generalism or *systems thinking* (more on this below). Unsurprisingly then, “semiotic modeling” and “systems” become married in the expression *modeling system*.

In 1967, Juri Lotman, the Russian semiotician spending his professional career at the University of Tartu, Estonia, provided a classic formulation of semiotic modeling systems, defining them as:

[...] the structure of elements and of rules for combining them that is in a state of fixed analogy to the entire sphere of an object of knowledge [...] Systems that have a natural language as their basis and that acquire supplementary superstructures, thus creating languages of a second level, can appropriately be called secondary modeling system. (Lotman 1967, cited in Sebeok 1991b [1988]: 50)

The term *modeling system* in contemporary viewpoints will not be a general replacement term for semiotics, but rather it hints at a precise conception of semiotics that mediates a synchronic approach (typical of Saussurean semiology) and a diachronic approach (typical of pre-Saussurean linguistics), giving equal weight to both structural and historical considerations. The historical element may be descriptive or also functional. The modeling system precisely illustrates the derivational character of culture in relation to *natural language*. Natural language here ordinarily refers to human habits of externalized speech and sign, and contrasts with artificially constructed language and so-called computer language. The Tartu–Moscow School’s use of *natural language* sometimes appears both more and less restrictive, however, including institutions and products of culture such as art.

With the sometimes-called Soviet⁵ view, linguistic systems precede religious systems and other cultural institutions (Zaliznjak et al. 1977, 47). In *Soviet*

⁵ The use of the term “Soviet” could prove problematic today given the negative ideological connotation that it may attach to semiotics. However there is a book titled *Soviet semiotics* (Lucid 1977), and Sebeok himself uses this expression a number of times to refer to the Tartu and Moscow school, e.g. “Soviet semiotics of the Tartu–Moscow school” (1988: 49) and “Soviet conceptions of models” (Sebeok 1991b: 53).

semiotics: An anthology, Lotman states that poetic language and natural language are particular manifestations of more general systems that are in continuous tension and mutual translation, while at the same time not being fully translatable (1977: 98). This distinction is specific to the work of Russian semioticians A. A. Zaliznjak, V. V. Ivanov, and V. N. Toporov, as well as that of Juri Lotman, who eventually taught semiotics in Tartu from 1954 until his death in 1993.

Nontranslatability at this juncture refers to entire conceptual regimes, not just a few linguistic tokens, eventually leading to conceptual metaphor *theory*, not just metaphors (Danesi 2013). Beyond semiotics, similar ideas were not so ambitious, where nontranslatability pertained to key metaphors, not intuited conceptual or blended metaphors (cf. Lakoff and Johnson 2003 [1980]), let alone social systems. But even at that smaller scale, whenever the ethnographer or translator encounters an opaque word or behavior, or a “rich point” (Agar 1994: 60), it's bound to be enlightening beyond the bounds of that word or behavior (cf. Ortner 1973).

According to Zaliznjak et al., there must be a *natural language* to be found at the basis of all other sign systems – not restricted to the naturally learned language that today is usually termed *natural language*. This Soviet notion of natural language consists in oral or/and written language – including the pictorial, or musical or vocal phrases, and even gesture and forms of human behavior like sleep, hypnosis, and ecstasy (1977: 49). This means that the primary modeling system in Tartu–Moscow semiotics may indeed include, besides spoken language, also sign language, a bona fide natural language, plus many external behaviors that would not be syntactic forms. However, Sebeok himself would not be using *language* to apply to any forms of expression or communication that were not both *naturally* learned and syntactic.

The Soviet notion of natural language would share, with other cultural systems, general features such as the possibility of articulating a sequence of elements belonging to that paradigmatic system, and other *paradigmatic* (largely spatial) relations, as well as *syntagmatic* (largely temporal) relations (Zaliznjak et al. 1977: 49). Notably, what post-Sebeok we would refer to as nonverbal communication, the Soviet semioticians would consider a *text* – this not limited to anything in a written language. For example, Pjatigorskij and Uspenskij state how the study of human personality can be based on analyzing “a text of behavior” (1977: 137). Thus, in Tartu–Moscow semiotics, linguistic systems were considered as universal sign systems constituting cultural *superstructures*.

The functioning of primary and secondary modeling systems in Tartu–Moscow semiotics is explained in Juri Lotman's work on the *semiosphere* (Lotman 1967, 2001 [1990]). The semiosphere is a model of culture comprising both center

and periphery, the locations of the primary modeling system and secondary modeling system, respectively. Lotman presents the primary modeling system as verbality (as in the tautology, verbal language), as well as pictorial representations, presumably of ideas supported by vision. In regard to analyzing pictorial texts, which he refers to as “iconic rhetoric,” Lotman says “the semiotic and conventional principle which lies at the heart of every semiotic fact has to be exposed, and the text, which is perceived by the naïve consciousness without its conventionality, must be recognized for what it is. In practical terms this means that at this stage, features inherent to a verbal text are ascribed to the non-verbal text” (Lotman 2001: 555).

The secondary modeling system would be instantiated in cultures and conventional sign systems at the level of institutions such as kinship, economics, law, religion. In the semiosphere, one can observe the derivational character of culture (Lotman’s secondary modeling system), with respect to verbal language (Lotman’s primary modeling system) serving as a model of continuity among systems of different supposed complexity (as imagined between alloanimal⁶ and human). Thus far, no semiotic modeling presumes to embrace the balance of the macroscopic and microscopic biomes, whether combined or not, excepting that of Sebeok, and his repeatedly (cf. Sebeok 2001b: 14–15; Sebeok and Danesi 2000: 158).

Semiotic modeling in general has been further explored by Sebeok himself (1991a, 1991b [1988], 1991c), Anderson and Merrell (1991), Krampen (1997), Sebeok and Danesi (2000), Danesi (2013, 2014), Cobley (2010), Kull (1998, 2010), Coletta (2015), Hoffmeyer (1996), Brier (2008), and Cannizzaro (2014). At the twenty-fifth Symposium of the Tartu–Moscow School of Semiotics (Imatra, Finland, 27–29 July 1987), Sebeok proposed a reconfiguration (1988)⁷ of the notion of primary modeling system developed in Tartu–Moscow semiotics, and in Lotman’s semiosphere.

⁶ Sebeok and Deely were both first exposed to the term, *alloanimal* (cf. Count 1973), referring to animals other than humans, in 1983, at the Fourth International Summer Institute for Semiotic and Structural Studies, at Sebeok’s Research Center for Language and Semiotic Studies, Indiana University, Bloomington, Indiana. Deely first used the term in Deely (2017), posthumously, while Sebeok may never have done so. Sebeok’s RCLSS was so re-named in 1975, taking over from his earlier Research Center for Anthropology, Folklore, and Linguistics, created in 1956.

⁷ The reworking of the Tartu–Moscow school’s notion of the primary modeling system was originally proposed by Sebeok during the Symposium and then published in the conference proceedings volume edited by Henri Broms and Rebecca Kaufmann (1988).

4 Sebeok's reconfiguration of "language as modeling"

In 1991, Sebeok published two different articles with the same title: "In what sense is language a primary modeling system?" (1991a, 1991b). The first, dating from 1988, Sebeok included in his 1991 volume, *A sign is just a sign* (1991a). The second was published in *On semiotic modeling* (Anderson and Merrell 1991). This chapter was the transcription, by John Deely, of a thus far unspecified address by Sebeok, made available through Deely's previously mentioned habit of audio-taping Sebeok's formal addresses and informal lectures. Sebeok authorized this transcription, with his edits, as he did not have time to contribute a written manuscript. Here, Sebeok explains that he had occasion to confirm his understanding of the Tartu–Moscow School semiotic modeling systems with Ivanov in Tartu in August 1970, while he was in Tartu for a lecture. That understanding he published in 1974 (cited through Sebeok 1985: 23, fn. 38). Sebeok emphasized the fundamental contribution that Soviet scholars brought to semiotics with their emphasis on modeling, this making imperative concepts of *space*, history, and innovation through translation, and foregrounding the *derivational* character of culture in relation to verbal language. Yet Sebeok suggested that Soviet semiotics⁸ did not sufficiently take into account our species' evolutionary history, that is, how humans could communicate and generate *cultures*, presumably before mastering externalized verbal signs, gesture through vision, and vocality through audition. He observed that verbal language "is the modeling system the Soviet scholars call primary but which, in truth, is phylogenetically as well as ontogenetically secondary to the nonverbal" (1991b: 55). Sebeok confirms that the Soviet conceptions of modeling systems were influenced by biologist Jakob von Uexküll's theory of meaning and *Umwelt* (1982 [1940]).

By the time Sebeok came to reconfigure the two Tartu–Moscow modeling systems into three, he had already expanded semiotics to include biosemiotics. Implicit in semiotics, and explicit in biosemiotics, it is recognized that any concept entails relations-*cum*-contexts, and those relations likewise have relations, although we needn't pursue any beyond a pragmatic horizon. A powerful model from von Uexküll, which he himself also applied beyond biology, is the notion of *Umwelt* (Uexküll 2001 [1937]). The term, from German, has been in the process of being naturalized in the English language ever since Sebeok rediscovered and promoted the term (cf. Deely 2004; Sebeok in Uexküll 1982 [1940]). At this time, many writers in English are declining *Umwelt* as a proper German word, but predictably, once fully naturalized in English, it will be neither capitalized, nor italicized, nor declined; here we will decline to decline it, for simplicity's sake.

Furthermore, von Uexküll's *Innenwelt* (Uexküll 1982 [1940]: 10–11) comprises those models that can be located to individuals of a species (of animals); some will code for approach and withdraw, others be more elaborate, and some no doubt will still be discovered. Then, as now, communication from the *Umwelt* and hence available to any creature arrives to the *Innenwelt* through senses that are analogues or homologues of our sensorium of touch, smell, taste, vision, hearing, and any number of *sixth senses* (cf. Howes 2009). These senses shape what individuals can notice, or passively receive, as incidental or premeditated communication from conspecifics or others in the *Umwelt*. Still other pathways have developed for the execution of communication, including vocal calls and bodily gesture, but none so far have exhibited the syntactic structures of natural human language. As to the *Umwelt*, we can imagine any organism's *Umwelt*, for example, but *Innenwelt* cannot be so obviously localized in a central, and cognitive, nervous system, other than provisionally for animals. Indeed, the models of *Innenwelt* and *Umwelt* have not been nuanced for plants, fungi, protista, and monera, the other kingdoms in Lynn Margulis's taxa that Sebeok introduced to semiotics in 1983 (cf. Anderson et al. 1984).

Through a phylogeny, that is, modeling, Sebeok reminded both scientists and humanists how hominids (including various species in the genus *Homo*, such as *Homo habilis*, *Homo erectus*, *Homo neanderthalensis*) (cf. Schwartz and Tattersall 2015), and even more, would have relied on multimodal nonverbal communication while externalized syntax-based linear language was developing. Verbal language, both gestural and then spoken, likely emerged in concert with culture in *H. sapiens* by 200,000 years ago. The faculty of verbal display (either in gesture or speech) depended on a capacity for syntax that would allow, for example, communication facilitating manufacture of tools with standardized techniques (though the habit of certain types of stone to break reliably in flakes is another factor allowing such techniques), but not yet to externalize and articulate linear speech (1991c [1988]: 55); hence, considering the phylogeny of communication of the genus *Homo*, Sebeok assumed that internalized and externalized nonsyntactic sign systems would have been *antecedent* to the externalized sign system that we now call linguistic. Earlier humans and related animals, particularly mammals, then and now, rely on vocal calls and “songs,” as well as the faculties of the other less controllable sense and expressive-related organs.

Nonsyntactic passive and then both passive and active communication is common to all living things (including animals, plants, fungi, protista, and monera) (Sebeok 1991b). Sebeok pointed to the earliest form of inter-organismic communication in our biosphere to be found in bacteria (Sebeok 2001b: 14–15). He also assumed that semiotic modeling systems would pertain to nonanimals, but

only in general. Following Hewes (1973), Sebeok accepted that nonvocal gestural language preceded vocal spoken language, both being verbal, that is, syntactic, and in today's terminology, both would qualify as natural language.

Note, the term *nonverbal* has become only more confusing since Sebeok's day; he himself referred to Bullowa's (1979: 9–10) coinage of extraverbal (cf. Sebeok 1991c: 335). Nonsyntactic communication as nonverbal or extraverbal also involves other communication taking place *within* an organism – these would include biological codes such as the genetic, metabolic, and immune systems and so on – or taking place *between* conspecifics or between dissimilar organisms or groups or assemblages of them. An example of the most expansive of such communication would be the different elements and relations in an ecosystem, as for example hypothesized by Lovelock in his Gaia hypothesis (1979).

For Sebeok, the nonsyntactic modalities are the repositories of actual pre-conscious and conscious feeling, emotion, affect, memory, engram that constitute the fundamental modeling that plays into a species' (or creature's) habitual behavior. In fact, Sebeok holds that “[Natural] [l]anguage evolved as an adaptation; whereas speech developed out of language as a derivative exaptation” (1991b [1988]: 56). It is likely, however, that adaptation is not the sole explanation of deeper-structure language, either, but surface-level sign and vocal language, languaging, remains an excellent example of Gould and Vrba's (1982) “exaptation.”

In the terminology emerging at the time, Sebeok declared that only hominids possess two mutually sustaining repertoires of signs: zoosemiotic nonverbal, thus nonsyntactic, versus anthroposemiotic verbal and syntactic (1991b: 55) – whether vocal or nonvocal. All living organisms in fact communicate exclusively through nonverbal means, with the sole exception of some members of the species *H. sapiens*, who communicate by both nonverbal and verbal means. Evidence of syntax among alloanimals remains a tantalizing possibility for some researchers, for instance with dolphins and other sea mammals.

Today, the nonverbal/extraverbal versus the verbal can more usefully be referred to as nonsyntactic and syntactic, respectively. Syntax is exclusive to human language, although semioticians may detect it elsewhere, as in culture; syntax consists in the system that governs the hierarchic structure of speech or signed language, those externalized communicative faculties we might also call *languaging*. Languaging is not a term we find in Sebeok, but other semioticians have found it useful (cf. Halliday 1975; Maturana and Varela 1980; Swain 1985). One reason for the increasing utility of the term *languaging* is that it subsumes both vocal and nonvocal (sign) verbal language.

The Tartu–Moscow *natural language* in their primary modeling system is *not* human natural language as verbally encoded, but rather inclusive of non-deliberate leaking and deliberate indicating of sensorial information manifest in chemical, thermal, olfactory, acoustic, haptic, balance, and visual forms. In humans, such primary modeling existed, phylogenetically, alongside the cognitive capacity manifest in the production of externalized verbal signs (now becoming Sebeok’s secondary modeling system). However, it was not until *H. sapiens* that such verbal signs (secondary modeling systems) were routinely circulated, eventually or concomitantly consolidating as *culture* in Sebeok’s tertiary modeling system.

To recapitulate, Sebeok has reconfigured the *natural language* expression from Tartu–Moscow semiotics’ primary modeling system, effectively splitting it in two – the nonsyntactic, evolutionary capacity for modeling, and the syntactic, exaptive capacity for communication. Also, it is worth noting that at the time of his writing, science was resistant to the folk knowledge that, in alloanimals as well as in other living things, not everything was *functional*, to be explained through natural selection. Indeed, (excessive) functionalism, also labeled the adaptationist program in evolutionary theory, continued for some time in biology after Gould and Eldredge’s introduction of the distinction between saltational reorganization in punctuated equilibrium, and strictly gradual change via natural selection, mutation, gene flow, and genetic drift (Eldredge and Gould 1972; Gould and Eldredge 1977; Gould and Lewontin 1979; cf. Pittendrigh 1958).

The exaptive, message-swapping function of communication can be intended as non-essential communication, which abounds in culture. A further distinction becoming more valuable is that between natural selection so evident in biology, mostly selection-*out*, versus artificial selection that dominates in culture, predominately selection-*in*. In general, biology proscribes, culture prescribes. Biological natural selection cannot come close to the mantra of “survival of the fittest,” for many reasons; if one needs to boil it down, it would be the teleological expression of “survival of the not terminally unfit,” while the terminally unfit and the unlucky would be culled, proscribed from remaining in the gene pool. One way or the other, however, biology self-corrects, or not, supporting not the fittest or even the fitter, but the fit enough to have threaded through the accidents and necessities Monod described as evolution (Monod 1972 [1970]). In contrast, cultural artificial selection routinely accumulates marginal, perhaps fashionable, traits and habits that can even be clearly deleterious; these may not be continually trimmed by the selection-out associated with natural selection and thus can lead to larger perturbations.

5 Levels in MST: primary, secondary, tertiary

Whether stirring up deleterious systemic perturbations or not, phylogenesis, selection, evolution, and development are key features of semiotic modeling systems. Modeling systems theory inherits from Lotman and Tartu–Moscow semiotics a strong evolutionary, *derivational* component. The fundamental recognition that there is a form of modeling faculty, the primary modeling systems (PMS), phylogenetically and ontogenetically antecedent to the externalization of syntactic signs – these now being secondary modeling systems (SMS) – constitutes the basis for Sebeok and Danesi's *Forms of meaning: Modeling systems theory* (2000) (MST). It follows that the Tartu–Moscow secondary modeling system becomes the tertiary modeling system (TMS), accommodating cultural and societal extensions of language and languaging. The deeper facilitating faculties of language interlock with those of culture, as both may materialize in external behavior, both in sign and speech, and in society.

The derivational character or extensionality principle, as Sebeok and Danesi call it, is also what most lucidly illustrates their evolutionary concept of modeling. Echoing Sebeok and Danesi (2000: 1), Coletta (2015: C.951) underlines how semiotic modeling is derivative of semiosis to produce forms to represent objects, events. Thus semiotic modeling would be virtually synonymous with semiosis. According to the MST perspective, what we generally call “semiotic modeling” may be understood to obtain, to manifest itself, in four developmentally arranged registers, only one of which is itself formally called “modeling”: these are “perception” “semiosis”, “modeling,” and “representation.”

Sebeok states that perception refers to sensory knowing of the natural world surrounding the living subject. Semiosis is the biological capability of recognizing forms, while modeling, a derivative of semiosis, is the actual activity of producing forms. Representation, a unique capacity of the *Homo* species that develops in childhood, consists in referring to the world in terms of singularized, composite, cohesive, and connective forms. Each of these cognitive steps is derivative, one of the other, and, like the modeling systems, must partake of extensionality. There persists a number of origin stories for the emergence of, first, internal language, and later and evolutionarily separately, that of externalized languaging. This resonates with Deacon's (1997) explanation of how language emerges from hominids' sociality, leading to larger-scale social interactions, rather than from disembodied genetic mutations and the other sources for phylogenetic change and ontogenetic development. By 2021, genetic evidence has multiplied the pathways that ultimately converge to trace the braid of human language with human speech and signed communication (cf. Jarvis

2019; Petkov 2020; Petkov et al. 2005). Most emphatic in the twenty-first century, and now accepted, is that deeper-structure language and externalized surface structure speech and sign have independently evolved and also independently emerge throughout ontogenetic development too, their disorders and remediations also being distinctly different.

Consonant with contemporary linguistic theory, MST and its derivational character assume *continuity between nature and culture*. This idea likewise resonates with Bateson's "phylogenetic homology" and his signature phrase "the pattern which connects nature and culture" (Bateson 2002 [1979]: 9).

Sebeok and Danesi provide, through their MST, a comprehensive framework for the analysis of sign systems (2000: 14) – categorizing all types of signs, and the relations among them, that pertain to living things. MST provides a vocabulary and a nascent methodology for studying *forms of meaning* across different systems (cosmological, biological, cultural, cognitive).

Hence, MST aims to be a comprehensive framework for systems analysis – be the system a single text, a social habit, or a cultural system – that is, contending with signs' origins and levels of signification. Systems analysis investigates how models are constructed, what their species-specific functions are, and how they generate forms of meaning (Sebeok and Danesi 2000: 158).

According to the authors, the modeling PMS is the biologically natural ability to model the sensory properties of objects within the *Umwelt* through *iconic* representational forms such as iconic signs, iconic texts, iconic codes, and meta-forms. The modeling SMS holds the potential to make reference to objects through *indexical* (indicative and extensional) forms, with syntax being its key defining feature. However, while Sebeok, like all linguists, distinguished internalized *language* from externalized *linguaging* in speech and sign, he would not have realized the extent to which notions about deeper-structure language are inferred, back-engineered, from realized speech and sign. It's now understood that externalized linguaging is saturated with both the sociocultural and the psychological; the modeling TMS is the capacity to further extend secondary models to acquire *symbolic* values, constituting cultural superstructures.

According to Sebeok and Danesi, systems analysis as performed through MST is particularly appropriate for studying human cultures, yet it also may document and catalogue the manifestations of all types of modeling forms across species. In fact, in addition to linguistic expressions and social systems, MST can also be used to grasp the nature of alloanimal models, from the iconic character of camouflage and the indexical function of the honeybee dance to the symbolic persuasion of the nest-decorating bowerbird mating gift.

6 Peircean influence on MST

In the characterization of modeling systems in MST, there is a reference to the sign types of icon–index–symbol. To contextualize this explicit reference, Sebeok and Danesi state that the three types of modeling systems correspond *grosso modo* to what Charles Peirce called firstness, secondness, and thirdness (2000: 10; also see Danesi 2014). The nature of this correspondence between the icon–index–symbol characterization of modeling systems and Peircean broad philosophical categories is not explained any further in their 2000 book, except through the use of examples, and Danesi's remarks in other publications (e.g. Danesi 2014).

One example is when the authors state that the child's earliest strategy for knowing the world through the senses is a *firstness* strategy (PMS). Danesi recalls how firstness in Peirce associates with *iconicity* (Danesi 2014). The secondary modeling system is the knowing strategy that urges the child to engage in extensional and *indexical* forms of modeling (Sebeok and Danesi 2000: 10). Danesi then (2014) explains how this strategy pertains to secondness and is the capacity to refer to objects with extended primary forms and with indexical (indicational) forms. The TMS allows the child to engage in *symbolic* forms of modeling available in its surrounding sociocultural context, which Danesi marks as a thirdness form of knowing. In these 2014 remarks, Danesi elucidates the relation of the different levels of MST to Peirce's philosophy somewhat more than what was revealed in the original co-authored MST book.

The mapping of the modeling systems' strategies onto Peirce's philosophical categories points at a correspondence across primary/icon/firstness, secondary/index/secondness, and tertiary/symbol/thirdness. However, were this relation to be taken as straightforward, it would not be without problems, hence probably the reason for Sebeok and Danesi – and for us too – formulating it as a *grosso modo* relation.

As an example of such issues, let's consider how modeling systems were characterized before their consolidation in MST. In an earlier publication, Sebeok observes that language is a secondary modeling system by virtue of the fact that it incorporates a syntactic component like no other in zoosemiotic systems, but that this feature, referring to syntax, “does abound in endosemiotic systems, such as the genetic code, the immune code, the metabolic code, and the neural code” (1988: 58). As an ancillary note, perhaps these should not have been called “codes,” as the flagrant use of “code” in and out of semiotics has led to a lot of fuzzy thinking. However, Sebeok's point here is that these systems have grammars, as does natural language, while culture hasn't yet been so revealing; furthermore, in his 1979 essay “Precognitions of art,” Sebeok explores the aesthetic forms of

expression of humans and alloanimals in terms of what they have in common, or homologies. He does so by first categorizing organic forms such as kinesthetic signs, musical signs, pictorial signs, and architectural signs as “artistic products of averbal semiotic systems” (Sebeok 1979: 12), and thus have to be considered not as *languages* as such but as forms of nonvocal–nonverbal–nonsyntactic communication. In MST terminology, these could be mapped as PMS. Sebeok was stalwart critic of other extensions of the term, *language*, including that used in so-called ape language research (cf. Sebeok and Umiker-Sebeok 1980).

Now, were there a straightforward correspondence between Peircean categories and modeling systems, a primary form could not also be a tertiary form, or firstness could not contain thirdness, be it artistic or cultural (although as an aside, it is now documented that almost all mammals and also other creatures do participate in their own cultures, if not also ours; their cultures are learned, as are ours). That is because in a Peircean framework, thirdness includes firstness, but not the other way round. However, in MST, PMS would include not only firstness, but also include secondness and thirdness in some degree or capacity.

In this sense, for example, PMS would not only be iconic but also indexical. Yet, the chapter on the secondary modeling system (Sebeok and Danesi 2000: 82–119) presents a range of almost exclusively linguistic examples to elucidate secondary models, with a reliance on semiological terminology and a coming back to human ontogenetic examples, before developing general ideas of modeling.

While ontogeny will not recapitulate phylogeny, it’s possible that, for some purposes, taking a deeper temporal perspective might elucidate recurring patterns. The same chapter also mentions a handful of examples of indexicality and secondary forms within the nonhuman animal and occurring in (nonhuman) nature, these referred to as instances of *natural indexicality* (Sebeok and Danesi 2000: 96), such as the indicational behavior of the honeyguide bird; the indexical behavior of the flagellae of the bacterium *E. coli*; plants’ indexicality in orienting to the sun; and the human immune system relying on indexical signs exchanged among cells in order to circumscribe the self. Hence, it can also be the case that classification cannot capture phylogeny, when the more we understand, the kinkier it will be, with “bushes all the way down,” recalling Stephen Jay Gould and discussed above (Gould 1987).

The explanation may go like this: the modeling systems may “fit” most macroscopic animals, for us outside in third-person, and they can be used to “talk about” other creatures and other scales of phenomena, such as the immune system – and, back to pointing, the motivation may initiate in firstness, but that’s about it. But there’s no reason that Peircean categories should fit neatly into MST any more than the fact that in some linguïcultures, humans have a penchant for

dividing things into threes with more conviction than using dichotomies, sometimes cheating by introducing an otherwise excluded middle!

Furthermore, looking back on Peirce as a whole, everything for him boiled down to process, to continuities in time and contiguities in space, and overlapping sliding scales in all of the above (Kemple 2019). Hence, forcing the modeling systems of MST into Peircean categories as if these were stacked taxonomic categories would not necessarily move anything forward for either theory or analysis. Most or many consumers of Peirce long for categories, labels, signs – and no surprise, since most research is expressed in English, a hearer-oriented language that is very noun-dominated (Durst-Andersen 2011). As an aside, we might imagine that were Peirce to have had almost any other language as his first language, the systems he discerned would be otherwise expressed, unrecognizable through translation – and not just because, by historical accident, English has a stunning inventory of lexemes, quite a number plundered from distant lands (Nicoll 1990).

7 Analogue levels of modeling systems – on PMS's indexicality

Hence the three modeling systems cannot be viewed literally as levels. We underline how the modeling systems are primarily characterized according to the features of singularized forms. These have to do with his six general sign types, with Peircean notions only suggestions: symptom is leaked without intention (rheme); signal is emitted into fallow ground with or without intention (dicent); the name is with deliberation but with or without reason assigned/attached (legisign) – then the icon (motivated translucent relation to object in one dimension, often spatial, such as a representation in some dimension, though not necessarily visible); and index (motivated translucent relation to object in more than one dimension, often temporal, such as deictic trajectory); and symbol (non-motivated, arbitrary, and opaque relation to object, fixed unto non-arbitrariness by time and habit, hence, naturalized, conventionalized signs) (Figure 1).

Symptom – rheme
 Signal – dicent
 Name – legisign
 Icon – spatial (motivated sign)
 Index – temporal (motivated sign)
 Symbol – naturalized conventional sign

Figure 1: Singularized forms undergirding MST with their Peircean counterparts.

It is clear that in MST, Sebeok deliberately sought out these categorically distinct labels of familiar receivable and interpretable signs, distinctions that were, moreover, not at all either exhaustive or even umbrellaed in a single super-category. In MST, these are *paradigmatic* and digital in being distinct, in contrast to *analogue*, as all of Peirce's continuous and deferred examples.

However, in *Signs: An introduction to semiotics* (2001a [1994]), Sebeok discusses the analogue levels of the sign in a less paradigmatic fashion than in MST. In this text, Sebeok makes the fundamental point that the six-type sign classification (later proposed in MST) refers to *aspects, or levels, of the signs, rather than fixed types*. Sebeok echoes Eco's affirmation that "it is not signs that are actually being classified, but more precisely, aspects of signs: in other words, a given sign may [...] exhibit more than one aspect, so that one must recognize differences in gradation" (Eco 1972, cited in Sebeok 2001a: 43). With this acknowledgment comes what is to us an important clue concerning the fuzziness of MST's basic premises: that the three modeling systems – PMS, SMS, TMS – cannot be viewed literally as levels or as related in any systematic or seemingly mechanical fashion, but as *analogue* levels of the sign.

Indeed, in discussing the notion of "indexicality," Sebeok acknowledges that

[...] this Peircean category, like every other, cannot be well understood piecemeal, without taking into account, at much the same time, the veritable cascade of other irreducible triadic relational structures which make up the armature of Peirce's semiotic – indeed, without coming to terms with his philosophy in its entirety. (Sebeok 2001a: 84)

Hence, if one acknowledges Peirce's influence on the six sign *types* described in MST, these are not to be taken as fully paradigmatic, self-contained entities, but as analogue categories that overlap and cooperate with other sign categories. In a true Peircean fashion, opposition and competition among sign types is not fully realizable. Sebeok recalls how iconicity and indexicality have often been polarized, "although never by Peirce" (2001a: 88). Despite Peirce once stating "uncommonly loosely" that a sign "is either an icon, an index, or a symbol," he soon realized that the utility of his trichotomy was greatly enhanced by recognizing that it is not signs but rather aspects of signs that are being classified (cited in Sebeok 2001a: 90). Furthermore, in addition to acknowledging that the six general categories refer to aspects of the sign, there is indeed a hierarchic principle inherent in the architecture of any species of sign, since "the sign is legitimately, if loosely, labelled after the aspect that ranks predominant" (Sebeok 2001a: 44).

Much as in Eco's limits of interpretation, circumstances or context influence the aspect or level of the sign that can be ranked as predominant, since "a given object can, depending on the circumstance in which it is displayed, momentarily function,

to a degree, in the role of an icon, an index, or a symbol” (Sebeok 2001a: 89) – or symptoms, signals, name, to add the remainder of the categories mentioned in MST. Hence, the primary, secondary, tertiary modeling systems, being loosely based on analogue sign levels – including but not exclusively, iconic, indexical, and symbol aspects – appear to be not strictly paradigmatic but quasi-paradigmatic. To come back to the earlier issue, the recognition of this feature of MST's categories, allows us to understand why the primary modeling system harbors indexicality in addition to iconicity. Furthermore, for Sebeok all externalized signs necessarily partake of secondness, in other words, they contain an indexical level, although this aspect is prominently upgraded only in certain contexts (Sebeok 2001a: 90). Sebeok states how signs with indexical function occur at a cellular level as entities which can issue instructions for their embedding organism in the manner of an index (2001a: 91). Positing indexicality within a phylogenetic fashion, Sebeok reminds us how “the indexical relation of secondness – along with its elder and younger siblings, firstness and thirdness – appeared in terrestrial evolution of life forms about 3.6×10^9 years ago” (Sebeok 2001a: 90).

What this turning to functions and interpretants leads us to conclude is that the primary modeling system can be both iconic *and* indexical, despite its definition in MST as “the innate category for simulative modeling” (Sebeok and Danesi 2000: 44). This category is only *foregrounding* the iconic aspect of primary forms, rather than exclusively categorizing it as such. Hence, as a form of modeling evincing some survival function, PMS is the repository of action-triggers or reagent signs, and as such has a strong indexical-indicative component that pertains, in Peirce's terms, to secondness.

8 Systems thinking influence on MST

But it isn't the Peircean heritage alone that allowed Sebeok to conjure modeling systems in an analogue fashion. It was also his systems thinking imprint. He testified to his long interest in systems thinking in a 1977 essay:

The kinship of semiotically based programmes [...] to the movement known as General System Theory (Bertalanffy 1968), or GST, is seldom underlined yet their common denominator is rather obvious. As a 'natural philosophy', both these variants of a single metatheory can be traced back to Leibniz [...] and his programme for a *mathesis universalis*. (Sebeok 1977: 185)

In this context of cosmological, biological, and cultural modeling, analogue models, and relative analogue levels, are a necessity. Analogue refers to the fact that the system or form is fuzzy from the outside, for the observer. From the inside

there may be many descriptions but the actual processes will be so unknown, multiple, and even contradictory as and until they might self-organize. From the outside, especially for a naïve observer or analyst, the system and its constituents can be both general and vague, this also illustrating the human reliance on metaphors from sight, our privileged sense. In general quotidian terms, human individuals, and human groups, will necessarily have simplified models of their “others,” basically reflecting their inevitable and manifold ignorance.

Systems thinking recognizes and even builds on the analogue–digital distinction, with or without the counterbalance of the *third* elicited by Peircean semiotics. Before devoting himself full-time to semiotics, and wandering away from linguistics (cf. Cobley 2003), Sebeok’s passion for bringing minds together placed him in conjunction with similar transdisciplinary in general systems theory. One of his most significant events, held at Indiana University, was that in 1962 devoted to an inquiry about paralinguistics and kinesics. In this phenomenal congregation, Margaret Mead tipped the balance in determining how, in English-speaking North America at least, *semiotics* would indeed be called *semiotics*. Mead and other players, some co-editors of the 1964 transactions, were also foundational in the establishment of general systems theory (cf. Sebeok et al. 1964). This conference forced these semioticians and systems thinkers to integrate the outer realms of human languaging, bringing in extensions of language-qua-language in embodied meaning-making within the context and with the movement of the body, now recognized as the specialized fields of study paralinguistics and kinesics.

While systems thinking is less confrontational than the assertion of systems theory, in the West at least, these two natural allies have not to date joined forces. Ambitious, holistic approaches in semiotics alone include the Society for the Advancement of General Systems Theory in 1954, involving both Gregory Bateson and Margaret Mead, which organization in 1988 ratcheted up to the International Society for the Systems Sciences, in which few card-carrying semioticians still participate.

To trace how systems thinking arrived in semiotics through MST, one can look even further back at a broader historical-political context. Waldstein (2008) explains how in the 1940s, Soviet academia (the repository for early Tartu–Moscow semiotics) was strongly influenced by cybernetics in light of the appeal of ideological neutrality and the systematic exactness which it embraced. This seemed to perfectly suit the needs of an academic environment which was frustrated by the state’s and the Party’s infringements on the personal and corporate autonomy of academics and academia, and hence was pervaded by a wariness of overtly political projects. In fact, in 1964 the term “secondary modeling system” (notably, “modeling” is a mathematical term) was used as a euphemism for semiotics

because the very term “semiotics” was prohibited by scientific state officials (Chernov 1988: 12).

Hence the “alliance” of Soviet academia with cybernetics can be seen as the beginning of a process of de-Stalinization of knowledge, later dubbed as Eurocommunism, or “the vast process of change involving the left everywhere in the world” (Ross 1980: 15). This aligns with a political formation that sets out to transcend the failures of the past through involvement in political struggles that take place within institutions and a principled support of social and political pluralism (Boggs and Plotke 1980: 7). It is in this context of striving for pluralism which academics in Soviet times were trying to achieve that systems thinking, through modeling, also surfaces as semiotics.

Coming back to the continuity between PMS and SMS, this can be seen through a systems-thinking lens in the following way. In terms of the evolutionary emergence and the ontogenetic development of meaning-making, paralinguistics and kinesics turn out to be foundational, arising from PMS. Once emerged and established, paralinguistics and kinesics can both support (dialectically) and/or fuse with syntactic forms in SMS like languaging, as well as become independent singular forms in TMS.

Hence, conceptually the PMS may be based in impedance-matching, often in a sensorial realm, to be used as is, perhaps limited to those internalized functions that have sometimes been called *codes* despite their syntactic functions, such as the *genetic*, the *immune*, the *metabolic*, the *neural*, the *histone*, the *epigenetic*, the *virome*, sharing syntactic structures and functions with the verblability in the SMS. Some functions of PMS may carry over into the secondary modeling system once there is any externalization with a significant surround, that being somewhat complementary and iconic or in incipient firstness. But in actualization of any processes, those processes will be by definition in secondness.

9 Pandemic's dance among the modeling systems

As so evident in the nuances and probes around MST, Sebeok's sovereignty in semiotics in no way reflects his adopting or developing any singular theoretical paradigm. With respect to ideas in general, he was a gourmand rather than a gourmet, always keeping himself open to surprise, never consolidating his formulations into stiff, consistent definitions or models. This reflects his broad background as well as his idiosyncratic habits. Upon his retirement from Indiana University in 1991, Sebeok proved himself, naturally, irreplaceable.

While Sebeok and his ever-expanding interests attracted followers from every age grade and profession, there would be no Sebeokian school. Perhaps this

reflects the incredible breadth, depth, and variety of his pursuits, which evaded any Procrustean force that might lend consistency and coherence to a single paradigm. At the same time, while there is no school, all semioticians find themselves recurrently entangled with Sebeok's incommensurable passions, from MST to Jakob von Uexküll's *Umwelt* and *Innenwelt* to James Lovelock's Gaia Hypothesis. Often, what Sebeok continually pulls closer for semiotic attention turns out to be the biological, often the lesser-recognized PMS, and the problematizing of boundaries within and beyond both culture and biology.

MST allows a play between composite rather than prismatic modeling systems: a more primary though not purely iconic modeling system, a somewhat secondary without strictly indexical modeling system, and a tertiary surely symbolic modeling system for everything else. Once Sebeok brought biological processes into the PMS, some distinctions between the ensuing and presumed three levels of the modeling systems dissolved. The clarity of Sebeok's PMS, infused with what now seems obvious, given biological evolution, actually troubles both the SMS and TMS, in part because it is increasingly clear that there will be no clear-cut boundary between the biological, or nature, and the socio-culturo-linguistic, or nurture.

In the case of *Umwelt* and *Innenwelt*, Sebeok's attention was drawn to the dynamics of sensation and perception, perhaps en route to cognition. With *Umwelt*, the unit of analysis may be either individual or species, referring to the German loanword labeling an abstract and non-reciprocal significant surround of a creature. *Innenwelt* pertains to the individual, but again, of an animal. Neither *Umwelt* nor *Innenwelt* will satisfactorily model the relations of living things in kingdoms other than Animalia. One can imagine that Sebeok would eventually resolve this conceptual missing link.

The Gaia Hypothesis posits that the earth, our geologic substrate, is also a living organism. Sebeok was attracted to the strength of Lovelock's metaphor, or perhaps also a simile, because it brought biology into play on our planet regardless of any human inhabitants (cf. Lovelock 1979). Biological process will never be totally described by entropy; living things infect the inert, and render the new whole into a far-from-equilibrium dynamical system, much as with King Midas's touch. This of course, echoes Ilya Prigogine (1917–2003), whom Sebeok followed even though the Russian–Belgian was a physical chemist, and not a biologist (cf. Prigogine and Stengers 1984 [1977]). Sebeok was successful in drawing mathematician René Thom into his semiotic web, however (cf. Thom 1990), as well as Robert Rosen in biophysics (2012 [1985]).

Another biologist and systems thinker, G. Evelyn Hutchinson, was asked in his final year what then, in 1991, was a major gap in scientific theory. He replied without hesitation: “insides and outsides,” hence, boundaries realized in relations

of containments and connections (Anderson 2000). Hutchinson's insight points to the most semiotic element in all of biology: the membrane. Being both transitive and intransitive, the membrane allows, more than directs, the disparate violations of itself through activities that, in themselves, define the boundary; the membrane may constitute a grammar in itself.

Molecular biologist Hoffmeyer, coming to biological understanding of semiotics from a parallel yet converging trajectory as Sebeok, recognized that boundaries, skins, membranes, or "surfaces within surfaces" (2008) are essentially constitutive of the biological self, and that the membrane's function of negotiating an external environment for the benefit of the collective is essentially a semiotic capacity (2008: 25, 28). "If any agency in the body deserves to be called directive or controlling, it would not be the DNA but instead the membranes that permeate the body" (Hoffmeyer 2008: 31).

The blood-brain barrier has been a quintessential paradigm of biological modeling, whereby the brain would be blocked from infectious agents, toxins, and antibodies carried by blood, while the blood would also be free of backslash from disorders in the central nervous system. Yet it turns out that some analogue permeability may be both regular and modulated by everything from mood to exercise to nutritional state to gut microbiota. That is, the barrier is less efficient with negative moods, inert behavior, poor health, and less diverse microbiome (cf. Abbott 2020).

With the twenty-first century's pandemic, everyone regardless of background finds themselves aware of membranes of the virus, the metaphoric membrane allowing or preventing contagion, the membrane of the social fabric that can grow herd immunity. The virus has reintroduced us to ourselves, as well. No one has doubted that our species is saturated in sociality, but the extent to which the PMS is predicated on the sensual presence of others, or other creatures, has never been so clear (cf. Field 2003 [2001]; Guerro et al. 2017 [2001]). Over the last year and half, substituting in-person office meetings with videocalls has not quite been the same – worse for some, better for others – yet undoubtedly at the same time *both* unsatisfactory *and* harboring new communicational opportunities. The physical-into-social distancing represents, and often actually creates, a conflict of physical onto social membranes – as an extreme point in case, think about the shootings that have happened across the world due to people disregarding or overly regarding distancing, with or without face masks.

With its biological overtone, PMS and its manifestation in proxemics is the primary grounding for social distancing. But considering the analogue levels of MST, social distancing is an institutional intervention in twenty-first century human communication habits that builds on all three modeling systems. It interferes with human's phylogenetic and adaptive proxemic habits and prescribes an

ontogenetic, exaptive one – one meter apart (if not two) from another human being. Making the point for us, Fleming and Slotta (2020) sensibly warn us to be careful not to oversimplify and just physicalize the act of “social distancing,” ignoring the elaborate cultural frameworks and discursive mediations that underpin this avoidance register, in other words, ignoring the SMS and TMS layers of social distancing. Social distancing complicates phylogenesis and ontogenesis, intervenes within a very short time-span on adaptative yet not purely functional communicational behavior. As Cobley once put it, this was exactly the kind of thing that Edward T. Hall was predicting in his 1959 book, *The silent language* – not the virus, of course, but a potential crisis articulating proximity and distance. It should definitely bring semiotics and communications studies, and especially modeling systems theory with its composite, analogue, non-paradigmatic semiotic modeling systems, to the forefront of research.

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