

| The Human in Reference to the Post-Planetary |

Perhaps the Age of the Anthropocene, a time when the human mark on the planet reaches the geologic scale, will also become the marker in human history when we began to question our own survival as a species. The implications of climate change could be so catastrophic that *Plan A* (repairing the damage on-planet) is no longer an option and making a mass migration off-planet, *Plan B*, becomes our only hope for the continuation of the only surviving species of the genus *Homo*, the *human* being. Will, as Kim Stanley Robinson writes in his novel *2312*,¹ *The Dithering* and *The Crisis* come to pass? And if they do, if our only hope is to move off-planet in pursuit of new worlds in the far reaches of the universe, then must we not review what *version* of the human we *should* propagate into the vast cosmos? What human designs *should* survive?

These are incredibly complex questions that require investigation into the multi-faceted nature of human cultural and social structures (technology, economics, philosophy, history, politics, etc.). Yet even before embarking on such an immense task, I believe we must first question the more fundamental aspects of what it means to *be* human—the biological human. What *is* a human being?

| The Human as Holobiont |

We are only just beginning to understand what it means to be human. The discovery of DNA and the mapping of the human genome (1990) began to present a blueprint of human evolution. Yet more recently (2008), a more complete picture of *the human* is being uncovered as scientists map the

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human microbiome—the home of the microbial organisms that live inside the human body and on the surface of our skin. As DNA sequencing is becoming ever cheaper (economic implications of Moore’s Law), the field of microbiology is exploding, with new information coming forth each week. As such, our ability to understand the microbial world is expanding even our notion of ourselves in relation to the microbe. *Humans* are now understood to be holobionts—“biomolecular networks composed of a host plus the associated microbes whose collective genomes forge a hologenome.”²

Microbial ecologists, such as Jessica Green, working at the Biology and the Built Environment Center at the University of Oregon, are researching human microbial clouds and are showing in laboratory experiments³ that one’s own microbial makeup is as unique as our fingerprints. Just last month, new research from Northern Arizona University in Flagstaff revealed that even cities have individual microbial signatures⁴ which has interesting implications for the relationship between the urban environment and *the human*. And of course my own MFA thesis research—a collaboration with the MIT Media Lab, Weill Cornell Medical College and The Cooper Union—which involves mapping the microbial makeup of cities (New York, Sydney, Melbourne, Venice, and Tokyo) using metagenomic sequencing of environmental samples from bees is revealing the microbial diversity by neighborhoods within a city.

Just in April of this year, scientists from the University of California, Berkeley and the University of Waterloo, made a revolutionary discovery about the diversity of life on Planet Earth and literally rewrote the phylogenetic (or biological) *tree of life* which maps all living organisms. They discovered that life on Earth is more

² <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002226>

³ <http://www.sciencefriday.com/videos/your-very-special-microbial-cloud/>

⁴ <https://www.sciencedaily.com/releases/2016/04/160419144724.htm>

numerous than we ever realized, and it is made up mostly of bacteria. Moreover, biologists are only beginning to study these new forms of life:

We visible organisms ... [are] the latecomers to Earth's story, and represent the smallest sliver of life's diversity. Bacteria are the true lords of the world. They've been on the planet for billions of years and have irrevocably changed it, while diversifying into endless forms most wonderful and most beautiful. Many of these forms have never been seen, but we know they exist because of their genes.⁵

Thinking about this microbial dark matter—the unclassified and overwhelming majority of biological life on this planet—across time and space, “from star, to planet, to crystal, to microbe,”⁶ may inspire us to reexamine our own *human* position across scales.

| Positioning The Human Across Scales |

These are the oldest memories on earth, the time codes carried in every chromosome and gene. Every step we've taken in our evolution is a milestone inscribed with organic memories. From the enzymes controlling the carbon-dioxide cycle, to the organization of the brachial plexus and the nerve pathways of the pyramid cells of the mid-brain. Each is a record of a thousand decisions taken in a chemical crisis. —J.G. Ballard, *The Drowned World*⁷

Buckminster Fuller referred to our planet as “spaceship Earth”⁸ and in so doing helped position humanity within a cosmic scale of space and time. In the context of universal temporality and given that our universe is 14 billion years old and our own planet 4.5 billion, *Homo Sapiens'* 200,000 year existence is but a spec of dust barely perceivable

⁵ <http://www.theatlantic.com/science/archive/2016/04/the-tree-of-life-just-got-a-lot-weirder/477729/>

⁶ Taken from Ed Keller's lecture on Geotemporality in Post-Planetary Design course at Parsons School of Design.

⁷ Ballard, J.G. “The Drowned World”. Liveright Publishing. 1962

⁸ Fuller, Buckminster. “Operating Manual for Spaceship Earth”. 1969.

to the naked eye. So how then can we contemplate who we really are when our capacity to fathom the scale of time and space from which we were born is so limited? What does it mean to be human in the context of geological and planetary time? Moreover, how are humans positioned within the expanses of cosmological space-time?

As part of my research in post-planetary design, I have begun thinking, not just about the scales across time and space, but about the isomorphisms across these scales which extend from the outer reaches of the known universe to the smallest elementary particles—from *universe*, to *planet*, to *human*, to *technoscape*, to *universe*. Taking inspiration from Benjamin Bratton's book *The Stack: On Software and Sovereignty*⁹ and from Ed Keller's geotemporality scales *from star, to planet, to crystal, to microbe, to star*, I have begun to diagram the isomorphisms across these scales of space and time:

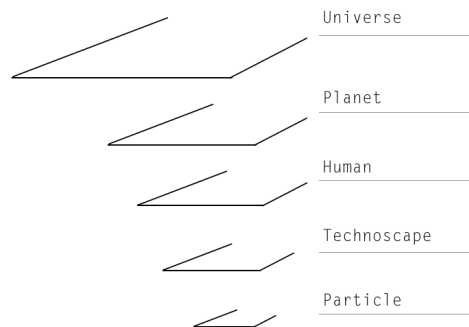


FIGURE 1 | THIS CRUDE DIAGRAM OF ISMORPHISM ACROSS SCALES OF SPACE AND TIME IS A NOD TO BENJAMIN BRATTON'S STACK DIAGRAM AND ED KELLER'S GEOTEMPORALITY SCALES.

Description of the layers in my *stack* diagram:

>> The cosmic web as a large-scale distribution of galaxies held together by gravity (*Universe* scale)

⁹ Bratton, Benjamin H. "The Stack: On Software and Sovereignty". MIT Press. 2016.

- >> Earth's mycorrhizal fungi networks considered to be planet-scale plant 'communication' networks serving such functions as water distribution and chemical information exchanges ¹⁰ (*Planet scale*)
- >> Neural pathways in the human brain that connect to form neural networks for chemical information flow (*Human scale*)
- >> Internet as a network of distributed computation (*Technoscape*, the globally distributed technical landscape allowing the communication of ideas and information, exists at both the human and the planet scale)
- >> Quantum entanglement – sub-atomic particles interacting such that the quantum state is not defined at the individual particle level, but rather at the entire system level or a network of particles in a system (*Particle scale* and every other scale simultaneously)

In this context, are there isomorphic morphologies that exist across scales? What structural properties do they share? Do the individual networks in the stack act on one another such that there is vertical communication flow?

The rise of mathematical theories of communication in the middle of the 20th century made possible the emergence of planetary scale cyber infrastructure across the scale of whole continents. With the discovery of DNA we began to understand that life itself is informational. We haven't fully grasped the implications. With the Deep Address initiative, we are ... thinking across such scales at once, from the intercontinental and the intercellular, if you like. Universal addressing platforms, like IPv6, are one way that the real movement of information between scales can be conceptualized and diagrammed. –Benjamin Bratton¹¹

¹⁰ <http://www.newyorker.com/magazine/2013/12/23/the-intelligent-plant>

¹¹ Benjamin Bratton. Deep Address Project. Center for Design and Geopolitics.
<<http://designgeopolitics.org/projects/deep-address-ipv6-ecology/>>

Can our own technologies serve as metaphors (or actual maps) to help us understand morphologies across scales and the interactions between them? Benjamin Bratton, head of the *Deep Address* project at the Center for Design and Geopolitics at the University of California San Diego, also seems to question the implications of how technology might serve to link landscapes across scale. Bratton asks: “What if *everything* in the world—all the way down to the scale of nanometers and up to the scale of human ideas and global cities—could directly exchange information, could *communicate*, as part of a massive universal addressing system?”¹² And what if that addressing system could extend outside of the planet to the trillions of stars and galaxies in our universe? I wonder if that is, in fact, how the cosmic structure already works—a vast flow of electromagnetic energy, originating with the Big Bang 14 billion years ago, flowing through time and space and interacting with networks of information-flow across scales. And if that is the case, perhaps the most important question is, what are the implications, if any, on *what the human is*?

| The Human: The Technoscape & The Bioscape |

But when we put *the human* back into the here and now, living inside of the immensity of the technoscape and positioned within the bioscape, we can see that our technologies are very much informing our understanding of what it means to be human. Advancements in DNA sequencing are already (today) allowing the human to understand herself in new lights. For example, Oxford Nanopore Technologies released a product last year called MinION. Revolutionizing DNA sequencing, the MinION fits in the palm of your hand, plugs right into your laptop, and allows for on-the-fly DNA sequencing—a process that traditionally requires massive sequencing machines the size of entire rooms.

¹² Ibid.

I can imagine that in the next five to 10 years, as the Internet of Things grows, sensors can be embedded into the built environment, constantly reading DNA data of the plants, animals, and microbes in the environment. In the future your mobile device could contain embedded Nanopore hardware. Imagine an iPhone app called *mCloud*—an application for human identification using airborne microbial cloud-sensing technology. As we are just on the brink of understanding the full implication of the human-microbe relationship, how will an added layer of metagenomic data at the planetary scale enhance our understanding of what it means to be human or, rather, a holobiont?

| Conclusion |

Once aware of the “companion species”¹³ that live on us, in us, and among us, might we begin to review what it means to *be human*¹⁴? Might we begin to review our relationships with our environments and to see our cities as more than just vast metropoleis, but as “complex and adaptive biological superstructures”?¹⁵ Thus, we will need to make some fundamental shifts in our understanding of ourselves before we go off-planet.

Humans will need to evolve into beings whose very consciousness is synonymous with the understanding that humans are fundamentally connected to each other, to the planet Earth, and to the cosmos—biologically and energetically (Big Bang/Cosmic Microwave Background). We must recognize that the isomorphisms found in nature across scales of time and space are the keys to unlock the mysteries of our own existence. We will need to identify the systematic (mathematical and physical) factors that create similar morphologies: the planetary flora

¹³ Haraway, Donna J. “The Companion Species Manifesto”. The University of Chicago Press. 2003.

¹⁴ This paragraph, in part, borrowed from my thesis paper *Holobiont Urbanism*.

<<https://issuu.com/reginafloresmir/docs/holobionturbanism>>

¹⁵ Taken from a memo written by Kevin Slain.

web (mycelium),¹⁶ the bimolecular networks of microbial life, the informational architecture of the Internet, the matrices that define string theory, the machine learning neural-network models (the origins of AI), and the dark matter suffusing the cosmos. Are these all evidence of an evolutionary “information system” governing reality, the *fabric*¹⁷ of space-time itself? Humans must recognize that we *are*, like a fractal, embedded in a never-ending repetitive pattern of information flow—an ‘Internet of Energy’ (IoE) born 14 billion years ago. We must understand that we are but a node in the vast planetary, universal, mesh-network that makes up our cosmological ecology¹⁸. This is what it means to be human.

¹⁶ Miller, Kenneth. “How Mushrooms Can Save the World”. Discover Magazine. May 31, 2013. Web. <<http://discovermagazine.com/2013/julyaug/13-mushrooms-clean-up-oil-spills-nuclear-meltdowns-and-human-health>>

¹⁷ Term borrowed from Brian Greene’s book *The Fabric of the Cosmos*.

¹⁸ The concepts in the last paragraph are ideas I have been working with for the greater part of the past two years during my studies at Parsons. While they have evolved, and certainly been shaped further by the Post-Planetary Design course, I first wrote about these ideas in the Design for the 21st Century course. This last paragraph in particular is taken, in part, from my paper *Ecological Synergies: A Model for a Better World*, section 4 *The Future of our Consciousness*, paragraph one. The full paper can be found here: <<http://www.reginafloresmir.com/blog/2015/1/20/ecological-synergies-a-model-for-a-better-world-final-paper-in-design-for-the-21st-century>>