Meaning comes first: languaging and biosemiotics

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Abstract In linking evolution, biosemiotics and languaging, analysis of meaning is extended by investigation of natural innovation. Rather than ascribe it to internal or external content, meaning comes first. Ecological, evolutionary and developmental flux defy content/ vehicle distinctions. In the eco-evo-devo frame, I present the papers of the Special Issue, pose questions, and identify a direction of travel. Above all, meaning connects older views of semiosis with recent work on ecosystemic living. Whilst aesthetics and languaging can refer to evolving semiotic objects, nature uses bio-signals, judging experience, and how culture (and Languages) can condition free-living agents. Further, science changes its status when meaning takes priority. While semiotics shows the narrowness of laws and recurrent regularity, function brings semiotic properties to causal aspects of natural innovation. By drawing on languaging one can clarify, for example, how brains and prostheses can serve human cyborgs. Indeed, given a multi-scalar nexus of meaning, biosemiotics becomes a powerful epistemic tool. Accordingly, I close with a model of how observers can use languaging to track both how self-fabricated living systems co-modulate and also how judging (and thinking) shapes understanding of changing 'worlds.' In certain scales, each 'whole' agent acts on its own behalf as it uses epigenetic history and adjusts to flux by engaging with an ecosystem.

Keywords: biosemiotics, languaging, semiotics, eco-evo-devo, meaning, distributed language

0. Introduction

Ecosystems adapt, co-evolve, change their parts and, using lineages of sub-systems, renew themselves. To ask about evolution is thus to find meaning in natural innovation. In pursuit of shifts in flux, the Special Issue asks how people link observing, models, technologies and practices to living and, within limits, come to know. Life's interdependencies thus shape world making. In humans, this is enhanced as languaging links praxis with what has already been conceived. A person's acting and judgings prompt bodily modulation that draws on concepts. As part of action, a person observes and, to an extent, may describe what happens. However, since life use many scalarites of time and place, meaning also demands an ecological-evolutionary-developmental (eco-evo-devo) frame (Sultan 2017). While using bio-mechanisms, descriptions of life also use what happens in between times, places and other beings. Indeed, if human understanding is emplaced, in living, meaning comes first.

Theories of meaning often separate content from vehicle (Dennett & Kinsbourne 1992). The distinction links ancient views of concepts with information processing by pairing perceived entities (e.g., and, often, sense-impressions) with linguistic vehicles (i.e., words, sentences, propositions). Famously, Putnam's (1975) Meaning of meaning opened up externalism (and 4E views of mind)[1]. Rather than take an analytical starting point, the collection adopts a quite different direction of travel. It begins with 'bio-signals' or, broadly, how signs index a 'perceived.' For an observer these and their concomitants (semiosis) enable description of ecosystems, organisms, cells and persons. Since these depend on observations, meaning must precede description. The insight points beyond, for example, describing a chromatin system (Markoš *et al.* 2017) or how a Morse operator acts (Cowley 2019a) by tracing meaning to cases such as how human cyborgs use prostheses (Gahrn-Andersen & Prinz, this vol.), organisms and bio-signals co-evolve (Rama, this. vol) or Sellars's view of overt and covert judgings (Seiberth, this vol). Since evolution is self-guided, life arises as meaning – and, thus, analysis – use natural innovation.

The Call for papers stressed the co-evolution of living and languaging. It defined languaging, first, as activity that is 'iconic, indexical and, in overlapping senses, symbolic.' Second the qualities of wordings were taken to include 'affect, repeatable phonetic gestures, mimesis and norm-based ways of concerting action.' Languaging unites activity, observings, praxis and 'languages.' In bioecologies (viz. consortia of organisms) humans talk, use history, alphabets, rituals and text-production systems like GTP-3 (Floridi & Chiriatti 2020). Practices bind languaging into a nexus of whatever gets done. Persons draw on techniques, doings and wordings that echo texts, institutional practices and collective beliefs. We find signs of culture in three-month old infants whose ontogeny is part of a meaning giving nexus. Languaging, practices, and humanity act like an unfolding Möbius strip (Raimondi 2019) as fire, crafts, literacies etc. serve people who perform, among other things, caregiving, rituals, harvests, sport and computational tasks.

0.1 Overview

Biosemiotics uses the insight that living can be described as semiotic. It is a good partner for languaging in that, together, they place observed and phenomenal aspects of life beyond a philosopher's 'propostions.' The move reestablished the tongue's role in understanding. While the view of languaging was current in the 1580s (see, Cowley 2019b) scholars have focused on languages, texts and what is said, allowed or intended. Given suppression of languaging, 'speaker bias' became dominant in philology and, later, linguistics (Andresen 2013). Yet, in the last 60 years, languaging has broken into the academy. First, challenging Kantian immanence, Sellars (e.g. 1960; 1967) traced explicit and implicit judgings to languagings. Later, Maturana (e.g. 1988) developed the view that human observers construct worlds by drawing on languaging. While all living beings depend on structural coupling, human worlds link languaging to praxis and consensual domains. Recently, languaging has become a focus for general and applied linguists who study, among other things, particularity (Becker 1991), meaning-making (Swain 2006) or creativity in poetry (Lee, in press) and translanguaging (Li 2018). Theoretically, human dialogicality (Linell 2009) distributes meaning in space and time. Denying languaging any privileged locus underpins enactive linguistics (Bottineau 2017; Bondì 2017) and radical ecolinguistics (Steffensen & Cowley 2021). As activity,

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[1] This is Menary's (2010) label for the externalist views of cognition as embodied, embedded, extended, enacted etc. (see Newen *et al.* 2018).

languaging prefigures the 'objects' of natural and artificial languages or, indeed, so-called 'use' in interaction, writing or data processing. Languaging also enables national (or supranational) 'languages' to be put to ideological use. Thus, while language and languages are formalized as systems, languaging is intrinsic to human agency. In biosemiotics, it takes on a dual role. First, it allows biosemiotic description of, say Morse operating or the chromatin system. Second, as activity, languaging is necessary (but not sufficient) for description of biosemiotic processes.

In human ontogeny, languaging enables lineages to use linguistic pattern (and, thus, features). It arises in an actional or enchronic scale for someone who is somewhere. In spite of emplacement, languaging also sustains agentive wholes – organizations, scientific domains, states, religious sects, families etc. As praxis, it demands a framing such as that of Sultan's (2017) eco-evo-devo model. It shows hybridization in that, as with scaffolding, its developmental pathways and phenotypic outcomes use what encompasses the body (Griesemer 2014). As a hybrid trait, like affect, languaging has qualities based on entanglement with how, when and where it emerges. Hence understanding arises for a person who acts in multiply embedded systems. It links lineages of beings that are multi-scalar, open and, as in §2.1, reliant on (weak) autonomy and evolutionary 'wayfinding.' While compatible with Peircean realism, its bioecological embedding also uses a collective domain of life. Contrasts appear around how world constructing uses 'languages.' Kravchenko (this vol.) traces 'thought' and 'language' to linguistic semiosis or a kind of linguistic relativity. By contrast, Batisti (this. vol.) finds slight biases and tendencies that alter behavioural patterns and concludes that linguistic diversity may contribute much to human social agency.

1. Life's wayfinding

Life's simplex tricks include inhibition, function and vicariance that alter mappings, strategies or courses of action (Berthoz 2012). Ecosystems exhibit a detour principle (Berthoz 2012) that captures how co-functioning equilibria emerge, self-maintain, and shift. Not only does simplexity defy models of evolutionary engineering, but it uses much more than tinkering's cumulative effects (Jacob 1977). Rather, natural innovation exhibits patterns like Ingold's 'wayfinding'. In delicate phrasing, he suggests that, for a wayfarer, 'every destination is by the way; the path runs in between' (Ingold 2015:133). Since no movement is linear, organisms rely on shifting in between worlds. Paths arise as, by changing themselves and connections, wayfinding changes the possible – ecosystems are their own designers. The collection has a similar genesis. As Editor, I had no idea what would come from a Call on how human agency meshes with beliefs, writing systems and linguistic and other practices. In fact, the reader will find remarkable consensus. Meaning is taking up/selecting bio-signals/actions as historically infused judging: its wayfinding uses vicariant processes that can be described by signs.

Seiberth (this vol.) identifies judging as 'Ariadne's thread.' He critiques Kant's view that, 'physical objects and events exist only in certain conceptual representing.' On this view, whether judging states of affairs or comparing truth with actuality, reason enables correct outcomes. Since judging is often ascribed to mind, it can invite description in terms of vehicles (and content). Putting meaning first thus challenges what Sellars (and Seiberth) call Kant's 'strong immanence'. In a related move, Peirce reached beyond laws or symbols by turning to signs, living systems and ontology. Not only can signs describe life, but the move opens up biosemiotics. As Sebeok (1994) begins an influential book, semiosis is 'the phenomenon that distinguishes life forms from inanimate objects' (Sebeok 1994). By contrast, Seiberth (this vol.) uses critique of Kant to introduce a theory of experience. In linking the conceptual with what nature engineers, he presents

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Sellars transcendental account of languagings. While little known to linguists, the 'world involving' view resonates with treating languaging as activity with wordings (or coordinations of coordinations). The causal-semiotic combination ensures that, in Sellars' sense, we picture the world. Conceptualising creatures can draw on both the hitherto uncharted and, with training, what science (and culture) makes knowable.

In rejecting content and vehicle, one turns from 4E views or 'stand alone' theories of meaning, intuitions and judgements. Instead of interrogating an internalist/ externalist divide, one rejects both mental representations (Chemero 2011) and a view that, like software, 'organisms' rely on organizational closure. For reasons of exposition, in Figure 1, I sketch the latter view around how De Jaegher and Di Paolo (2007) idealise 'participatory sense-making' in a simple model.
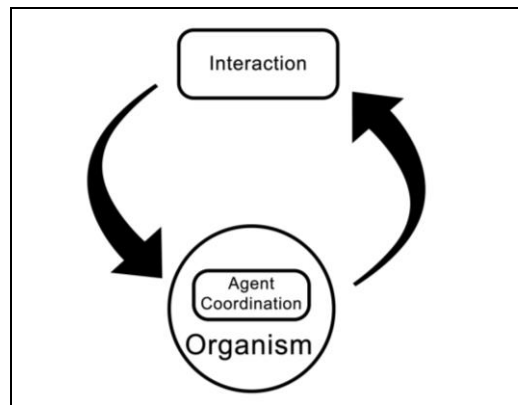

Figure 1: Participatory sense making (PSM).

As in De Jaegher and Di Paolo's (2017) model of how the social contributes to PSM, arrows suggest how an agent interacts and, in time, changes its coordinating (through influence of others). Interaction enables the organism to bring forth a world of signification. The circle emphasizes that all structural change occurs 'inside' an operationally closed domain where an organism generates an 'identity'. The organism lacks causal powers (i.e., interaction is purely functional; function is wholly interactional).

As the source of 'sense making', the organism comes first. A history of interaction sets off potentially reciprocal change in coordinating partners. While important, as sketched in §4 below, natural innovation does not privilege an inner domain. As Rama stresses, meaning grants organisms a causal role in nature (see, Walsh 2007) that, as shown by homeotic genes (see below) also allows sub-organismic systems a part in 'causal-semiotic' ecologies. Bio-signals harness vicariance within self-modulating networks (e.g., an RNA complex or, generally, epigenetics) that change themselves. In larger systems (e.g., animals, persons, ecosystems, organizations etc), meaning is judging. Contributors to the collection will generally agree that, by definition, (weak) autonomy is a system acting on its own behalf:

> All free-living cells and organisms are autonomous agents. But a bacterium is 'just' a physical system. In its Kantian form, my core question became, What must a physical system be such that it can act on its own behalf? The stunning fact is that autonomous agents do, every day, reach out and manipulate the universe on their own behalf. Yet that truth is nowhere in contemporary physics, chemistry or even biology. So, what must a physical system be to be an autonomous agent? (Kauffman 2000: x).

Entanglement and multiple embeddings rely on, not organizational closure (see, Cowley & Gahrn-Andersen 2015) but how systems use working cycles to self-fabricate, act and self-maintain. They must 'build a machine to lower the degrees of freedom available for the dissipation of energy (Markoš 2004)' In making the investment, a behalf relies on 'a cycle (or spiral) of work that can be utilized to reproduce the system or to increase its organization (e.g., by building new machines allowing new kinds of work cycles)' (*Ibidem*). The results of work (and the parts that contribute) serve as meaning for a living whole (or a behalf). The cycles can 'also be used for mapping the surrounding universe in an active search for resources which can be used to perform work.' Autonomous systems are able to create leeway for change. They have a behalf, openness, and contribute to wayfinding.

Living beings change themselves, their worlds and, of course, each other. They use what Sebeok calls modelling or how, for Von Uexküll (1992) an Umwelt opens up a (proto) subjective Innenwelt. As for Kant and Peirce, subjectivity comes to the fore. For Kravchenko (this vol.) too, human subjects (observers) use culture as virtual linguistic symbols take on subjective values for a person. In turning to aesthetics Robuschi (this vol.) also emphasizes 'someones' (ascribing them to even simple systems). However, others play down reduction of symbols to virtual types by using biosemiotics to reach beyond what Lassiter (this vol.) calls 'materialism'. In his proposal, a causal powers realism can rethink 'interpretation' in systems as diverse as molecules and people. Taking another view, Gahrn-Andersen and Prinz (this vol.) use neural implants and bodily prothseses to show how meaning enables bodily use of evoneered devices. Here the Umwelt unites praxis, technology and living experience.

While re-echoing debates about signs and mechanism, the collection's focus is on languaging. While some link this to Peirce's views, others stress how signs co-function with causal systems. Hence, Lassiter carefully separates semiotics from code biology (see also, Kravchenko 2020) and Gahrn-Andersen and Prinz (this vol.) present complementary descriptions. At 'deep' levels, molecular systems use codes to build quantum engines which, in higher systems, are supplemented by other processes. Echoing Auletta (2011) they suggest that, perhaps, the inner brain is more computational while meaning is a concern of more peripheral systems. Rather as Seiberth (this. vol.) would view semiotics as using conceptual aspects of languagings, Cowley (this vol.) opposes Deely's ontology with the view that languaging uses semogenesis. Given the narrow limits of science, ecolinguists can draw on bisemiotics to change praxis.

1.2 Evolution and languaging

The context sensitivity of protein synthesis defies physicochemical description. For Barbieri (2018), organic coding enables metabolism. Even if many reject his application of 'code', the model grants variation to cells as adaptors use (some) leeway in self-fabrication. Leaving aside issues of labelling, such bio-signalling is semantic, uses history and allows vicariance: systems co-modulate. Contingencies affect ecosystems, evolution and, thus, the space of evolutionary possibility. A self-organised and self-maintaining cell acts on its own behalf to change both itself and the possible: the case scales up. Evolution arises in between embedded systems that, often, rely entirely on bio-signals (or semiosis). Rather than ask what meaning 'is', life can be traced to (code-based) wayfinding. The view challenges both the evolutionary synthesis and extensions such as niche construction theory. This is because wayfinding favours, not a 'level' of selection (e.g., the gene) but, rather, how change links scalarities of space and time. In Rama's work, for example, evolution draws heavily on epigenetics and individual life cycles

As hominin ontogeny evolved, humans gained acute sensitivity to emplacement[2]. They bring historically derived resources to the present in consistent behaviour by a 'behalf' that manages perceiving, acting and languaging. Since the results are neither objective nor reducible to normative practices, the relevant traits must use world scaffolding. Their hybridity arises as emplacement evokes, among other things, what is absent. Controversially, Rama traces this to representations (for an observer) and, equally controversially, grants a central role to bio-signals. Raimondi (this vol.) identifies parallels with reading Maturana's work as a bio-logic: although all animals use coordination, given social systems, humans alone master languaging and its consensual domains. This hybrid bio-social outcome that demands a weak view of autonomy. Languaging brings forth human agency as one uses here and now ('observing') in world constructing that uses cultural resources. Languaging brings the absent to experience in ways that include, but do not reduce to, physicochemical signalling.

The openness of living systems is confirmed by contemporary evoneering. As Gahrn-Andersen & Prinz (this vol.) show, brains can grant a person 'mind control' over an artificial prothesis (or a cyborg cockroach). Algorithm based systems enable persons to master techniques by using bodies and their parts as 'adaptors.' Even if often described as learning, this is neither skill acquisition nor operant conditioning. We know this because evoneered devices use (say) EEG measures to prompt emplaced bodily movements. Learning the techniques is natural evoneering that uses trial and error, adapting and refining judgements. Natural innovation of many kinds arises as children use practices to develop techniques used across settings. Doing so without knowing how one does so also implies that languaging may be hybrid. It links practices with collective ways of acting; paraphrasing Maturana, we happen through language. As historical resources inform human agency, sensitivity to emplacement transforms judging.

2. Overview of the papers

Sellars grants a transcendental role to experience. In The role of languagings, Seiberth (this vol.) shows how as living beings, we use languagings to transcend the order of reason. Quite independently of biosemiotics and distributed language, the focus falls on bringing forth thoughts and sayings. In striving to escape 'a realm of represented contents', the knowable and the known rely on epistemic practices. To achieve a similar effect, Peirce looked 'outside' to propose a relational or semiotic ontology. By contrast, Sellars works from 'within' to break with transcendental phenomenalism. He stresses human acts of judging or, as Sellars puts it, he challenges Kant's attribution of identity to 'judging with states of affairs' and tracing 'truth with actuality' (Sellars, 1967 §8). Whereas Kant invokes a categorial order, strong immanence can be rejected in a theory of experience. Thus, while Peirce's semiotic ontology shows how little of nature uses laws or symbols (see, Cowley, this volume), Sellars takes an optimistic view of science. Languagings are experience that, often, has an overt or verbal frame. On this theory of experience, 'world stories' allow those in scientific fields to compile empirical statements. Given an order of reason, the known advances (i.e., with recognition of valid judgements). Languagings are transcendental in that a 'picturing capacity' uses what is 'there.' Experience draws on isomorphisms from 'outside actual or possible representations.' Picturing links particularities of place ('objects') to languagings. For

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[2] Given languaging, human activity uses emplacement (see, Barron et al. 2020) in that it occurs not only occurs in surroundings but, fot those concerned these are somewhere, connects with what is absent, and draw on various projects for specific people.

Sellars, these are naturally engineered and semantic or Janus faced. In Love's (2014) terms, they feature two orders that allow judgings to fuse functional roles with perceiving. Given emplacement, a fruit may be seen as an apple/Apfel and, if overt languaging arises, the results will 'signify a representation.' Far from being a vehicle of content, the judging enacts roles (hence, emplaced states of affairs) that can be used, say, in testing the GTP-3 system. For conceptualisng creatures, their history brings passivity and spontaneity to knowing. In science, wayfinding unites praxis, a person's abilities and conceptual domain. As emplaced beings, we mesh languagings, contingencies, intuitions and perceivings. Judgings connect lived (and living) embodiment with objects (viz. as isomorphsms set off signs). Picturings give languaging a verbal aspect that fuses linguistic and semiotic judging. An engineered aspect of languagings break into cultural or 'horizontal' realms of possible and actual representations (for an observer). Analysis and even content/vehicle distinctions serve many roles (e.g., writing grmmars, using 'artificial languages'). However, they use appearances – ways of describing relations. In this 'transcendental phenomenalism', judging serves to bind the conceptual, the semantic and 'objects' that are there for someone. Sellars puts meaning first.

In Raimondi's (this vol.) Operational matrix of languaging, Maturana's work is read as framing how languaging is possible. The bio-logic is traced to an operational matrix of social interdependencies. Human agents distribute experience by using patterns of concerted actions in practices. Although applicable to reasoning, Raimondi's concern is how a matrix unites biology, human agency, society and culture. Within its operations, languaging places observable events at the fore. Raimondi thus makes at least three valuable theoretical moves. First, he distances himself from privileging a bodily locus of languaging (see, Di Paolo *et al.* 2019). Second, while stressing autopoiesis (i.e., how living systems self-maintain what Kauffman calls a behalf), he links this to the scalarities of evolutionary wayfinding. For Raimondi, languaging has a recursive history (evo-devo) that unfolds in a world of social systems. Face-to-face interaction enables self-organising which shapes agency (the focus of empirical work on languaging/ translanguaging). Third, while more central to an earlier paper (Raimondi 2019), humans (at least) draw on a history of evolutionary drift. Thus, while neo-Darwinians focus on adaptation in the genotype, structural drift places human evolution within sociocultural orbit. Emphasis on human social systems enhances the eco-evo-devo view: the bio-logic stresses neither the brain's role in language nor linguistic semiosis. The move also shows how much is at stake in reading of Maturana's work either as perspective on language and/or as a bio-logic. For Raimondi, the symbolic/verbal is embedded in, not brains, but practices (e.g., science) or, as Seiberth would say, the order of reason. Seen thus, the bio-logic contrasts with semiotics by allowing the linguistic (or 'symbolic') to co-function with the causal. As applied to languaging, emphasis shifts from interpretation to construction. In humans, languaging grants prominence to how social systems draw on how experience has previously been framed. On this radical view, living collectives use interdependencies to build social systems as the locus where coordinating self-organises. Not only can they use conceptual and 'engineered' languaging (Love's two orders) but, as they do so, the wider ecology can be transformed as human developmental life cycles co-evolve with cultural practices.

Biosemiotics at the bridge treats organisms as 'active agents' of development and evolution. While having a developmental focus, Rama (this vol.) draws on Sultan's (2017) eco-evo-devo theory. Gene expression and metabolic processes connect genotypes with environments. Bio-signalling extends inheritance, variation and fitness through cross-over between kinds of signs. For Rama, biosemiotics can be a bridge between evo-devo and representationalist work. Rejecting externalism, he grants a

representational capacity to life. In a niche, diversity uses the 'complex dynamics of signal development.' As conditions vary, organisms gain from consistent functioning/acting. Without 'content', development could bring off neither phenotypical effects nor affect the niche. For Rama, therefore, representations are signs that link information flow with traits. While often hybrid, they use adaptive process (a 'level' such as the organism). Self-sustaining relies on, not operational closure, but what can be identified as content. In that this is bio-signalling, it is consistent with tracing autonomy to working cycles. The model, thus, looks beyond computational models of mind, externalism and the new mechanism. Properties of bio-signals link consistent environmental effects of informational functions. Bio-signals need not display content for the living systems because they use what Lassiter (this vol.) calls manifestation partners. A textbook example (e.g., Carrol 2005) is how, when experimentally transferred across lineages, homeotic genes set off context specific functions (e.g., fruit flies can grow two pairs of antennae --not legs). Whether or not called covariance, the content of bio-signals manifestly allows individuals and lineages to engineer innovative ways of re-using evolutionary history. In another famous case, British blue tits (cyanistes caeruleus) learned to drink cream from milk bottles that were delivered to doors and, later, adapted to new aluminium tops (see, Cowley 2017; Aplin et al. 2013). Ecosystemic change led to innovative behaviour that, in this case, had phenotypical effects and the use of bio-signals drew on historical contingency. In rehearsing the examples, I stress the importance of Rama's view. He breaks with traditions, meshes biosemiotics with mainstream biology, offers a wide evolutionary frame and, above all, connects bio-signals with cognition. Rather than appeal to an abstract principle, semiosis, information processing, sense-making or picking up affordances, he traces such behaviour to contingencies in the evolution of functional signalling. Especially with hybrid traits what matters is, not context-free function, but 'content' that matters, at times, for an observer, and, at others for one or more whole organism.

Right on cue, in the Importance of aesthetics Robuschi (this vol.) argues for the evolutionary importance of aesthetics. With an eye on language, she connects Sebeok and Lotman's work on modelling to how the poetic is stressed by Vico, Croce and Eco (among others). Robuschi uses biosemiotics to argue that aesthetics allows 'all living beings' to make creative use of differences and similarities. Humans also co-evolve brains whose culture specific symbolic capacities bring semiotic freedom. Orienting to products of 'chance and constraints' enables novelty and, in humans, this applies to averbal aspects of expression (or languaging). Hence, aesthetic experience is for someone: it bears on what is perceived as right. Given analysis, its 'content' bears on external criteria that, in principle, use judging and, ultimately, bio-signals. However, in highlighting 'language', Robuschi turns to Deacon's claim that that Homo symbolicus preceded Homo faber (for another view, see, Idhe & Malafouris 2019). Taking an outsider perspective, she ascribes innovative connections to a someone. On this relational view, aesthetic experience enacts sensitivity to signs (based on modelling systems). Her claims are thus at odds with how Bergson (1988), for example, traces creative innovation to use of collective tools. Of course, their work can be reconciled – an outsider's 'dialectic' between the verbal and the averbal (code duality) need only be combined, somehow, with how praxis informs an observer's languaging (cf. Raimondi, this vol.). Hence, 'code duality' leads to what one can call Robuschi's problem: while aesthetic novelty characterises the living, human semiotic freedom needs a 'brain' that can put aesthetics to work. We learn neither where an aesthetic 'someone' comes from, nor why similarities/differences trump, say, unlikenesses or use of what is absent. Nonetheless, Robuschi is surely correct that judging influences evolutionary history by

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granting aesthetic contents to bio-signals and, indeed, the effectiveness of many kinds of language (and languaging).

In How cyborgs transcend, praxis makes human cognition 'irreducible to the localised.' Gahrn-Andersen and Prinz (this vol.) invoke cyborgs to pursue the generative basis of languaging. Using biosemiotic description, they use technologies to argue that, as with 'thought control' of a prosthesis, saying needs no mental representation. Acts rely on 'embedded hierarchies of molecular coding.' In moving a prosthesis (or cyborg cockroach), these are supplemented by input from a neural implant or an EEG device. Brain activity brings 'meaning potential' to engineered algorithms that grant a person (some) control of movement. The brain generates potential for actions, feelings and thoughts. Since moving and reports assimilate technical and conceptual knowhow, neural process generates potential for languaging. Rejecting top-down causation, Gahrn-Andersen and Prinz ascribe meaning potential to code relations that enact 'theoretically possible directions.' More starkly, 'cyborgs are deeply embodied and must be the mind.' Brains re-use a history of movements by making directional choices as a person acts with a prosthesis. Since intent is not 'in' the algorithms, the results can only draw on the working of the brain's molecular hierarchies. These bring extant functionality to a continuing history of bidirectional coupling. For Gahrn-Andersen and Prinz, coupling builds on embodied hierarchies of codes or bio-information quanta (BiQ) that bridge between worlds. Yet, since there are no 'worlds' at higher neural levels, BiQ systems need to be supplemented by 'code praxis.' In Buzsáki's (2019) terms, as orchestrated at different frequencies, working cycles are meaning. BiQ therefore co-function with electromagnetic resonance to grant algorithm-mediated control of a prosthesis. A molecular substate enables movement, feeling and linguistic information as 'skilfully enacted knowhow' (i.e., expertise, experience and social praxis that mesh with 'verbal' aspects of language). The model aligns with eco-evo-devo, rejects internalist/externalist debate, and grants descriptive value to both code biology and Peircean models (while showing their limits). Equally the case shows how human brains can use extant bio-systems in sensitising to evoneered devices. In humans, new kinds of thought control suggest the co-evolution of praxis and phenotypic plasticity.

Lassiter (this vol.) rejects both 'Peirce's metaphysics and materialism'. In Empowering biosemiotics, he notes that biosemiotics and languaging appeal to naturalism, are anti-Platonic and anti-Cartesian. In their place, he makes a case for a neo-Aristotelian view. Since 'languaging activity, is distributed,' he argues, 'meaning cannot be encodable.' As part of being immersed in the world, languaging cannot map onto fixed entities. Thus, while open to 'Barbieri's aim of naturalizing biosemiotics', he rejects description of 'vehicle' and 'content' (or form/meaning). Rather, to save organic coding, he appeals to causal powers realism. On this view causally efficacious processes can encompass use of signs among cases as diverse as how salt dissolves, protein synthesis, attending to an aspect, or languaging. In protein synthesis, for example, metabolism needs no agents to 'grasp signifying objects.' Although humans ascribe content to 'bridging between worlds', no sign points for an 'interpreter' (viz. as a part of a living system). For Lassiter, this lies outside semiotics where, by definition, an interpreter uses an indexed object that is absent or distant. For example, making the colour of a button on a web page 'nicer' can change click behaviour. A change in design may nudge sub-personal systems into 'wanting to buy'. Since wanting arises, it is semiotic. Causal powers give rise to bodily vicariance or clicking (rather than doing nothing, a person is move to act). As Lassiter stresses, this is itself empowering (for customers, web-page designers and sponsors alike). Colour change in a wide system nudges bodies to orient to the non-present. The case contrasts with how metabolism uses a cell's organic memory to substitute one bio-signal for another (in a mapping or 'bridging between worlds'). It also serves to clarify

Robuschi's (this vol.) problem of how to distinguish aesthetic description of life from how a 'brain' enables aesthetic function. If one starts with causal powers, one needs an agent for aesthetics to draw on what is 'not present.' While this may be a person or animal, as with the web page, it must also use neural sub-systems. Therefore, appearance of an aesthetic effect suggests a metaphorical someone. However, at times, no 'someone' is there. No interpretation occurs when GTP-3 software uses the not-present to 'write' a contract or a poem. There are only codes. In conclusion, semiotic (and aesthetic) properties differ from semiotic (or aesthetic) powers. In the case of powers, whole animals/persons observe manifestation partners and treat signs as signs: they act as 'someones'. By contrast, with the 'nice' button, sub-personal judgings of the not present may suffice. For a causal powers realist, in such cases, meaning (or aesthetic properties) tap into a body's learning history. Experience (and the pre-reflective), not a someone, prompt modulation within a wide system or semiotic-causal nexus that includes criteria that an observer deems to be aesthetic.

In Approaching linguistic semiosis biologically, Kravchenko (this vol.) marries a bio-cognitive view to Peircean symbols. First, like Maturana, he sees languaging as cooperative behaviour that uses coordination of coordinations (in a consensual domain). Rejecting a third person view, Kravchenko speaks from an 'insider' perspective on the 'bio-socio-culturally structured dimension of human cognitive dynamics.' Hence linguistic semiosis is 'ecological, dialogical and non-local' (Cowley 2011). Taking an iconoclastic approach to the distributed perspective, he adopts Deacon's (1998) doctrine that brains co-evolved with the symbolic 'core of language.' As for Peirce, wordings are a 'complex cognitive phenomenon' whose types ('symbols') depend, Kravchenko asserts, on the brain. Whereas animals rely wholly on structural coupling (or coordination), humans underwent 'a major evolutionary transition'. As for Chomsky, Sebeok, Hoffmeyer, Barbieri and others, 'it is obvious', Kravchenko claims, 'that the origins of sapience lie in linguistic semiosis.' Maturana's work is read as, not a bio-logic, but a perspective: an infant's pre-prepared brain enables it to solve Theiner's (2013) symbol ungrounding problem. Public language is a hybrid mechanism that, in time, can sustain (what Theiner views as) symbolic mental representation[3]. Turning from the evolution of human ontogenesis, Kravchenko posits 'neuronal process' that enacts 'abstract thought.' Since the basis of the major transition is unknown (and placed over 100 000 years ago), 'the emergent architecture of language' pertains to a 'framework of biological organization.' By playing down the collectively organised, Kravchenko denies that, in hominins, languaging uses a history of tracking recursive vocalizations. In his view, wordings did not evolve from entrenching use of the 'tongue tool' (Cowley & Kuhle 2019). Indeed, if the symbolic enables abstract thought, the aesthetic or averbal (code duality) is unlikely to bear on symbolic evolution and an ontology of causal powers is a distraction. Given a distributed ontology of symbols, linguistic semiosis draws on how culture bounds intuitions, thought and, indeed, what can be said (viz., what Sellars calls languagings).

Batisti (this vol.) builds on the finding that linguistic diversity covaries with 'slight biases and tendencies in behavioural patterns.' The Argument for Languages challenges proponents of languaging. By starting with activity (or biosemiosis), such facts remain beyond explanation: one overlooks 'linguistic diversity.' While linguistic interaction uses embodiment, mimesis and the social order, appeal to languaging fails to consider how activity draws on wordings. Batisti therefore rejects reduction of 'second-order' language

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[3] Without citing Theiner, others use 'ungrounding' to ask: 'how, for a developing child, do … grounded forms ever gain symbolic properties?' (Raczaszek-Leonardi et al. 2018). The mystery becomes one of how 'forms' in embodied coordination enable a child to discover/construct a semiotic ontology.

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to cultural constraints (Love 2004; 2017). It follows that appeal to linguistic reflexivity omits how languaging draws on languages. The argument also applies to verbal patterns – no-one explains how 'words' affect interaction or social agency. Batisti's diagnosis of 'the causal problem' is correct: many taking a distributed view have inadvertently obscured how Languages (whatever they are) exert effects. However, this does not apply to Kravchenko's (this vol.) 'symbolic' approach. On this view. a working brain shapes languaging as symbols (or virtual types) operate within a consensual domain. Linguistic semiosis enables (what the folk call) 'thought.' Since each individual constructs a linguistic world, a brain solves the causal problem by granting an individual leeway with the symbolic. One wonders how Batisti would respond. The implication that 'thought' is bounded by a Language may be hard to fit with findings about 'interactional relativity.' Above all, lexicosyntactic 'features' of languages exert 'collateral effects' that, for Sidnell and Enfield (2012), suggest 'differences in possibilities for social agency.' Such work seems more compatible with a bio-logic that makes languaging into an ontogenetic achievement. Indeed, social agency allows for bidirectional mesh between cultural practices, symbolic and, perhaps, aesthetic aspects of language. Plainly, the 'causal problem' demands detailed consideration. Equally, one needs to consider what is lost (and gained) in tracing 'thought' to interactions and effects. Whatever ontological status we grant to Languages, as Batisti notes, they bear on 'import.' Linguistic diversity thus allows us to follow Adriane's thread back to how nature shapes judgements. Batisti believes that Languages influence judging and, thus, how we grasp consequences of what is and, more strikingly, what is not said.

Biosemiotics and ecolinguistics builds on semiotic critique of tracing knowledge to sense impressions. In so doing, it offers a counterpoint to contemporary focus on scientific progress. Cowley (this vol) concurs with Deely's (2015) view that science relies on bringing signs under critical control. It thus extends languaging and uses objectifications (and a community's use of devices and norms). Semiotics shows the limits of knowing and, in so doing, hints at consequences of tracing, say, technology to sign-based reasoning (and logics). What grounds semiosis? Like the majority of contributors, Cowley is wary of semiotic ontology. Rather than posit a 'suprasubjective', he traces languaging to what Halliday (1997) called semogenesis. On this ecolinguistic view, we rely on belief in signs. Hominins need no more to transform situated activity because culture and agency co-evolve. Indeed, beliefs sustain praxis and make emplacement part of being moved to feel, observe, think, and go on. Humans bind aspects of the present to other places, times and living beings. To actualize practices is to use expertise and experience. Where sayings (or thoughts) play a role, practices inform how we feel, think, observe and act. Given the messiness of praxis, there is an incentive to use signs to refine how we actualize what we do (and vice versa). Beliefs bring a semiotic aspect to living as we link contingencies to knowing, acting and languaging. In collective worlds, human agents engage, intervene and interpret. Hence, in Deely's sense, we use 'mind dependent' signs to construct/ suppress, decorate, describe and correct what is observed. Belief in signs aligns communities with use of semiotic artifacts, causal systems and logics. In science, as in other fields, we use objectifications. Therefore, increasing precision can emerge in how we perceive regularity, build models and specify laws. We create self-referential symbols and, above all, writing and number systems that serve to correct judgements against praxis and practical ways of knowing. We use a history of engaging with artifacts and, above all, icons, alphabets, diagrams etc. In the unfolding ecological catastrophe, Cowley suggests, we all need to acknowledge the limits of science.

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3. Meaning: entanglement in action

Meaning need be traced to neither analysis, vehicles, or language. Provided one escapes empiricism and strong immanence, natural innovation can be pursued without prioritzing genes, mental software or organizational closure. In an eco-evo-devo frame, working cycles enable survival of entangled bioecologies. These rely on self-modulating sub-systems (e.g., metabolic process, brains) where whole agents act on a behalf as they participate in wider systems (e.g., as cyborgs in an experiment). Rather than highlight an organism's use of coordination (see Figure 1), as the Special issue suggests, meaning comes first. Hence entangled modulations lead to judging as languaging also opens a conceptual domain. One can picture this as a causal-semiotic nexus (see, Figure 2) whose dynamics draw on cross-over between modulatory shifts (in small and large systems) and ways of judging by self-fabricating 'whole' agents.
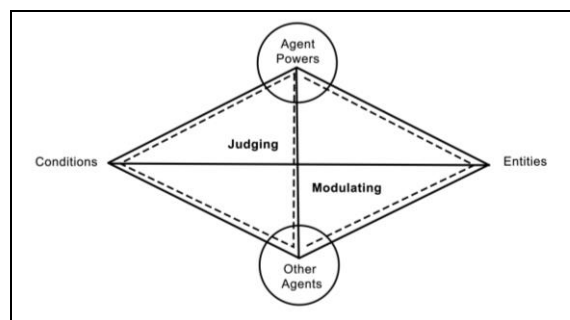

Figure 2: A causal-semiotic nexus

The modulating shown in the outer diamond arises as agents exert effects on entities, conditions and each other as they draw on signs of ongoing change. The dynamics shown by the inner diamond arise as judging links a setting with signs of the not present that use learning, experience and expertise; with languaging, human agents also come to use the resources of emplacement.

Bidirectional shifts connect (nonliving) entities, ecosystemic conditions (which may include culture) and ensembles of organisms. Since an observer is essential to any description, the model is shown as a double diamond. Inspired by a dialogical model (Linell, 2009: 95-96), ways of judging constitute an inner diamond. In ontogeny human infants come to perceive entities as things, others as people (or, say, dogs) and, of course, to use emplacement in self-modulation. The results link concepts, acting and perceiving. Generally, causal-semiotic shifts enable lineages to self-construct, change worlds, find ways of orienting to semiotic properties as agents and consortia set off effects. Living systems act/perceive, suffer actions, self-transform and, often, actively avoid/exclude aspects of the world. Since content uses bio-signals, it binds interactions, evaluations of risk (i.e., being perceived/acted on) and, with learning, agents use conditions that prompt incorporation/exclusion of aspects of what could be perceived. In sub-systems, content arises on 'behalf' of a situated organism (or emplaced person). Bio-signals act as representations (for an observer). Mappings (or codes) shape metabolism and, in many animals, a world that one is in prompts learning, skill development and adaptive expertise. In human judgings, content emerges for a behalf that, at times, focuses on languaging and, at others, on social and/or material engagement. For Peirce, the results are iconic, indexical and symbolic and, for Sellars, the engineered/conceptual arises in Janus faced languagings. Bodies connect metabolism with human conceiving and the conceptual in praxis that contributes to

world making. Hence humans use pasts and imagine as they link social norms, artifacts, concepts and activity. Semiotic description serves, above all, to simplexify and find things out.

Although most papers allow space for causal-semiotic dynamics, views of biosemiosis lead to different emphasis. For Robuschi (this vol.) and Kravchenko (this vol.), the causal is secondary. They posit pure relation by following Peirce in rejecting strong immanence 'from the outside.' The ontology demands a theory of the 'symbolic' whose self-referential nature grants access to what lies 'beyond'. In Kravchenko's iconoclastic work, linguistic semiosis derives from an evolutionary history of coordinations of coordinations. For Robuschi, semiotic ontology allows natural innovation to be, in part, aesthetic but also raises the problem of how a 'brain' brings aesthetics to a (human) someone. By contrast, the other authors challenge strong immanence 'from the inside'. There is no need for a semiotic ontology if knowing draws on emplaced experience, judging and languaging. For Seiberth (this vol.), these abilities use nature's engineering to transcend the conceptual; Raimondi (this vol.) traces the known to how an observer's operational matrix uses structural coupling; Rama (this vol.) (this vol.) posits that 'representations' enable organisms to use bio-signals with causal effects; in evoneered systems, Gahrn-Andersen and Prinz (this vol.) argue, meaning is how cyborgs use algorithmic input together with neurodynamics; Lassiter (this vol.) allows mappings (and codes) to complement semiotic descriptions (e.g., where causal powers use the non-present); Batisti (this vol.) argues that historical ways with wordings or Languages transcend both symbols and languaging; and Cowley (this vol.) rejects semiotic ontology by arguing that human semogenesis serves to build epistemic tools. On all such views, human judgings entangle as semiotic description with the causal. Even if semiosis is virtual, biosemiotics can reject models based on appeal to genes, brains, organisms or even a world. Rather, meaning comes first.

Semiosis can aspire to explain (or define) life as a domain of signs. The position favours a representational view of science (for critique, see Frigg & Nguyen 2017) as opposed to one that highlights its constructive power. Once traced to languaging, biosemiotics appears as an epistemic tool (see, Boon 2017). Noting regularities allows semiotic description to inform observing and acting. The results can be used to simplexify (Cowley & Gahrn-Andersen, in press) as models harness signs to causal forces. In evoneered systems, the causal works with, for example, seeing while moving an arm. An agent to draw on semiosis (i.e., seeing 'things') while algorithms enable control of a prosthesis. One makes practical use of 'distanced' models and what Marková (2012) calls objectifications (e.g., program function). Epistemic tools (and semiosis) serve to test and refine content-based world making. Recognition of a causal-semiotic nexus also supports the view that wordings evolved with primate tool use. While languaging is partly engineered (by a history of bio-signalling), judging arises in sub-personal bodily systems that use trial and error learning. As tool users orient to the normative, they stumble on and gradually come to make anticipative use of hedonic content. The personal and the contextual trigger what Kechagias (2011) calls soft skills (e.g., creativity, flexibility, emotional intelligence) or hybrid traits that link vicariance, wordings and material engagement (Malafouris 2013). By hypothess, this may also apply to the aesthetic. This is because, in a multi-scalar nexus, the context sensitive allows the absent to map onto current needs. It is striking, that Peircean, Aristotelian, Sellarsian, Maturanian (and other) frames all treat the not-present as crucial to human agency. Instead of pursuing interpretation (and reference), one turns to how consistency can link the semiotic-causal nexus through action/perception and human languaging. As a result, epistemic functions typically bridge between worlds. In material engagement, bio-signalling uses cultural variation, languaging and aesthetic judgements. Since enactive

signification (Malafouris 2013) prompts ways of judging (using standards defined by a community), the aesthetic can reshape human living and languaging. Indeed, with aisthesis (Montani 2019), action can also use ethical judgings. Insights into natural innovation may contribute, as Stibbe (2015) advises, to stories that change the world. The epistemic power of meaning can serve us in seizing responsibility for the future of evolution.

References

Aplin, L.M., Sheldon, B.C., Morand-Ferron, J., (2013), «Milk bottles revisited: social learning and individual variation in the blue tit, Cyanistes caeruleus», in *Animal Behavior*, 85 (6), pp. 1225–1232.

Andresen, J. L. (2013), *Linguistics and evolution: A developmental approach*, Cambridge University Press, Cambridge.

Auletta, G. (2011), *Cognitive biology: Dealing with information from bacteria to minds*, Oxford University Press, Oxford.

Barbieri, M. (2018), «What is code biology?», in *Biosystems*, 164, pp. 1-10.

Barron, E. Hartman L & Hagemann F. (2020), «From place to emplacement: the scalar politics of sustainability», in *Local Environment*, 25/6, pp. 447–462.

Batisti, F. (this vol.), «An argument for languages in languaging», in *Rivista Italiana di Filosofia del Linguaggio*.

Becker, A. L. (1991), «Language and languaging», in *Language & Communication* 11(1), pp. 33–35.

Bergson, H. (1988), *Matter and memory*, translated by N. M. Paul & W. S. Palmer, Zone Books, New York [Originally published, 1888].

Berthoz, A. (2012). *Simplexity: Simplifying principles for a complex world*, translaed by G. Weiss, Harvard University Press, Cambridge MA.

Boon, M. (2017), «An engineering paradigm in the biomedical sciences: Knowledge as epistemic tool», in *Progress in biophysics and molecular biology*, 129, pp. 25-39.

Bondì, A. (2017), «Entre énaction, perception sémiotique et socialité du sens : phénoménologie de la parole et de l'activité de langage», in *Signifiances (Signifyng)*, 1(2), pp. 5-19.

_____

Bottineau, D. (2017), «Du languaging au sens linguistique», in *Intellectica*, (68), pp. 19-67.

Buzsáki, G. (2019), *The brain from inside out*, Oxford University Press, Oxford.

Carroll, S. B. (2005), *Endless forms most beautiful: The new science of evo devo and the making of the animal kingdom*, WW Norton & Company, London.

Chemero, A. (2011), *Radical Embodied Cognitive Science*, MIT Press, Cambridge MA.

Cowley, S: J., (2011), *Distributed language*, John Benjamins Publishing, Amsterdam.

Cowley, S. J. (2017), «Changing the idea of language: Nigel Love's perspective», in *Language Sciences*, 61, pp. 43-55.

Cowley, S. J. (2019a), «Wide coding: Tetris, Morse and, perhaps, language», in *Biosystems*, 185, 104025.

Cowley, S. J. (2019b), «The return of languaging», in *Chinese Semiotic Studies*, 15(4), pp. 483-512.

Cowley, S. J. (this volume), «Biosemiotics and ecolinguistics: two tales of scientific objectification», to appear in *Rivista Italiana di Filosofia del Linguaggio*.

Cowley, S., & Gahrn-Andersen, R. (2015), «Deflating autonomy: Human interactivity in the emerging social world», in *Intellectica*, 63(1), pp. 49-63.

Cowley, S. J., & Kuhle, A. (2020), «The rise of languaging», in *Biosystems*, 198, 104264.

Cowley, S.J. & Gahrn-Andersen, R. (in press), «Simplexifying: harnessing the power of enlanguaged cognition», to appear in *Chinese Semiotic Studies*.

Deacon, T. W. (1998), *The symbolic species: The co-evolution of language and the brain*, WW Norton & Company, London.

Deely, J. N. (1966), «The emergence of man: An inquiry into the operation of natural selection in the making of man», in *The New Scholasticism*, 40(2), pp. 141-176.

Deely, J. N. (2015), «What semiotics is», in *Language and Semiotic Studies*, 1/1. Available at: http://lass.suda.edu.cn/_upload/article/files/be/0d/3283c81f44fa822b29066a72fe9f/5 a0fc96d-e6d9-406b-b9c6-64d22d8cec64.pdf downloaded 25 May 2021.

Dennett, D. C., & Kinsbourne, M. (1992), «Time and the observer: The where and when of consciousness in the brain», in *Behavioral and Brain sciences*, 15(2), pp. 183-201.

Di Paolo, E. A., Cuffari, E. C., & De Jaegher, H. (2018), *Linguistic bodies: The continuity between life and language*, MIT press, Cambridge MA.

De Jaegher, H., & Di Paolo, E. (2007), «Participatory sense-making», in *Phenomenology and the cognitive sciences*, 6(4), pp. 485-507.

Floridi, L., & Chiriatti, M. (2020), «GPT-3: Its nature, scope, limits, and consequences». in *Minds and Machines*, 30, pp. 681-694.

Frigg, R. & Nguyen, J., (2017), «Models and representation», in *Springer handbook of model-based science*, Springer, London, pp. 49-102.

Gahrn-Andersen, R. & Prinz, R. (this vol.) «Languaging with cyborgs», to appear in *Rivista Italiana di Filosofia del Linguaggio.*

Griesemer, J. (2014), *Reproduction and the scaffolded development of hybrids*, in L.R. Caporael., J. Griesemer, & W.C. Wimsatt, (eds), *Developing scaffolds in evolution, culture, and cognition*, MIT Press, Cambridge, pp. 23-56.

Halliday, M.A.K. (1997), «Linguistics as metaphor», in *Amsterdam Studies in the Theory and History of the Language Sciences* 4, pp. 3-28.

Ihde, D., & Malafouris, L. (2019), «Homo faber revisited: Postphenomenology and material engagement theory», in *Philosophy & Technology*, 32(2), pp. 195-214.

Ingold, T. (2015), *The life of lines*, Routledge, London.

Jacob, F. (1977), «Evolution and tinkering», in *Science*, 196(4295), pp. 1161-1166.

Kauffman, S. A. (2000), *Investigations*. Oxford: Oxford University Press.

Kechagias, K. (2011), *Teaching and assessing soft skills*. The MASS project, Thessaloniki (Neapolis). Downloaded from: https://www.yumpu.com/en/document/view/10974306/teaching-and-assessing-soft-skills-mass-measuring-and-/5 30 July 2021

Kravchenko, A. V. (2020), «A critique of Barbieri's code biology», in *Constructivist Foundations*, 15, pp. 122-134.

Kravchenko, A.V. (this vol.) «Approaching linguistic semiosis biologically: implications for human evolution», to appear in *Rivista Italiana di Filosofia del Linguaggio.*

Lassiter, C. (this vol.) «Empowering biosemiotics», to appear in *Rivista Italiana di Filosofia del Linguaggio.*

Li, Wei (2018), «Translanguaging as a practical theory of language», in *Applied linguistics*, 39(1), pp. 9-30.

Linell, P. (2009), *Rethinking language, mind, and world dialogically: Interactional and contextual theories of human sense-making,* Information Age Publishing, Charlotte NC.

Lee, T.K. (in press), «Memesis and contemporary Chinese poetry A distributed view on world literature», in *The making of Chinese-Sinophone literatures as world literature*, Hong Kong University Press, Hong Kong.

Love, N. (2004), «Cognition and the language myth», in *Language Sciences* 26(6), pp. 525–544.

_____

Love, N. (2017), «On languaging and languages», in *Language Sciences* 61, pp. 113–147.

Malafouris, L. (2013), *How things shape the mind,* MIT Press, Cambridge (MA).

Markoš, A. (2004), «In the quest for novelty: Kauffman's biosphere and Lotman's semiosphere», in Σημειωτκὴ-Sign Systems Studies, 32 (1-2), pp. 309-327.

Markoš, A., Švorcová, J., & Lhotský, J. (2017), «Living as languaging: Distributed knowledge in living beings», in *Cognition beyond the brain*, Springer, Cham, pp. 193-214.

Marková, I. (2012), *Objectification in common sense thinking. Mind, Culture, and Activity*, 19(3), pp. 207-221.

Maturana, H. R. (1988), «Reality: The search for objectivity or the quest for a compelling argument», in *The Irish Journal of Psychology*, 9, pp. 25-82.

Menary, R. (2010), «Introduction to the special issue on 4E cognition», in *Phenomenology and the Cognitive Sciences*, 9(4), pp. 459-463.

Montani, P. (2019), «Technical creativity, material engagement and the (controversial) role of language», in *Aisthesis* 12, pp. 27–37. doi: 10.13128/Aisthesis-10727

Newen, A., De Bruin, L., & Gallagher, S. (Eds.). (2018), *The Oxford handbook of 4E cognition*, Oxford University Press.

Putnam, H. (1975), *The meaning of 'meaning'*, in K. Gunderson (ed.), *Language, Mind, and Knowledge*, University of Minnesota Press, Minneapolis, pp. 131-193.

Rączaszek-Leonardi, J., Nomikou, I. Rohlfing, K., & Deacon, T.W. (2018), «Language development from an ecological perspective: Ecologically valid ways to abstract symbols», in *Ecological Psychology*, 30(1), pp. 39-73.

Raimondi, V. (this vol.). «La matrice operazionale del languaging: un approccio radicalmente relazionale del linguaggio», to appear in *Rivista Italiana di Filosofia del Linguaggio.*

Raimondi, V. (2019), «The role of languaging in human evolution: An approach based on the theory of natural drift», in *Chinese Semiotic Studies*, 15, pp. 675-696.

Rama, T. (this vol.) «Biosemiotics at the bridge between Eco-Devo and representational theories of mind», in *Rivista Italiana di Filosofia del Linguaggio.*

Robuschi, C. (this vol.) «The Importance of Aesthetics for the Evolution of Language», to appear in *Rivista Italiana di Filosofia del Linguaggio.*

Sebeok, T. (1994), *An introduction to semiotics*, University of Toronto Press, Toronto.

Seiberth, L.C. (this vol.), «The transcendental role of Languagings in Sellars' account of intentionality», in *Rivista Italiana di Filosofia del Linguaggio.*

Sellars, W. (1960). «Being and being known», in *Proceedings of the American Catholic Philosophical Association* (1960), pp. 28-49.

Sellars, W. (1967), «Some remarks on Kant's theory of experienc», in *The Journal of Philosophy* 64, pp. 633-47.

Sidnell, J., & Enfield, N.J. (2012), «Language diversity and social action: A third locus of linguistic relativity», in *Current Anthropology*, 53, pp. 302-333.

Steffensen, S. V., & Cowley, S. J. (2020), «Thinking on behalf of the world: radical embodied ecolinguistics», in *Routledge Handbook of Cognitive Linguistics*, Routledge, London, pp. 723-736.

Stibbe, A. (2015), *Ecolinguistics: Language, ecology and the stories we live by*, Routledge, London.

Sultan S. (2017), *Eco-Evo-Devo. In: Evolutionary Developmental Biology*, Springer International Publishing, London, pp. 1–13.

Swain, M. (2006), *Languaging, agency and collaboration in advanced language proficiency*, in Heidi Byrnes (ed.), *Advanced language learning: The contribution of Halliday and Vygotsky*, Continuum, London, pp. 95 –108.

Theiner, G. (2013), «The symbol ungrounding problem», unpublished conference paper at Trends in interdisciplnary studies. An International Avant-Conference, Torun, Poland.

Von Uexküll, J. (1992). «A stroll through the worlds of animals and men: A picture book of invisible worlds», in *Semiotica*, 89(4), pp. 319-391.