

Roundtable:

The future of culture in more-than-human worlds of being

(T)RE(E)MEDIATION

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This essay explores some of the arboreal imaginings that inform analogies between mycorrhizal and technical, or arboreal and human, infrastructural networks. Rather than embrace or dismiss the idea of a wood wide web, I interrogate this intriguing comparison with the help of a variety of natural and human scientists. In so doing I explore how technical, human, arboreal, and mycorrhizal infrastructures are linked by their participation in processes of radical tree mediation.

Wood Wide Web

In the late 1990s, during the early explosion of internet enthusiasm in the west, the concept of a ‘wood wide web’ began to be adopted by botanists, dendrologists, and natural scientists, based in part upon research by Suzanne Simard and others showing that trees reciprocally exchanged nutrients with mycorrhizal fungi through their roots. Perhaps because these inter-species exchanges created ‘hyphal networks’ whose structure seemed analogous to the World Wide Web, the editors of *Nature* coined the phrase ‘wood wide web’ for the front cover of its 7 August 1997 issue, which featured a story about



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Simard's research called 'The Ties that Bind.' The author of the cover story, Sir David Read, reported favorably on recent experimental findings by Simard and her associates, which are featured in that same issue. Interestingly the phrase 'wood wide web' does not appear in either Read's or Simard's piece (Read,1997). Nonetheless the name stuck around. Beginning in 2012 its usage began to multiply significantly, continuing to increase in the following decade.

This analogy between arboreal-mycorrhizal networks and technically mediated ones is part of a widespread arboreal imagination that has flourished in the popular media over the past couple of decades. Simard herself has begun retroactively to use the phrase wood wide web to describe the results of her doctoral and subsequent research. Born to a family of horse-loggers in British Columbia, Simard's lifelong research project has been directed squarely against the North American logging industry, particularly its wasteful, destructive practices of clearcutting and monocultural reforestation. Increased popular and cultural interest in trees and forests has been spurred on by similar concerns about the destructiveness of rampant deforestation, which threatens to increase global warming and contribute to the extinction of countless species (Simard, 2021). But recent developments in scientific understandings of how trees communicate and cooperate with one another and across species has spurred on the imaginations of writers, artists, and natural scientists.

Simard's fullest expression of her research findings in terms of the wood wide web occurs in her 2021 book, *Finding the Mother Tree*, an autobiographical account of her journey as a woman scientist making her way in the masculinist worlds of botany, forestry, and forest science. But even before this book Simard had already been recounting the origins of her doctoral research in terms of the wood wide web, as she does in the 2016 afterword to the English edition of Peter Wohlleben's *Hidden Life of Trees*, which also argues for trees as sentient, social beings (Wohlleben, 2016, pp. 248-49). Simard writes:

In pulling back the forest floor using microscopic and genetic tools, I discovered that the vast belowground mycelial network was a bustling community of mycorrhizal fungal species. These fungi are mutualistic. They connect the trees with the soil in a market exchange of carbon and nutrients and link the roots of paper birches and Douglas firs in a busy, cooperative Internet. When the interwoven birches and firs were spiked with stable and radioactive isotopes, I could see, using mass spectrometers and scintillation counters, carbon being transmitted back and forth between the trees, like neurotransmitters firing in our own neural networks. The trees were communicating through the web!

'This discovery,' Simard sums up, 'was published by *Nature* in 1997 and called the "wood wide web."' (Simard,2021).

In addition to noting the origin story of the phrase 'wood wide web,' this passage sets forth three of the most common metaphors used to describe this mycorrhizal-arboreal mediation: economic ('market exchange'), cognitive ('neurotransmitters firing in our own neural networks'), and communicative ('communicating through the web'). Not only does Simard see trees and fungi communicating through networks that function like the internet, but she also understands these mediations as engaging in market-based exchanges of carbon and other nutrients, transmitting carbon molecules in mycorrhizal networks that bear a topological resemblance to the neural networks of the human brain.

In this essay I explore some of the arboreal imaginings that inform analogies between mycorrhizal and technical, or arboreal and human, infrastructural networks. Rather than embrace or dismiss the idea of a wood wide web, I interrogate this intriguing comparison with the help of a variety of natural and human scientists, including botanist Francis Hallé, neurobiologist Stefano Mancuso, philosopher Emanuele Coccia,

and others. In so doing I hope to explore how technical, human, arboreal, and mycorrhizal infrastructures are linked by their participation in processes of radical tree mediation.

Plant theory?

In the twenty-five years since Simard's research was featured on the cover of *Nature*, ideas of arboreal mediation have blossomed, not only in the natural sciences but in the human and social sciences as well. The analogy between arboreal and human networks has captured the scholarly and public imagination. The co-evolution of humans and trees is in some sense only a special case of the co-evolution of plant and animal life on the planet. Mancuso, Coccia, and others remind us that the oxygen which animals breathe has been produced by plants and trees, without which there would be no animal life on earth as we know it. Emitting as a by-product of photosynthesis the oxygen that animals need to live, plants make animal life on earth possible. If all animal species were to disappear, plant life would continue without very much change; but if all plant life were to disappear, animals would soon follow them into extinction. While human and nonhuman animals are dependent on plant life for their continued existence, this dependence is not mutual, but asymmetric. When humans are gone, plants and trees will get on just fine without us, as they did before we primates came down from our arboreal homes.

Emanuele Coccia explains this dependence of animal life on plants and trees in terms of the immediacy of plant mediation. Unlike plants, he claims, 'higher life seems never to have had immediate relations with the inanimate world.' Coccia remedies the idealist claim, expressed most powerfully by Hegel, that humans can never have an immediate relationship with the world. Coccia would deny such immediacy to 'higher life' more generally, even while ascribing immediacy to plants. Because so-called higher forms of life are parasitic on energy provided by the lives of other living beings for their sustenance, Coccia argues, they do not have an immediate relation with the material world. But plants 'have no need for the mediation of other beings in order to survive. Nor do they desire it,' he writes. 'They require nothing but the world, nothing but reality in its most basic components: rocks, water, air, light.' (Coccia, 2019, p. 8).

Because they produce their own atmospheric environment and the environment for terrestrial life in general, plants disrupt the fundamental logical opposition between individual and environment upon which so much of ecological and biological science is based. 'Plants are the real mediators,' Coccia writes: 'they are the first eyes that appeared and opened themselves onto the world, they are the gaze that came to perceive it in all its forms. The world is, above all, everything the plants could make of it. They are the ones who made our world, even though the status of this making is quite different from that of any other activity of living beings.' (Coccia, 2019, p. 21). Coccia's description of plants as 'the real mediators' echoes a claim by Deleuze that 'Mediators are fundamental.' Deleuze writes: 'Creation's all about mediators. Without them nothing happens. They can be people—for a philosopher, artists or scientists; for a scientist, philosophers or artists—but things too, even plants or animals, as in [Carlos] Castaneda.' (Deleuze, 1995, p. 125). Or as I have restated this passage in terms of the concept of 'radical mediation,' 'Without **mediation**, nothing happens. Creation. . . is all about **mediation**.' (Grusin, 2015, p. 139).

As forms of radical (or 'radicle') mediation, plants are ontogenetic; they do not come belatedly, after the habitable world and its animal life are already in place, but create the conditions from which the conceptual opposition between animal life and the world or environment can emerge. 'Plants, in their history and evolution, demonstrate that living beings produce the space in which they live rather than being forced to adapt to it. They have modified the metaphysical structure of the world for good.' (Coccia, 2019, p. 10). What Coccia means by this is that plants provide an alternative to a traditional dualistic

ontology in which natural (and by extension technical) forms are understood as separate from their creators:

Plants coincide with the forms they invent; all forms are, for them, inflections of being, and not merely of doing or acting.... To the abstraction of creation and technique—which are able to transform the forms only at the cost of excluding the creator and producer of the process of transformation—the plant opposes the immediacy of metamorphosis: to generate always means to transform oneself. To the paradoxes of consciousness, which does not know how to conceptualize forms without first distinguishing them from itself and from the reality of which they are models, the plant opposes the absolute intimacy between subject, matter, and imagination: to imagine is to become what one imagines (Coccia, 2019, pp. 13-14).

In this passage, Coccia implicitly critiques Aristotelean hylomorphism, in which natural beings are seen to be composed of two distinct qualities, matter and form, with form preceding its realization in matter. Coccia contends instead that the forms plants take are not produced by an agent or action external to them but that their forms coincide with their very being. Form in plants is not distinct from matter but absolutely intimate with it: ‘to imagine is to become what one imagines.’ Plants, in other words, are their own infrastructures.

Coccia explains this ‘absolute intimacy between subject, matter, and imagination’ in terms of breath, writing that leaves and all other life co-create the atmosphere and the biosphere through breath and breathing. ‘The world is the matter, the form, the space, and the reality of breath. Plants are the *breath of all living beings, the world as breath*’ (Coccia, 2019, p. 63). All life begins and ends with breath, he says, and life is always engaged in mixing the breath of the organism, plant or animal, with the planetary breath that is our atmosphere. ‘Breath is the art of mixture, what allows each object to mix with the rest of the objects, to immerse itself in them. *Atmosphere*, the sphere of breath, its extreme horizon, is the form of intimacy and unity that defines itself not through the homogeneity of substance or form but through the sharing of the same breath, of a family *resemblance* among a collection of elements that is not a simple combination of disparate objects.’ (Coccia, 2019, p. 62).

This is an important, if not immediately apparent, point. Coccia's idea of mixture as key to the life of plants, and to life generally, has interesting affinities with Karen Barad's insistence that bodies (whether human or nonhuman) should not be thought of as distinct organisms living in the environment of the world but must be understood as inseparable parts of the very fabric of that world. Our breaths are always mixing with the atmosphere, which circulates through our bodies in order for them to live. In other words, breath is a form of radical mediation—not coming between living beings and the world but helping to generate the atmospheric medium which makes terrestrial life possible. In the process of breathing, our living bodies are always producing mixtures (or mediations) which then mix with and change, or re-mediate, the atmosphere, environment, or medium in an ongoing cycle of breath. When living beings stop mediating and remediating the atmosphere, they die. If, as I have argued elsewhere, radical mediation is a fundamental process of human and nonhuman existence, and life itself a form of mediation, we are now in a position to ask what kind of work is being done by the analogy underlying the concept of a wood wide web, that trees communicate through infrastructural mycorrhizal networks just like humans communicate through the World Wide Web? (Grusin, 2015)

Tree Mediation

Like trees and the mycorrhizal networks that connect them, plants, too, have recently come to be understood as sharing affinities with the internet's distributed modular infrastructure. Mancuso and Viola explain that 'what ultimately distinguishes a plant from an animal is its divisibility: its being equipped with numerous "command centers" and a network structure not unlike the Internet's.' (Mancuso and Viola, 2015, p. 3). In discussing how plants communicate similarly to animals, they contend that 'despite the similarities, a plant's internal communication pathways have a completely different architecture from those of an animal. Whereas animals are equipped with a central brain toward which all the signals are directed, plants—by virtue of their modular and iterative construction—utilize multiple "data processing centers" which permit them a very different sort of signal handling.' (Mancuso and Viola, 2015, p. 89). And in comparing the function of the roots of a plant to the brain of an animal, Mancuso and Viola contend that 'each plant is a living Internet network,' writing that 'each [root] tip is a true data processing center': it doesn't work alone, but in a network with millions of others that make up the plant's root system.' (Mancuso and Viola, 2015, pp. 140-41).

One of the liberatory strategies of arboreal humanities, like plant theory generally, is to advocate for trees and plants by presenting them as intelligent, complex, social beings worthy of our respect. Trees and forests are not just resources or commodities to be used by humans, but multispecies, collective organisms that need to be protected, whose webs and networks need to be nurtured and encouraged, not destroyed. If humans can be made to understand how trees communicate with one another like people, how they share with their neighbors and protect their kin like people, how they act collectively and altruistically like people—then it should not be difficult to make the case that trees and plants should have rights like people.

But I wonder if the best way to extend to trees and plants the right to live and be protected from violence is by making the case that they are like us. By using human intelligence, sociality, and technology as the measures of arboreal complexity, do we continue hubristically to perpetuate an invidious distinction between human and nonhuman that is inimical to multispecies thriving and well-being, indeed to the planet as a whole? Do these analogies reproduce the hylomorphism that Coccia, Mancuso, and others have shown plants and trees to resist, by imposing the form of human, technically mediated networks onto plants and trees or onto the material interconnections of roots and fungi? In arguing that trees, for example, care, share, and cooperate with fungal networks and other trees, do these analogies continue to imagine agency on the model of the human, only to extend it to nonhuman plants and trees?

What if, rather than starting with neural and technical networks as the measure of arboreal and plant intelligence, we turned this around and began instead with radical tree mediation? What if we considered the Internet as taking the form of mycorrhizal networks? Does it make sense to consider human cognition and communication networks as themselves arboreal? What would it mean to think of technical networks and mycorrhizal networks as the same kinds of thing, to consider the Internet (and even our neural networks) as themselves part of the co-evolution of humans and trees? Do trees communicate and share and cooperate and care like humans do? Or do humans do these things like trees do? Are trees like us or are we like them?

This is not just a matter of words.

In raising these questions I am not rehearsing the by now-familiar arguments for or against anthropocentric perspectivalism, the idea that humans are trapped in their own cultural, epistemological, and linguistic prison-house and thus can never attain a biocentric viewpoint or truly nonhuman

perspective. Nor am I making a case for biocentrism. If you choose biocentrism (or ecocentrism), as deep ecologists would, you still risk reproducing the fundamental divide between humans and nonhumans, culture and nature. The choice between anthropocentrism and biocentrism is a false choice, an offshoot of fundamental dualisms that have dominated western thought for more than two millennia, dualisms that are challenged by plants and trees. If the choice is posed as between anthropocentric or biocentric knowledge, I refuse to choose. I do not accept that premise and neither should you.

Rather I suggest that we begin with excluded middles, with relationality or mediation, with the kind of mixture that is breath. While I would reject outright the idea, predominant in western civilization for millennia, that trees and forests exist as natural resources for human use and dominion, I am less sanguine about recent claims that trees and forests think and talk and love like humans, as much as I love that idea. My hesitancy is not because I would deny trees and forests cognition, collaboration, or agency, but because I am not convinced that their actions need to be understood on the model of the human in order to have value.

Instead of measuring trees with the yardstick of the human, what if we instead measured the human with an arboreal yardstick (itself of course a technology derived from wood)? What might arboreal cognition and communication teach us about our own cognitive and communicative practices? Rather than granting trees a kind of intelligence according to our sense of human exceptionalism as self-conscious, free agents with the power of language or speech, what if we understood these powers as operating on the model of trees? Perhaps, that is, we should think of human cognition, communication, and sociality on the model of tree mediation. In particular, I want to ask what it might look like to think about human cognition, collaboration, and communication on the model of trees, or as I have phrased it for the purposes of this chapter, of arboreal mediation.

In the past few years that I have been working on arboreal mediation I have been intrigued by the idea that human language or thought might develop in the same way that trees grow, and wonder what it would look like to begin by considering tree mediation in terms of the accretive, annual generation of new growth through the entirety of a tree's life, and the way that new growth, particularly in the trunk, dies off and produces wood, which both provides an archival record of the tree's life through its tree rings and serves as infrastructural support for the trunk and crown. What would it mean to think of human language and knowledge evolving according to contiguity—as new rings are added to trees, or as new branches, buds, and roots are added every year—rather than through similarity or resemblance between fundamentally different kinds of things (internet and mycorrhizal networks, language and the world)?

Language-use has for centuries been a key part of the argument for human exceptionalism, particularly language understood on the model of expression (where humans use language to express what they are feeling or thinking); mimesis (where humans use language to imitate something other or nonhuman); and metaphor (which assigns to humans the unique ability to express linguistically resemblances between unlike things). What if, following Roman Jakobson's provocative work, we saw this question of resemblance not through metaphor but through metonymy, not through similarity of different kinds of things (language and tree communication, say) but through physical contiguity? (Jakobson, 1956) Recurring cross-cuts of a tree clearly resemble one another—but that resemblance is not through similarity or metaphor but through contiguity. Can trees show us a way to think about human language as operating not based on metaphor, where a word stands for or re-presents something it is not, but on contiguity? What would it mean to consider language producing language, or cognition cognition, as trees branch and rebranch year after year?

Perhaps Michael Marder can help me clarify my point. In considering what it means for plants to communicate, Marder writes: 'Plants help us provide some of the initial responses to this inquiry by revealing that the "message," or what is communicated, is not separate from the communicating agent, which is a communal being at every level of its cellular, tissue, and environmental architecture. Much in the same way, human language, erroneously identified with communication *in toto*, is not a tool for the transfer of information but part and parcel of our ontology, our inherent communal makeup.' (Marder, 2016, p. 95). Rather than seeing human language as an expression of autonomous individuals with free will to say and do whatever they choose, Marder suggests that we might consider human language and cognition as expressions of human ontology or our 'inherent communal nature,' just as tree rings or mycorrhizal networks express the ontology and communalism of trees and fungi. A tree does not choose to add branches and growth rings any more than humans choose to speak or to live socially.

I want to close, then, by suggesting that in co-evolving with technology, humans might also have been co-evolving with the arboreal. Following Gilbert Simondon I would maintain that the co-evolution of humans and techne means that both humans and technology are evolving (Simondon, 2016). Perhaps like trees, our technological mediations are not other from nature but of a piece with it, growing along with humans like the wooden trunk of a tree functions infrastructurally to hold up the living tree. For millennia weapons, tools, conveyances, houses, and furnishings, i.e., almost all of our technical infrastructure, have been made from wood. As many scholars have reminded us, the invention of the printing press (itself made in large part from wood) helped make paper the material through which power and discourse manifest themselves. Ironically with the advent of the digital revolution and technical networks like the internet, paper has begun to give way to the silicon and metal platforms of digital code. But they have not done away with tree mediation.

To return to the mycorrhizal networks with which we began, could we also say that mycorrhizal fungi and arboreal roots only want to keep on branching but to keep on linking as well? Could we think of language and cognition as forms of branching, to think that thoughts only want to keep on thinking, or words to continue speaking (or, pace Derrida's *Grammatology*, writing)? And might doing so let us see not that trees communicate through mycorrhizal networks like humans communicate through the world wide web, but that humans communicate through processes of branching and linking that operate like trees do?

References

- Read, D. 1997. The ties that bind. *Nature* **388**, 517–518.
- Simard, S. 2021. *Finding the Mother Tree: Discovering the Wisdom of the Forest*. NY: Knopf
- Wohlleben, P. 2016. *The Hidden Life of Trees*. Vancouver/Berkeley: Greystone
- Coccia, E. 2019. *The Life of Plants: A Metaphysics of Mixture*. Cambridge, UK: Polity
- Deleuze, G. 1995. *Negotiations: 1972-1990*. New York
- Grusin, R. 2015. *Radical Mediation*. Critical Inquiry. Vol. 42, No. 1, Chicago: The University of Chicago Press
- Mancuso, S and Viola, A. 2015. *Brilliant Green: The Surprising History and Science of Plant Intelligence*. Washington, DC: Island Press
- Jakobson, R. 1971. *Studies on Child Language and Aphasia*. Berlin, Boston: De Gruyter Mouton;
- Marder, M. 2016. *Grafts: Writings on Plants*. Minneapolis: Univocal
- Simondon, G. 2016. *On the Mode of Existence of Technical Objects*. Minneapolis: University of Minnesota

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