GROUNDING ECOLOGICAL DEMOCRACY: SEMIOTICS AND THE COMMUNICATIVE NETWORKS OF NATURE

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ABSTRACT

Developments in biosemiotics and democratic theory enable renewed appreciation of the possibilities for ecological democracy. Semiotics is the study of sign processes in meaning-making and communication. Signs and meanings exist in all living systems, and all living systems are therefore semiotic systems. Ecological communication can involve abiotic and biotic communication, including human language, facilitating an integration of politics and ecology in the form of ecological democracy encompassing communicative networks in nature and human society.

KEYWORDS

Semiotics, biosemiotics, ecological communication, deliberative system, ecological democracy.

1. INTRODUCTION

While humans can attend to communications in the non-human world, any political implications of that attention are a matter of continuing dispute. Skeptics still think that there is something unique about human linguistic communication that means there can be no active role for non-human

signals in politics. Thus while the idea of ecological democracy is now several decades old (see among others Dryzek 1987, 1995; Smith 2003; Eckersley 2004, 2020; McGinnis 1999; Romero 2020), critics believe that similarities and continuities between human and non-human communication are still too tenuous to ground the idea (Dobson 1996).[1] If the critics are right, nothing like Habermas's (1996) grounding of deliberative democracy in (human) communicative action is possible when it comes to ecological democracy. Perhaps more problematic from an epistemological perspective is that as currently formulated, communicative ends such as justice or even sustainability are formed only by linguistic or verbal communication, thus failing to give full credit to non-human signals.

These limitations yield implications for democracy in an ecological context if we believe that the authentic communication at the heart of democracy can be a matter of better integration of political and ecological aspects. Authentic communication has to be reciprocal, yet nonhuman entities cannot it seems challenge our interpretation of their needs (Vogel 1997). Yet it can still makes sense to speak in terms of the purposes of systems, even though those purposes can only be ascribed by an interpretant. Human organisms face particular challenges here because they have devised social structures that disable their capacity to interpret signals from the nonhuman world, even when those signals are vital to the (less controversial) purpose of human flourishing.

Our intent here is to strengthen the case for ecological democracy through attention to developments in biosemiotics and associated thinking about the standing of the different kinds of entities that are capable of both making and interpreting communication on the one hand, and in democratic theory on the other. We discuss two types of communication: abiotic and biotic, and show how they can be understood through semiotics, biosemiotics, and physiosemiotics. Both types are produced by the processes that help constitute meaningful ecological communication. We demonstrate how semiotic methods can be used to better appreciate ecological communication and its relationship to the ideal procedures of ecological democracy, which involve more effective human listening to signals pervading the natural world.

Ours is not the first case to be made for ecological democracy. The novelty of our treatment starts with recognition that the communicative dimension of ecological democracy is not a matter of bridging across a human/nonhuman divide. Rather, we show there are deep continuities across all forms of biotic and even abiotic communication that support a presumption of communicative

[1] Ecological and environmental democracy can be used in a number of different senses; see Schlosberg, Bäckstrand and Pickering (2019) for a survey. Our use of the term 'ecologcial democracy' is closest to the tradition they describe as involving 'decentralised, organic and grassroots democratic practices that give greater weight to the interests of nonhumans and future generations' (p. 1).

equality across forms of life that can ground ecological democracy. We radically expand the forms of communication that are relevant to democracy. This expansion is made possible by work in biosemiosis and abiotic communication that has not hitherto been brought to bear on ecological democracy. In addition, developments in democratic theory, especially those now prominent in the theory of deliberative democracy, enable identification of new ways in which the political roles of signals pervading the nonhuman world can be conceptualized, and new ways in which human systems can cope with the multiple and conflicting human interpretations of nonhuman needs.

We begin by explaining classical semiotics theory[2] then show that semiosis can be extended to non-human nature and the entire living world (Sebeok 2001). Extension to the non-living world is a bit more controversial, but its contemplation enables a more complete picture of the pattern of signs and interpretations as they relate to human communications. In this light, we show how abiotic and biotic semiosis can be joined. This joining enables new light to be shed on communicative rationality and ecological democracy. Deliberation is a critical ingredient for human communication across all scales of biological and ecological organization, and recent developments in deliberative democracy involving a renewed emphasis on listening and reflection, a broadening of reasons into considerations, the turn toward deliberative systems, the accommodation of non-deliberative acts within deliberative systems, and the epistemic argument for deliberation can all be deployed in enhancing democracy's openness to the nonhuman, and so strengthening the foundations of ecological democracy.

2. SEMIOTICS

The process in which something functions as a sign is semiosis, and is necessarily a matter of interpretation. The semiotic tradition involves the study of signs and symbols in communication. It is broader than linguistics, which studies only the sign processes of (human) language. In semiotics, relevant sign processes include any form of activity, conduct, or process that can contribute to the production of meaning (Eco 1986). In a tradition which goes back to the Ancient Greeks (specifically stoicism), semiosis has commonly been regarded as involving three factors: *sign vehicle* (S), *designatum* (D), and *interpretant* (I) (Morris 1944; Peirce 1992, Posner et. al. 1997). The signal is a *sign vehicle*; the taking-account-of is an *interpretant*; and finally that which is taken account of is a *designatum*. S-D-I is illustrated in Figure 1, which captures the essence of semiotics.

[insert fig. 1 here]

[2] In the 1960s semiotics was divided into two major schools, one following the linguistics of F. de Saussure, for which semiotics is a branch of psychology, the other Charles S. Peirce, who regarded semiotics as a branch of logic (Barbieri 2009). By the 1990s, the Peircean view dominated (Posner et. al. 1997).

Thus: *S* is a sign of *D* for *I* to the degree that *I* takes account of *D* in virtue of the presence of *S* (Morris 1944: 4). A sign is anything that communicates a meaning to the interpreter of the sign. For humans and other animals, communication can involve any of the senses (visual, auditory, tactile, olfactory, and gustatory). The necessary and sufficient condition for something to be semiosis is that *I* interprets *D* as representing *S* (Posner et. al. 1997: 4). These terms (S-D-I) make explicit the factors in the common statement that a sign refers to something that has meaning for someone in epistemological terms. An example is following: 'a wolf howls near to me'. Howl (S) is a sign of the wolf (D) for me (I) to the degree that I (I) take account of the wolf (D) in virtue of the presence of howl (S). An example at the ecosystemic level would be bleaching (S) is a sign of the coral (D) for me (I) to the degree I (I) take account of the coral (D) in virtue of the presence of the bleaching (S).

The sign in our first example (howl) differs from the other signs, such as linguistic or verbal signs, but it remains a sign. The wolf which howls does not respond to his or her own howl as does his or her listeners; but the sign is held in common, therefore it is a non-linguistic or non-verbal sign. On the other hand, the important characteristic of the vocal communication lies precisely in the fact that the emitter of the sound himself or herself hears the sound just as other do; when such sounds become connected with social acts, modern biology (Stegmann 2018), biocommunication (Gordon and Seckback 2016) and ethology (Goodall 1986; Safina 2016) can help us interpret the different signals. Various participants in the act (I_1, I_2, $I_{3,\ldots}$, I_n)[3] share this common sign, and in spite of their differentiated functions within the act (other humans, wolves, prey like deer or rabbits), share a common designatum (wolf), as illustrated in Figure 2.

[insert fig. 2 here]

For example, when the wolves separate from the pack to cover large areas of land in search of food, the pack uses vocal communication by means of the howl to hold together (S-D-I). The howling of a wolf can travel a large distance, indicating its position to the other members of the pack (Harrington and Mech 1979).

These features of semiosis enable a general epistemological framework of theory of signs (S-D-I). True, human communication mechanisms, language in particular, are more elaborate than communications within most other species (e.g. vocal communication in wolves or infrasound communication in whales); and the communications of different species vary in their complexity. To show why this does not cause insuperable barriers, let us take a closer look at the abiotic and biotic factors of semiosis. This is made possible by developments in biosemiotics theory (Hoffmeyer 1996, 2008; Sebeok 2001; Barbieri 2009).

[3] *I* should be understood as I_1, I_2, $I_{3,\ldots}$, I_n, according to the participants in each *n* process of semiosis.

3. ABIOTIC AND BIOTIC SEMIOSIS

Ecological communication should involve both human and non-human nature. Thinking about communication in these terms reflects the idea that we can communicate because we are nature, and nature has allowed us to communicate today through a process of natural evolution that has among other things yielded linguistic codes (Chomsky 1965; Enard et. al. 2002; Barbieri 2003).

Barbieri argues that the four billion year evolutionary history of life on Earth reveals continuity from the genetic code of the cell to linguistic codes of culture (Barbieri 2003: 231). In this light, building upon Barbieri, genetic code is there in the origin of life as well as in linguistic codes in cultural human evolution. A general theory of biological and ecological communication can therefore encompass both linguistic and non-linguistic communication. Any communication can be understood as being based upon a shared way of making sense of the world that is then embedded in signals according to semiotics (this is what we would call a discourse if it involves only human communication). The making and reception of these signals require shared capabilities and dispositions that enable participants in a given communication to recognize and convert biological inputs into coherent accounts of a situation - like the wolf in the pack. Examples of such communication include biological communication (dominant in biosemiotics) and ecological communication, which can be across different species, including the human species. Ågren, Davies and Foster point out that the evolution of communication is central to all ecological systems, especially when it comes to the evolution of cooperation (and suppression of selfish behavior) in all levels of life, from genomes, complex cells and multicellular organisms to single-species societies and even to mutualisms between different species in ecosystems (Ågren, Davies and Foster 2019).

Biosemiotics is the synthesis of biology and semiotics, and its main purpose is to show that semiosis is a fundamental component of life, i.e., that signs and meaning exist in and are necessary to all living systems (Hoffmeyer 1996, 2008; Sebeok 2001, Barbieri 2009). 1960s works by Howard Pattee and Thomas Sebeok were key in establishing the field. Pattee pointed out that the discovery of the genetic code means that the cell is a physical-chemical system controlled by symbols or signals (Pattee 1968). At about the same time, Sebeok started questioning another of our traditional beliefs, the conviction that semiosis exists only in human interactions that use signs in the context of culture. Culture must have biological roots, he argued, so there must be some forms of semiosis in the animal world (Sebeok 1972, 2001). This idea is consistent with the fact that animal communication is based on signs that also show up in human communications (body language, facial displays, vocal communication, pheromones, and physical expression of emotions).

The idea of a union between biology and semiotics – what today we call biosemiotics - started from the genetic code on the one hand (Pattee) and animal semiosis on the other (Sebeok). However, semiosis goes beyond what happens within a single species (or in evolutionary speciation). Semiosis also applies to ecological communication that transcends species boundaries. Creation, modification, or destruction of ecological niches are biotic and abiotic signals within ecosystems – such as the bleaching of corals in Australia´s Great Barrier Reef due to the loss of zooxanthellae. The different signals occasionally capture human attention, especially when the consequences appear bad for humans, as in bleaching (in corals), desertification (in soil), deforestation (in forests), climate change (in temperature and sea level rise), and so forth.

Semiosis and ecological communication suggest that signals from non-human organisms and within ecosystems are plentiful. For humans, it is then a matter of asking the right questions, and listening carefully to the answers, using all the senses (not just hearing), as well as aids such as scientific instruments. In this process it is necessary to be patient, persistent and not anthropocentric (or even biocentric, which implicitly negates the human aspect of communication). There may be much to learn from the practices of indigenous peoples here, and it is also possible to think about education that would cultivate such capacities. Methods and techniques of questioning should be appropriate to the communication present, to obtain the necessary information for subsequent inferences, in for example figuring out how to understand the processes of resilience in coral biology before the entropy phase (by which time it may be too late to act effectively to prevent bleaching). Biosemiotics and the idea of ecological communication help us to understand that the signs of nature allow us to recognize that there are agents in nature (D), to affirm that these agents emit signals (S), and to assert that those signals can be interpreted (I).

It is not necessarily easy or straightforward for humans to interpret signals ‘correctly.’ There are signs in nature that are hard for humans to perceive: think of infrasonic waves, or the range of smells that dogs can perceive that humans cannot. Scientific instruments can enhance perceptions. Asking the correct question too can benefit from scientific understandings of how nonhuman systems work. There is virtue in humility which recognizes that there are complex questions that require careful thought about how they are framed – as opposed to the imposition of simplistic ideological formulae. Different people may reach different interpretations. A catastrophic bush fire may be interpreted as evidence of desiccation due to climate change, or as an unfortunate event resulting from a conjunction of short-terms factors such as high fuel loads and the presence of arsonists. Disagreement may be reasonable. The epistemic argument for democracy is that faced with complex problems, people can be much better reasoners collectively than they are individually,

though much depends on the conditions of their interaction. Equally, they can be much better interpreters collectively than individually. We develop this epistemic point in section 4 below.

The recognition of agency in nature is crucial. Now, agency is often defined in terms of the capacity to think and then act. But this is an unnecessarily anthropocentric view (which would even exclude impulsive human actions, and call into question human group agents such as organizations that are increasingly recognized in philosophy; see for example List and Pettit 2011). Within this dominant anthropocentric perspective, nature´s agency as such is denied (Plumwood 2001b), and a unique human capacity for culture validated. To the extent that non-human nature has its own recognizable forms of culture and agency – seen clearly in bonobos and chimpanzees - the opposition between nature and culture is simply invalid, but agency in non-human nature is actually much more pervasive than that. Recognition of agency in nature would underwrite respect for signals emanating from the natural world in biotic and abiotic terms. In other words, our relation to the natural world would not be just an instrumental intervention and observation of the results of that intervention, in the interests of control. Instead, that relationship would involve communicative interaction sensitive to the physical and chemical properties that can be described as the sum of local abiotic factors, such as climate and geology, and local biotic factors, the other organisms and ecosystems that share human habitat. Human attention would turn to interactions of organisms with their environment, and topics of interest would include biodiversity, species distribution, biomass, and populations of organisms, as well as cooperation and competition within and between species in ecosystems (dynamically interacting systems of organisms, the communities they make up, and the abiotic components of their environment) (Margalef 1968).

Here we note that biosemiotics does not encompass the sum of all communication, because non-living entities matter too. Communication is developed in an environment between abiotic and biotic factors. In this light, an appropriate schematic classification of different forms of communication is as in fig. 3, beginning with a distinction between *abiotic communication* and *biotic communication*. Biotic communication is gestural in the sense that it involves gestures and signs, be they conscious and learned or somatogenic (ie, originating without reference to any central nervous system); auditory, vocal, olfactory, gustatory, or tactile.

[insert fig. 3 here]

On the one hand, *abiotic communication* (or non-gestural, in the terms of semiotics), would correspond to the abiotic elements of nature. These include climatic, edaphic (concerning soil), and hydrographic elements, and cover phenomena such as lightning, desertification, drought, and thaw of sea ice. Abiotic communication can have its source in a change in the condition of a nonhuman element such as a flood, or as a drought gradually desiccates a landscape. The idea of *abiotic*

semiosis is advanced by Deely (1990: 94). For Deely, semiosis precedes life, and so what he calls physio-semiosis existed in the universe even before life evolved. However, the idea that semiosis can occur without life is unnecessarily controversial from our point of view. In terms of the sign-designatum-interpretant trio that we set out earlier which defines semiosis, it is hard to see how interpretation (the ascription of meaning) can be done by an entity that is itself abiotic (Champagne 2013). But we can still speak of abiotic semiosis when *S* and *D* are abiotic, but *I* is a form of life. A human animal could interpret abiotic signs as bringing ecological risk for the human community and for nonhuman nature. For example, a drought could be interpreted by a human as a sign of the designatum of global climate change. A non-human animal might respond to the same drought as a sign of purely local environmental inhospitability, and the need to move towards another ecosystem to look for water. If unable to respond effectively, an organism might simply die due to its inability to supply the high metabolic demands of its physiology, as in the case of polar bears responding to loss of sea ice. At any rate, abiotic communication clearly has a place in semiosis.

That place in semiosis matters from the point of view of humans and other living entities because variable abiotic factors constitute the physical-chemical characteristics (such as temperature, light, humidity) that are integral to all ecosystems, and indeed help determine the distribution of living beings. Thus the capacity to interpret abiotic signs is indispensable for all living beings and systems. When an abiotic factor reaches a level beyond that which a species can tolerate, it becomes a limiting factor, effectively destroying the ecological niche for that species. Living beings can modify the level of abiotic factors that define (or destroy) niches. In the Anthropocene (defined as an emerging epoch of human-induced instability in the Earth system), this capacity is concentrated in humans (Steffen, Crutzen and McNeill 2007). Irrespective of the source of the fluctuation in abiotic factors, a capacity to interpret them is crucial for all forms of life. In this light, the recent advocacy of the idea of planetary boundaries by Earth scientists (Röckstrom et al 2009) can be seen as a particularly sophisticated way to interpret fluctuation in abiotic factors (such as radiative forcing leading to global warming, concentration of stratospheric ozone, ocean acidity) as well as biotic factors (such as global biodiversity) in the interests of enabling collective human life to flourish.

Biotic communication (or gestural, in the terms of semiosis) for its part, corresponds to the living biotic elements of nature. It includes communication in linguistic terms (as in humans through language), as well as in non-linguistic terms (as in humans and other animals). In this characterization, *non-linguistic biotic-gestural communication* can be examined through ecological, ethological, psychological and biosemiotic lenses. This communication can take place between

members of the same species (intraspecific), and in interaction between two or more individuals of different species (interspecific).

Current developments in linguistic communication can profitably join work in the philosophy of language, evolutionary biology, anthropology, psychology, and neuroscience (Hauser, Chomsky and Tecumseh Fitch 2002). This kind of work has moved from theory to an empirically focused uncovering of both shared and unique components of the faculty of language. For example, Mark Pagel offers a Darwinian perspective on how languages evolve (Pagel 2017). Using methods borrowed from evolutionary biology, this Darwinian perspective has brought new insights into the evolution of human languages. These insights can be applied to the statistical inference of the evolutionary relationships between languages, the study of how linguistic traits evolve over thousands of years of language change, the reconstruction of ancestral languages (linguistic archaeology), and the structure of languages. While biological bodies are repositories of genes, human minds are repositories of words combined in syntax, semantics, and pragmatics that can be deployed in linguistic communication.

In addition to studying linguistic communication, the field of biocommunication investigates both intraspecific and interspecific non-linguistic communication, involving information transfer in and across species as varied as bacteria, fungi, plants, non-human animals, and human animals (Gordon and Seckback 2016). Biocommunication among animals includes vocalizations (as found in bird species and canines, among others), pheromone production (in insects and mammals), and chemical signals (also found in plants). Biocommunication can be associated with the semiosis process involving different participants (I_1, I_2, I_3,...,I_n) - as in the case of the wolf pack we discussed earlier. Organisms deploy signs in communication to exchange information for purposes of coordination and cooperation, reproduction, and defense. This communication can also serve social organization between members of the same, related, or unrelated species. All coordination between cells, organs, and organisms depends on successful biocommunication (for examples, see Safina 2016; Gordon and Seckback 2016). Experimental approaches in the analysis of chemical communication analyze how information can be transferred between cells within an organism (via hormones and neurotransmitters) or between organisms (via semiochemicals). Chemical communication can take place across different species (via allelomones), for example when a prey species freezes upon detecting the odor of a predator. Within the same species, pheromones can for example enable females to attract males. Harari and Sharon (2016) deal extensively with infochemicals in the whole phylogenetic tree (which represents the evolutionary relationships between all organisms), and show how complex biocommunication can be found between plants, which can for example call other plants for help against herbivores. Thus an ecosystem involving a

prey (plant), its predator (herbivore), and the herbivore's predator can feature multiple communications. The herbivore can be attracted by a signal emitted by a plant (kairomone). The plant can then release a pheromone to warn nearby conspecific plants of the presence of herbivores. The informed plants can then release a long range volatile substance that informs the potential herbivore's predator of the location of its prey (Harari and Sharon 2016, p. 234). Other examples of biocommunication include warning signals that are used to inform a predator that the emitter is aware of its presence and that contact with the emitter bears a potential cost to the intruder. Thus the bright colors of the granular poison frog signal a warning to predators of its toxicity (this is known as aposematism). Gestural communication in sub-adult bonobos can according to primatologists involve twenty different non-verbal gestures--one auditory, eight tactile and eleven visual (Pika, Liebal and Tomasello 2005). As these examples illustrate, the kinds of biocommunication are wildly diverse, their content depending on the availability of media in different ecosystems (for example, whether the habitat is aquatic or terrestrial), the function of the information transferred (a cue or a signal, a pheromone, or allelomone) and the available building blocks.

This richness notwithstanding, a skeptic might still maintain that meaningful communication only corresponds to human language. The anthropocentric position is that humans are superior to all other animals, despite similar circulatory, pulmonary respiration or endothermic systems, because they have language (though if we look hard enough, we may find something like language in non-human animals; see Meijer 2019). Sometimes anthropocentrists go so far as to say that humans are the only species that can communicate in symbolic terms. True, only humans have human language, but it is not their only means of communication. Non-linguistic communication is present in the daily life of humans (in courtship, interpersonal relationships, public debates, the expression of emotions, and so forth), and this presence reveals more in the way of continuity with non-human communication.

A Habermasian grounding of democracy in communication rests on the assumption that the only meaningful kind of communication is linguistic, which in our characterization is a type of biotic (gestural) communication. However, in his most recent attempts to ground his theoretical project, Habermas considers his philosophy to be 'weak naturalism', drawing on Darwin (Habermas 2003: 22). Accepting Darwin implies recognizing the natural character of the human being in relation to other animals and their environment in non-hierarchical fashion. Linguistic communication can, then, itself be grounded in the natural as well as cultural aspect of being human. Nature allowed the appearance of language before culture, enabling recognition of communication without culture of the kind that helps to underwrite ecological democracy.

Those who speak of progress with humans at the pinnacle thanks to their possession of language start from an arbitrary ontological bias. That humans have language does not prove their biological or evolutionary 'superiority'. It is simply one characteristic among many present in the animal world. If we were to choose instead the capacity to communicate at a distance without artificial aid, blue whales would look superior. The capacity for sonar would put bats and dolphins on top. Land speed would put cheetahs first. Metabolic rate would favor insects. For humans to choose the characteristic that humans happen to have developed more than any other animal as a way to justify human superiority is not only self-serving, but also fallacious if it is taken to mean that humans are the mostly highly evolved animal in evolutionary terms. Any such comparison is based on criteria of particular progress, not general progress.

The emphasis we have placed on effective communication in all parts of nature helps to counteract anthropocentrism. The attempt to overcome these barriers in ontological terms corresponds to understanding nature as a network. In political terms, relationships between humans and nature can involve hierarchy, instrumental rationality, domination, control, colonization, and so authoritarianism. However, they can also involve equality, communicative rationality, reciprocity, feedback, liberation, and so ecological democracy (Plumwood 1995).

4. THE COMMUNICATIVE NETWORKS OF NATURE

As we have seen, both biosemiotics and ecological communication move beyond linguistic communication. In this section we attempt to sharpen and further explicate the notion of communicative networks of nature. We show that the hierarchical model of human/nature relations has discriminatory vertical properties that can be corrected without submitting to a simple biocentrism.

The anthropocentric hierarchy that puts humans over nature represents the lingering influence of pre-Darwinian understandings, as illustrated in Figure 4.

[insert fig. 4 here]

For Plato the contrast is in terms of reason/body, reason/emotion, and universal/particular. Aristotle's great chain of being was taken up in medieval times as the *scala naturae,* influencing the much later naturalistic studies of Buffon, Linnaeus and Lamarck. Descartes stressed a mind/body dualism, while Rousseau and Hegel dealt in mutually reinforcing dichotomies of public/private, male/female, universal/particular and reason/nature. Marx emphasizes dichotomies of freedom/necessity, culture/nature, civilized/primitive, mental/manual (a variant on mind/body) and production/reproduction (Lovejoy 1936; Habermas 1975; Plumwood 1984; Lloyd 1984; Eckersley

1992). Again, these dichotomies are mutually reinforcing. According to Plumwood different philosophers and different periods of philosophy 'have focused on different pairs of these dualisms and have defended different linking postulates', that 'have obscured the pervasiveness of dualistic and rationalist (instrumental rationality) influence in philosophy' (Plumwood 1984: 45). All share a superior/inferior dualism in a pre-Darwinian vertical hierarchy (Figure 5).

[insert fig. 5 here]

In this light, denial of the reality of ecological embeddedness is simply a refusal to admit the natural reality of humans and our relation with nature as fellow members of a biotic community (Leopold 1949). Dualism creates an exaggerated separation between nature and human that, for all the reasons we have specified, should now be indefensible. Thanks to Darwin and the phylogenetic picture of life, we should be aware of the common ancestors of different forms of life (Figure 4), and thanks to ecological theory we should recognize the complex relationships of different living beings among themselves and with their surroundings.

Here, communicative relationships are not vertical and hierarchical. Rather, in a horizontal network two or more organisms communicate with each other - as in our earlier example of wolves. And they communicate with their ecological environment, which can include abiotic aspects - as in our earlier case of polar bears responding to changes in ice coverage in the Arctic. Say 'D' (*designatum*) sends signals to 'I' (*interpretant*). After receiving signals 'I' sends *feedback signals* to 'D' – and can perform an action. So communication takes the form of a network as illustrated in Figure 5, where 'D' and 'I' are not necessarily superior and subordinate, but communicate, as illuminated by biosemiotics and ecological communication. For us, humans, this communication is supposedly easy to understand and deploy when it is solely linguistic. Can we also reach a good understanding of communication in non-human nature?

Nature is not like a mechanism involving a series of gears and static formulas that move the system forward. Rather, everything is intertwined in a complex dynamic network of abiotic and biotic factors (Margalef 1968; Georgescu-Roegen 1971). This network is organized so intricately that we will probably never be able to understand its full workings, as Peter Wohlleben points out in the case of forests (Wohlleben 2017) and many other examples. This recognition should not be discouraging, since for example it allows us to admire the world of flora and fauna, and to recognize our own place in complex interactions with other species and ecosystems. However, such recognition of the limits to our understanding might make us wary of seemingly small interventions in ecosystems, which may have great consequences. Think for example of the introduction of European rabbits in Australia, which has been devastating. Rabbits have had an immense impact on the abundance of natural resources, as well as creating havoc for farmers (Cooke 2012). When

humans intervene in nature in an overconfident belief in their capacity for instrumental manipulation based on their own standing in a hierarchy of species, the consequences can be surprising and disastrous.

A communicative network involving both linguistic and non-linguistic biotic and abiotic aspects represents another context for thinking about 'intervention' in non-human nature. For humans, this would involve a lot more listening (Dobson 2010), pointing to a more egalitarian and so democratic capturing of signals in an ecological community without rigid human/nonhuman boundaries. It would still be possible for humans to act more intelligently in response to feedback from their interventions. Collective decisions could be *ecologically* rational (Author 1987, 1995; Plumwood 2001a, 2002).

Ecological rationality as a concept can be interpreted in narrow anthropocentric terms as the fulfilment of a set of structural conditions in human problem-solving mechanisms. In this light, ecological problems present a particular set of characteristics (such as wickedness, complexity, uncertainty, human free riding on the efforts of other humans, extended temporal consequences of present actions) to which human institutions (such as governments, legal systems, and markets) treated as problem solving structures should adapt, and be appropriately configured. This configuration might involve improved monitoring of ecological conditions, better coordination across different actors (such as states) in order to overcome free riding and to confront commons problems, better ways to anticipate long-term challenges, and an ability to perform well across a range of ecological conditions (including, at an extreme, a state shift in the condition of the Earth system).

However, a richer conception of ecological rationality can be brought into view once we recognize the communicative network in which humans are situated, and appreciate the semiotic processes already present in nonhuman communication.

This in turn requires a depth of ecological reflexivity that is currently missing in human institutions, even ones that try to reform themselves in order to deal more effectively with ecological challenges (as for example the global climate governance regime has reformed itself in recognition of its failure to generate a multilateral agreement with legally binding targets for emissions reduction applying to all countries). Truly ecological reflexivity would require not just the capacity for institutions and practices to reconfigure themselves in response to their own failings, but to do so in a manner that treats the nonhuman world not just as presenting a set of problems to human societies (even if those problems have been created by humans), but rather as a potential partner in creating the conditions in which human and nonhuman life alike can flourish, whose signals require careful interpretation.

Human/nature dichotomies would yield to thinking about humans in nature that is neither anthropocentric nor biocentric, recognizing that humans in nature can communicate reciprocally in the terms we have indicated. This thinking would be ecologically rational in the more profound sense of seeking rationality in the workings of systems that encompass the totality of biotic and abiotic communication, rather than in simply the human social structures where the linguistic subcategory of biotic communication happens to predominate. Ecological rationality in this type of democracy provides the infrastructure for societies where human beings can develop alongside the other biotic and abiotic components of systems.

5. DEVELOPMENTS IN DEMOCRATIC THEORY

As we noted at the outset, a deliberative approach has become central in democratic theory. Especially when combined with the kinds of developments in biosemiosis and associated fields that we have canvassed, recent developments in deliberative democracy augment the case for ecological democracy. These developments are as follows.

Recognition that listening and reflection are just as important as speaking. Deliberative democracy is sometimes characterized as a 'talk-centric' as opposed to 'voting-centric' approach (Chambers 2003: 308). However 'talk' is only part of the story, even if we think narrowly in terms, of human systems. Equally important are listening and reflection. Listening itself can be seen as an active process, trying to understand and analyse what another is saying – or signalling. Dobson (2014) calls this 'apophatic' listening. It is not simply passive reception of a communication. Listening then needs to be accompanied by reflection, which entails openness to changing one's mind in light of what one hears (Goodin 2003). This emphasis on listening and reflection is especially applicable and important when the source of communication is not a human voice. As we have stressed, humans would do well to attend more carefully to the abiotic and biotic signals that pervade the nonhuman world, and to the interpretations that already pervade that world. Human receptivity here can be enhanced to the degree democracy fits particular ecological niches, which would require a radical re-drawing of the boundaries of political units in order to fit more closely with bioregional distinctions (McGinnis 1999). Different complex problems reside at levels ranging from the local to the global, just as the scale of ecosystems can range from the local to the global.

A broadening from reasons to considerations. One of the roots of deliberative democracy is in Habermasian communicative action, for which reason-giving is central. This rationalistic emphasis, criticized for its privileging of particular styles of speech and categories of speakers (see for example Young 1996), has in recent thinking about deliberative democracy given way to recognition of the multiple considerations that can act as warrants for positions taken in

deliberation. These considerations might include personal experiences and stories. In practice, ordinary citizens recruited to forums that enable their interaction under good deliberative conditions (sometimes called mini-publics) generally make points in terms of personal stories rather than abstract arguments. The emotion that accompanies stories or arguments can play a powerful role in inducing reflection, as can the invocation of empathy on the part of listeners. Even the physical settings where deliberation occurs can make a difference to the outcome (Rollo 2017). So a deliberative process might yield different results if it takes place in a forest rather than in an office building. Niemeyer (2004) relates a case where the participants in a deliberative citizens' jury on what to do about a track that had been illegally bulldozed through a tropical rainforest were taken for a trip along the track into the rainforest. When their vehicle broke down they spent some extended time in the forest, and reported that this experience had a major impact in forming their opinion in regard to the policy decision that should be taken about the track. There proved to be a difference between learning about the rainforest in the abstract through linguistic and visual means, and experiencing it more immediately in a way that implied openness to biosemiosis. This case suggests that a combination of deliberative processes among humans combined with direct exposure to relevant nonhuman settings is a promising way to enhance the kind of human interpretive capacity that we earlier identified as crucial. An expansive approach to the kinds of communications that can be incorporated into deliberation means that it need not be confined to entities that meet the demands of abstract reason-giving, and opens the door further to non-linguistic and non-human sources of considerations.

The systemic turn. Once largely conceptualized in the image of a forum, deliberative democracy is now thought of by many of its theorists in terms of a system (see for example Parkinson and Mansbridge 2012). Like any system, a deliberative system can be thought of in terms of differentiated but linked parts that can be interpreted in light of some purpose. The elements of a deliberative system might include citizens, social movements, the media, legislatures, and negotiating bodies. The common purpose—inevitably a matter of interpretation—might include the generation of intrinsically meaningful communication, the achievement of democratic legitimacy for a political system, conflict resolution, or the effective resolution of common problems. What matters most is the degree to which the common purpose is achieved by the system as a whole, rather than in any of its components. It is not required that all components of a system share the purpose, or indeed are aware that there is a purpose to be shared. As we have stressed, common purpose is a matter of interpretation. This systemic emphasis means that each component need not be subject to the burden of fulfilling all deliberative criteria at once, which in turn allows for a division of labor within the system. So we might (for example) expect the deliberative virtue of

justification (making the case for a course of action) to be exercised by social movement activists and politicians, while the virtue of reflection is better sought in forums composed of lay citizens - just as in a jury trial in a criminal case we expect lawyers in the courtroom to engage in justification, the lay jurors in reflection. Parts of the system are allowed to perform different roles in the interests of the deliberative qualities of the system as a whole. One such role might involve biosemiosis, enabling the organization of interpretations of signals from the nonhuman world that enriches the deliberative system in which those interpretations are processed.

Our invocation of the deliberative systems idea does not imply some god's-eye view at the system level that means steering such systems centrally is easy. Particular interpretations of the purpose of the system may need arguing for; think of the system of global governance of climate change, whose plausible purposes might range from creating an international regulatory system for emissions to transforming the global political economy to protecting the economic interests of states to securing climate justice across states, persons, and generations. Deliberative systems should also ideally be reflexive, cultivating awareness of their own limitations and the need to correct for them. As noted above, the self-transformation of the system of climate governance around the time of the Paris Agreement in 2015 provides some hints of reflexivity.

Recognition of the importance of interruptions in deliberative systems. One of the axioms of the deliberative systems approach is that intrinsically non-deliberative acts or practices (such as protests or ridicule of mendacious leaders) can have positive consequences for the deliberative system as a whole. Curato (2019) analyses such acts in terms of interruptions that involve the suspension of deliberative norms, which can we welcomed to the degree they redistribute voice, visibility, and attention in defensible ways that are ultimately positive and productive when it comes to the deliberative and democratic qualities of the system as a whole. The interruptions themselves do not have to come in linguistic form. It is possible to think of interruptions such as those demanded by the bleaching of a coral reef, catastrophic fires, or more intense hurricanes in these terms. In anthropocentric terms, these biotic and abiotic interruptions can redistribute voice to the most vulnerable who are hurt by such events, enhancing their visibility to others (for example through the media) and calling attention to suffering. In broader ecological terms, visibility, and attention could refer to nonhuman entities, such as the visibility of large-scale fish kills in a drought-affected river, and attention to the condition of an Earth system that increasingly yields such droughts. For nonhumans, we can think not in terms of the enhancement of voice, but rather in terms of the broader category of semiosis, whose quantity and quality can also be affected by interruptions of the kind we have identified, which add force to the need to attend to signals in and from the nonhuman world more seriously, and interpret them more carefully. What humans

experience as interruptions may be consequences of a systemic failure to act upon more subtle signals. For example, catastrophic bush fires in Australia in 2019-2020 eventually forced a recalcitrant government heavily influenced by the coal industry to at least claim it recognized the reality and severity of a changing climate.

Epistemic democracy. The core of the epistemic argument for deliberative democracy is that deliberation enables the productive integration of bits of knowledge and information held by different participants. This integration can enable the creation of a rational whole out of imperfect parts, especially appropriate in the content of complex and intractable problems. Here, cognitive diversity across participants proves more important than individual ability in yielding rational collective decisions (Landemore 2012). Deliberation can also resolve conflicts between different human interpretations, likely to occur when complex contexts mean that a plurality of reasonable interpretations (each perhaps informed by a different perspective, be it that of a scientific discipline or lay experience) is available. Recognizing biosemiosis suggests that relevant information and interpretations can be held and transmitted not just by humans, but also by nonhuman entities. The epistemic challenge is then to figure out how to bring these sources of information and interpretation into productive interchange with human deliberation in the interests of a whole that is more rational than any of its components - including the sum of its human components. Ecological democracy can preserve the epistemic benefits of human deliberation while also integrating relevant considerations from the nonhuman world.

All five of these developments point to enhanced possibilities for an ecological deliberative system in which biosemiosis (and indeed abiotic communication) can play a key part. They can be reinforced by empirical findings that point to the compatibility of ecological and deliberative democracy, especially in small-scale citizen forums (mini-publics), in the sense that lay citizens participating in such forums become more attuned to ecological values, and less easily distracted by communicative distortions in the public sphere that systematically suppress both ecological concern and ecological signals (Niemeyer 2020). Recognizing the role of biosemiosis and abiotic communication is one step beyond what is already commonly observed in citizen deliberation, but not such a big step. This move in turn could help reinvigorate deliberative democracy by extending voice, representation, inclusion, listening, and reflection into ecological democracy.

Replicating the positive results from small scale citizen deliberation in larger systems is a major challenge. Relevant reforms might include a formalized role for lay citizen bodies - for example, in reviewing legislation, perhaps even acting as an upper house in a parliamentary system. Citizen forums (and more conventional elected bodies) might develop systematic links with scientific assessments. So the Intergovernmental Panel on Climate Change or Intergovernmental

Science-Policy Platform on Biodiversity and Ecosystem Services might usefully convene a citizens assembly that would help the scientific body to frame the kinds of questions the science needs to address, as well as facilitate the more effective interpretation and communication of findings to broader publics.

6. CONCLUSION

Democracy should, then, be deliberative in its human aspect, sensitive to the signs of nature in its ecological aspect, and inclusive when it comes to both human and non-human actors and signals. Ecological democracy entails a capacity to relate dialogically to the more-than-human world, which means listening to signals, capturing signs, and acting with an ecological conscience. In this light, *ecological communicative justice* means according equal respect to abiotic and biotic signals that emanate from natural and human systems alike. Denying these forms of communication means less democracy. Communication does not have to be mediated by the material interests of particular actor or tested in a merely human dialogic consensus.

Conventional democracy scholars might protest that an ecological extension compromises the literal definition of democracy as rule by a people (demos). Yet the idea of a self-contained demos has always been a fiction, as theorists of a transnational 'democracy of the affected' (for example, Gould 2004) among others have pointed out. Ecological democracy connotes an expansion of the affected, with a claim to participate, into the nonhuman realm. Democracy has been an ever-evolving and contested concept. Ecological democracy is simply another, vital, twist in the evolving story.

The next step is to clarify the sort of outcomes that effective ecological communication – and ecological democracy - ought to produce. Currently, outcomes are much less well understood than processes of ecological communication. The outcomes in question should not refer to narrowly human values (such as distributive justice), but rather to values that encompass both human and non-human components of ecological systems. Such values might include planetary justice (which recognizes the standing and value of non-human entities including the Earth system itself, as well as human ones), ecological sustainability (the sustaining of the wellbeing of ecological systems – not just human generations), and ecological capabilities (extending the capabilities approach to human justice associated with Amartya Sen and Martha Nussbaum to the capabilities required for the flourishing ecological systems, not just human individuals and groups).

We can now return to a challenge we noted at the outset, to provide a grounding for ecological democracy in communicative processes parallel to Habermas's grounding of deliberative democracy in processes of merely human communication. We have elucidated a much richer

tapestry of communicative forms encompassing humans and nonhumans, the abiotic and biotic, the networked rather than the hierarchical. The continuities and lack of hierarchy across these forms provide an equally rich grounding for ecological democracy.

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Figure 1: Semiosis process (S-D-I)

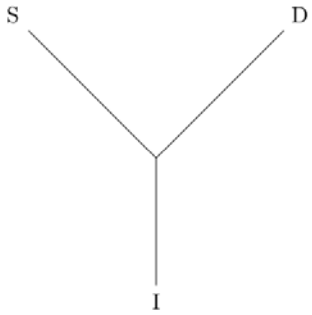


Figure 2: Semiosis process with different participants (I_1, I_2, I_3,...,I_n)

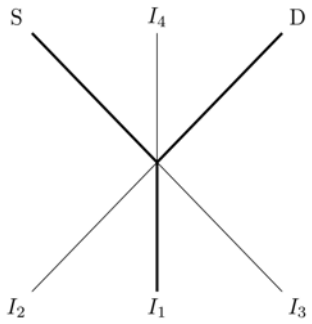


Fig. 3: Forms of Communication

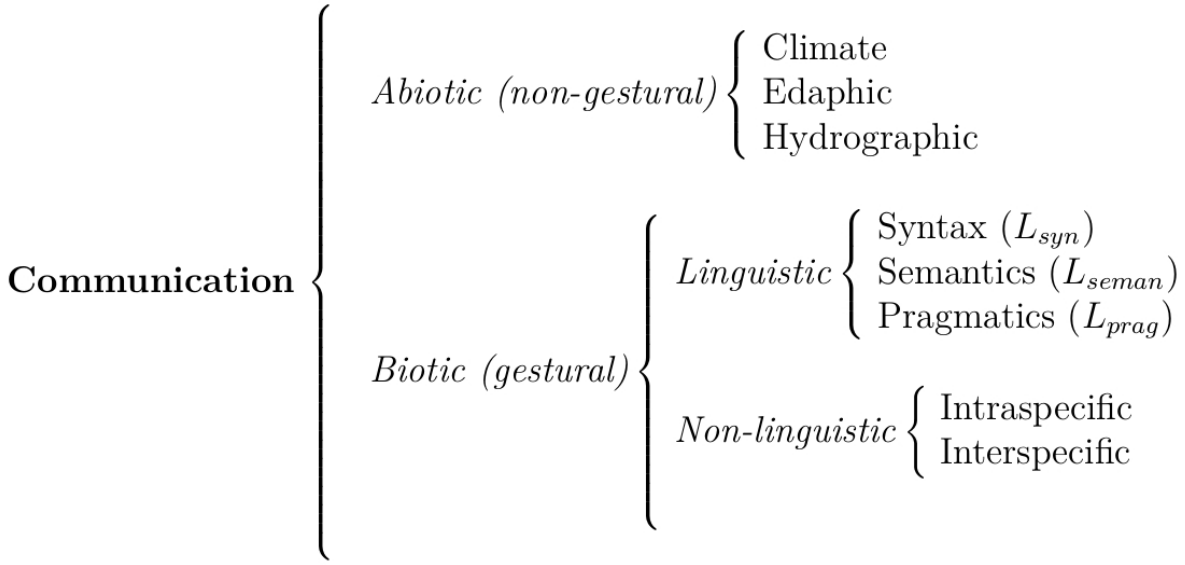


Figure 4: Different visions of living beings

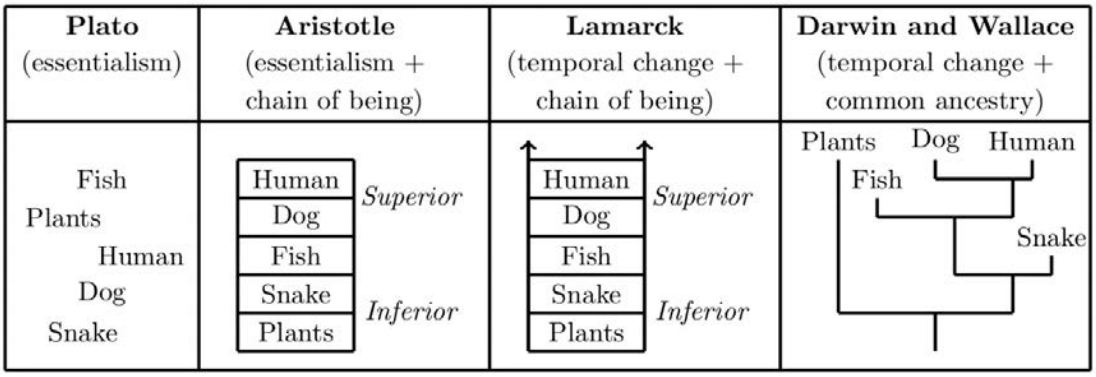
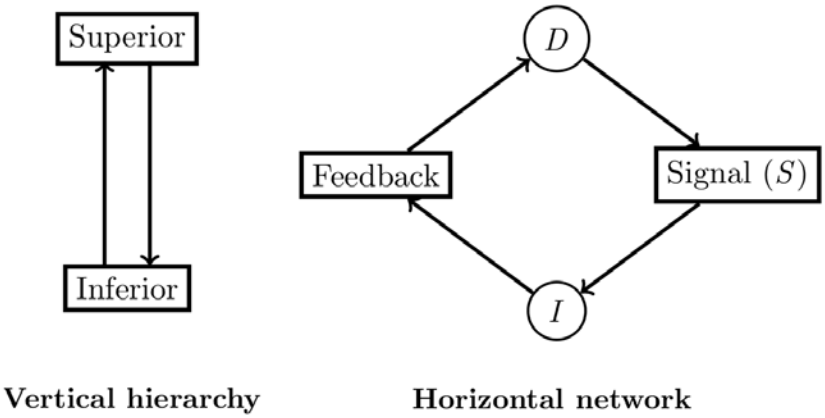


Figure 5: Different forms of relationship



Vertical hierarchy **Horizontal network**