Regina Flores
D21C Final Paper

Professor: Clive Dilnot
Instructor: Justin Charles

Ecological Synergies: A Model for a Better World

Introduction: A Perilous World with a Better Future?

In May of this year the amount of carbon dioxide (CO_2) in the Earth's air surpassed 400 parts per million for the first time in 800,000 years.[1] This catastrophic and unprecedented increase in CO2 is widely understood "by any serious person"[2] to have been caused by the industrial revolutions of the last two centuries. Our industrialization processes, that rely heavily on the burning of coal, oil, and natural gas, and our data centers, that have been named as "one of the fastest growing consumers of energy,"[3] are causing potentially irrevocable damage to the planet and to our way of life. This is, of course, not a surprise given that we are now living in the "Age of the Artificial" (Dilnot) where the *artifice* now completely encompasses our lives. Will the destruction of the planet allow us to have a future? And if so, what kind of a future will it be? Will it be (as Jaron Lanier described in *Who Owns the Future?)*[4] a dystopian, post-climate-change existence where corporate sponsored techno-bots are in control of even the wind (The Beach at the Edge of Moore's Law), and *nature* is but a forgotten memory? Or is there a potential for a better world? I think the answer lies somewhere in the aforementioned four words—*our way of life*—that must be examined if we are to do anything about this looming environmental threat and the insecurity of humanity's future. Should *our way of life*, one that has historically disregarded the planetary ecology, geology and ecosystem, be sustained? Or is it time to reimagine *our way of life* as we press on into the 21st

[1] Freedman, Andrew. "Carbon Dioxide Passes 400 PPM Milestone, NOAA Finds". Climate Central. May 10th 2013. Web. <http://www.climatecentral.org/news/carbon-dioxide-passes-400ppm-milestone-for-first-time-in-modern-human-histo>
[2] Dilnot, Clive. "Reasons to be cheerful, 1, 2, 3… (Or why the Artificial may yet save us)". Unpublished.
[3] Bouley, Dennis. "Estimating a Data Center's Electrical Carbon Footprint". *Insight.* White Paper 66. Web. <https://www.insight.com/content/dam/insight/en_US/pdfs/apc/apc-estimating-data-centers-carbon-footprint.pdf>
[4] Lanier, Jaron. *Who Owns the Future?* New York: Simon & Schuster. 2013.

century? Dilnot challenges us to consider the latter. "You will inhabit in this century a flawed world: it needs 'designing' to act otherwise."[5] *Our way of life* is antiquated, and it is time for, as Slavoj Zizek says, a "radical social change."[6] Put another way, Bruno Latour, in his essay *A Cautious Prometheus? A Few Steps Toward a Philosophy of Design*, proclaims "we have never been modern," arguing that it is a false idea that we are somehow separate from nature. This idea of separation, rooted in the seeking of a "modern" world, has pushed us into our current perilous, environmental situation. Latour urges us to shift our relationship with the artifice (or the objects around us) from "matters of fact" to those of "matters of concern,"[7] and in so doing open up the doors to our ability to *design* in order to address these concerns.

> '[D]esign' could offer a very important touch stone for detecting where we are heading and how well modernism (and also postmodernism) has been faring. To put it more provocatively, I would argue that design is one of the terms that has replaced the word 'revolution'! (Latour)

Like Latour, I believe the future of our world lies in our ability to *design,* or perhaps *redesign,* not just our objects, cities, and systems, but fundamentally *our way of life*. In other words, we need to *redesign* how we *think of acting* in the world.

Personal Design Principles: A Basis for an Ecologically Synergistic Model

Asking designers to "explore ways of making a better future" (Dilnot) or, as I have boldly demanded, *redesign our way of life* and how we *think of acting* in the world comes with a heavy responsibility and, of course, moral and ethical implications. As Latour writes:

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[5] Dilnot, Clive. D4TC: Final Assignment, #3: First Note. Unpublished.
[6] Zizek, Slavoj. "The End of Nature." *New York Times*. I.H.T Global Agenda 2011. Dec 2nd, 2010.
[7] Latour, Bruno. "A Cautios Prometheus? A few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk)." Keynote lecture for the *Networks of Design* meeting of the Design History Society. Falmouth, Cornwall. September 3rd, 2008.

> The spread of design to the inner definitions of things carries with it, not only meaning and hermeneutics, but also morality. More exactly, it is as if materiality and morality were finally coalescing. This is of great importance because if you begin to redesign cities, landscapes, natural parks, societies, as well as genes, brains and chips, no designer will be allowed to hide behind the old protection of matters of fact… By expanding design so that it is relevant everywhere, designers take up the mantle of morality as well. (Latour, pg 5)

Thus, as I lay out my model for the future, it behooves me to recall my own design principles (see Figure 1). As I take up the "mantle of morality" to tackle these global "matters of concern," these principles must be my guiding light.

Figure 1: Personal Design Principles[8]

1. Ecology above all else
2. Astrophysics as Aesthetic
3. Do No Digital (or Otherwise) Harm
4. (Critical) Design to Inspire

In *Reasons to be Cheerful*, Dilnot outlines the three ages of human history and argues that we are now fully immersed in the "Age of the Artificial"—a world where all that surrounds us is artificial. Look around you; is it not true? Is *nature* gone? Has nature, as Latour suggests, "…become a synonym of 'carefully managed,' 'skillfully staged,' 'artificially maintained,' 'cleverly designed' (this is true especially of so called 'natural' parks or 'organic foods')" (Latour, pg10)? This view of nature is unacceptable in my own vision of the future. To use Star Trek speak, my prime directive, above all else, is ecology. My first design principle was written above in a larger, bold font to drive home the point that as we begin to imagine, plan, redesign, craft, and envision our world, the biological ecosystem, *nature* if you will, must be primary. There may be a motivation to insert a verb before nature as Latour has done with his adjectives. Perhaps "sustain or maintain nature"? "Protect nature"? Unfortunately however, using these verbs is part of an old paradigm in which human beings see themselves

[8] Flores, Regina. "Personal Design Principles: An Approach to Future Design Projects and Work". Unpublished. October 2014.

separate from nature. Historically we see ourselves outside of nature, able to contain it, change it, and even *design* it. However, this manner of thinking, this arrogance, has led us to a catastrophic end—one where we realize our own demise is near (climate change, GMO food). Alternatively, then, how will using my own code of moral conduct (outlined above in Figure 1) impact my vision of the future? In his essay, *The Philosophy of Information, its Nature and Future Developments,*[9] Luciano Floridi makes the fundamental point that "[f]ailing to negotiate a fruitful, symbiotic relationship between technology and nature is not an option" (Floridi, pg 8). Ultimately all these guiding principles play a role and help determine the structure for my vision of the future, but like Floridi, I am uncompromising in my view that nature must come first.

A New Way of Acting in the World

If the symbol of the 19th century is steel and the 20th century is silicone, then, in my version of the future, the symbol of the 21st century is a plant (mycelium, bacteria). In their book *Speculative Everything: Design, Fiction and Social Dreaming,*[10] Anthony Dunne and Fiona Raby discuss their piece, *United Micro Kingdoms*, which uses critical design to outline four social archetypes of possible futures—their own exercise in imaging a better tomorrow. Through the practice of critical design they challenge the observer/user to question the current social construct and *inspire* us, me certainly, to look to concrete applications of their fictional/design-future world. The society of note is one they call the "Bioliberals."

> Bioliberals are social democrats who embrace biotechnology and the new values that this entails. They live in a world where the hype

[9] Floridi, Luciano. "The Information Society and Its Philosophy: Introduction to the Special Issue on 'The Philosophy of Information, its Nature and Future Developments'". *The Information Society.* Preprint Accepted for Publication.
[10] Dunne, Anthony. Raby, Fiona. *Speculative Everything: Design, Fiction, and Social Dreaming.* MIT Press. 2013.

> of synthetic biology has come true and delivered on its promises—a society in symbiosis with the natural world. Biology is at the center of their world-view, leading to a radically different technological landscape to our own. Nature is enhanced to meet growing human needs, but people also adjust their needs to match available resources. Each person produces their own energy according to their needs. (Dunne & Raby, pg 181)

It is in this design future that I find the basis for my own version of our world's future, one where there is, as Floridi, Dunne and Raby all agree, a *symbiotic relationship* with nature. I, however, will further refine the definition by replacing the word *symbiotic* with *synergistic*. This is a subtle distinction but one that I think is important to make. Buckminster Fuller, in his legendary book *Operating Manual for Spaceship Earth,*[11] appropriated the word, arguing that "synergy is the only word in our language meaning behavior of whole systems unpredicted by the separately observed behaviors of any of the system's separate parts or any subassembly of the system's parts" (Fuller, pg 78). In other words, the whole system is greater than the sum of its parts. Our future relies on the notion of ***synergy*** between all life forms on this planet (and perhaps beyond), and to achieve that synergy we must look to nature for guidance.

So, how we can arrive at a better tomorrow? How can we transform our culture from one that disregards nature to one that is in a *synergistic* relationship with it? Dunne and Raby articulate the answer when they describe the artifacts they constricted for Bioliberal design fiction:

> We wanted their vehicles to be non aerodynamic, big and unwieldy, suggesting that a very different logic informs their design, one that is absurd from today's perspective. But that's the point. This is a visual expression of what needs to change if we are to develop new ways of existing based on new values. (Dunne & Raby, pg 182)

[11] Fuller, Buckminster R. *Operating Manual for SpaceShip Earth.* Lars Muller Publishers. Zurich. 1969

To make a better world we must reimagine and redesign *our way of life* and the way we think of ourselves as actors in this world. Dunne and Raby argue that we need "new values" and a "different logic[al]" framework, and Dilnot suggests that because we are now totally immersed in the "Age of the Artificial "[t]he solution can only lie *within* the artificial; within the world we have created."[12] We must then reevaluate our relationship to the artifice—the way we *deal with objects.* In our consumer culture, "repair is synonymous with replacement" (Floridi, pg 11). Objects are meaningless, identical, reproducible, and replaceable. So we need to develop new identifications with our "things," our resources, and our waste.

Case Studies in Synergy: A Better Tomorrow is Possible

Floridi argues for the necessity of a "marriage [between] *physis* and *techne"* saying "[t]he challenge is to reconcile our roles as agents within nature and as stewards of nature" (Floridi, pg 9). This is the challenge for humanity in the 21st century: how will we create synergy with nature? How can we change the way *we act in the world* and *deal with objects* in order to create a synergistic relationship with nature? Many designers have already begun to answer these questions in practical, innovative, and creative ways. The book, *Design Ecologies: Essays on the Nature of Design,*[13] (Tilder) provides countless case studies that deal with the future of our world and how design can be a tool for change. The following is a selection of those case studies that best showcase my own vision of a better tomorrow, one where there is an ecological synergy between humans and nature.

[12] Dilnot, Clive. Design For the 21st Century Course. Lecture: "Design as a Mode of Acting in the World". Class Materials at Parsons The New School for Design. Fall 2014.
[13] Tilder, Lisa., and Beth Blostein, eds. *Design Ecologies: Essays on the Nature of Design.* New York: Princeton Architectural Press. Print.

1. The Future of our Waste

In my future, humans will live in complete ecological synergy with nature. The idea of producing waste will be a notion from a long forgotten past. Waste producing industrial processes like machining, as a means of construction, will no longer be used and will be considered barbaric. Humans will have moved away from the artifice as all encompassing, and biology will have emerged as the co-creator of our environments. Future Earthlings will not only live in environmentally friendly cities, they will literally "live in the environment."[14] Terreform, a Brooklyn based design firm, created a project called *Fab Tree Hab,*[15] a dwelling (see Figure 2)

> … composed with 100% living nutrients… [where] traditional anthropocentric doctrines are overturned and human life is subsumed within the terrestrial environs. Home, in this sense, becomes indistinct and fits itself symbiotically into the surrounding ecosystem. (Joachim, et al.)

In this design future, we will move away from the idea of *consume* (using up resources) and toward the idea of *subsume* (included within something larger).

Constructed environments, walls, airplanes, etc., will continue to exist, but the building materials will produce no waste, take other forms, and will be modeled from nature. Humans will now have "…the ability to redirect and engineer biological processes and then capture this understanding in computational models…" where cells "become our factories."[16] In the *Hy-Fi* project by The Living, organic bricks (see Figure 3) made from mycelium are shown as a prototype for a biological manufacturing future. The designers at The Living predict that in the future we will be able to "…harness the incredible

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[14] Mone, Gregory. "Grow Your Second Home: Designers Plant The Seeds For A High-Tech Version Of The Swiss Family Treehouse." *Popular Science.* November 1, 2006. Web. <http://www.popsci.com/arbona/article/2006-11/grow-your-second-home>

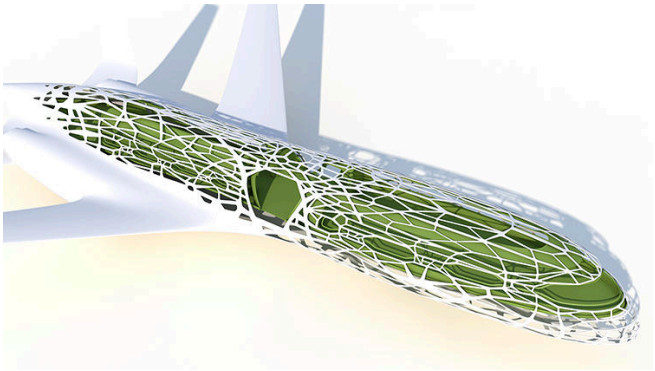
[15] Joachim, Mitchell Ph.D., Greden, Lara Ph.D. and Arbona, Javier. *Fab Tree Hab.* Massachusetts Institute of Technology Team H.E.D. [Human Ecology Design]. <http://www.archinode.com/fab-tree-hab.html>

[16] Coren, Michael J. "How We'll Grow The Next Generation Of Buildings With Bacteria". *Fast Company*. Auust 21, 2013. Web. <http://www.fastcoexist.com/3015899/futurist-forum/how-well-grow-the-next-generation-of-buildings-with-bacteria#4>

'biological algorithm' of mushroom roots and tune it to manufacture a new building material that grows in five days, with no waste, no input of energy, and no carbon emissions." [17] In this manor future humans can create a new ecological synergistic relationship with the artifice that surrounds them.

Figure 2: Image of *Fab Tree Hab* by Terreform.

Figure 3: (Left) Image of a brick from the Hy-Fi project by The Living. (Right) Rendering of an airplane produced from biological manufacturing.



[17] Rajagopal, Avinash. "Behind The Living's "100% Organic" Pavilion for MoMA PS1". *Metropolis.* Feburary 10, 2014. Web. < http://www.metropolismag.com/Point-of-View/February-2014/MoMA-PS1/>

2. The Future of our Energy

In my future, fossil fuels will not longer be used as a source of energy; thus concern over carbon emissions will no longer plague our society. Future humans will live in synergetic, *mesh-networked* environments where the transfer of green energies, such as solar, wind and biochemical energy, is seamless and integrated into the ecology. In an essay in *Design Ecologies*, Peter Hasdell describes this new energy system as "embodied energy," a form of energy consumption "… that begin[s] to approach the concept of food webs and nutrient flows found in the biological ecosystem" (Tilder, pg 95). This networked approach to energy generation is exemplified in Studio Formwork's *SolarSkins*[18] (see Figure 4), a patent-pending technology that is embedded onto/into a building's surface (like skin) and harnesses electricity similar to the method used by solar panels. *SolarSkin* is unique in that it distributes energy with concepts drawn from network ecology. Beth Bolstein, in her essay *Toward a Productive Excess*, uses my own *synergy* language to describe this technology saying *SolarSkin* shows *"…*the possibility of a productive, articulated, urban-energy field—where the whole exceeds the sum of its parts…" (Tilder, pg 247).

Jeremy Rifkin's idea of *The Third Industrial Revolution*[19] draws heavily on these ideas of a synergistic, mesh-networked, energy model (see Figure 5). The basis for his model is around:

> …distributed renewable energies that are found everywhere and are, for the most part, free—sun, wind, hydro, geothermal heat, biomass, and ocean waves and tides. These dispersed energies will be collected at millions of local sites and then bundled and shared with others over a continental green electricity internet to achieve optimum energy levels and maintain a high-performing, sustainable economy. The distributed nature of renewable

[18] Studio Formwork. *SolarSkin,* Web. < http://studioformwork.com/skins/>
[19] Rifkin, Jeremy. "The Third Industrial Revolution: How the Internet, Green Electricity, and 3-D Printing are Ushering in a Sustainable Era of Distributed Capitalism". *The World Financial Review. March 3, 2012.* Web. <http://www.worldfinancialreview.com/?p=2271>

> energies necessitates collaborative rather than hierarchical command and control mechanisms. (Rifkin, pg 5)

Serving as an advisor to Germany's Prime Minister, Angela Merkel, he authored a strategy that has helped the country generate 74% of their energy needs from renewable sources.[20] While the Germany case study is heavily rooted in today's infrastructure and far from the "continental green electricity internet" that Rifkin imagines for the future, it serves as a bridge toward a future version of our world where every human being manufactures his/her own green energy and shares it through a vast network of synergistic cooperation.

Figure 4: *Solar Skin* by Studio Formwork.

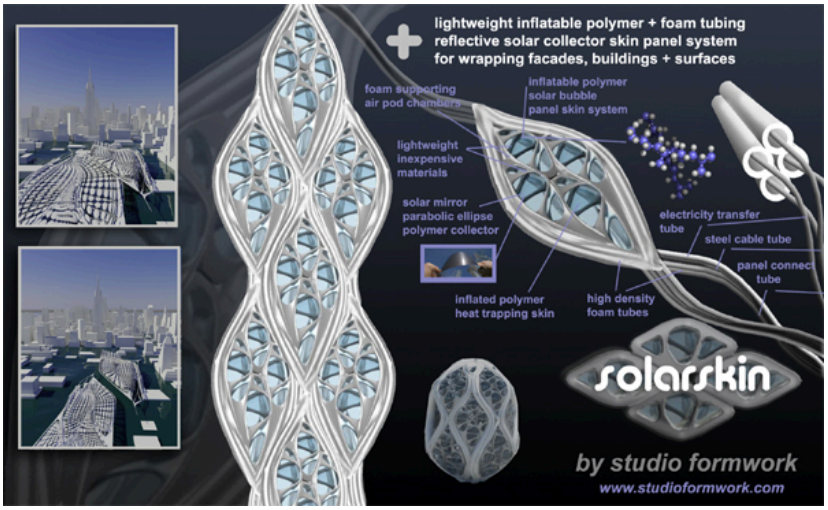


Figure 5: Artist's rendition of Jeremy Rifkin's idea of the "energy internet".

[20] Kroh, Kiley. "Germany Sets New Record, Generating 74 Percent Of Power Needs From Renewable Energy". *Climate Progress*. May 13, 2014. Web. < http://thinkprogress.org/climate/2014/05/13/3436923/germany-energy-records/>

3. The Future of our Systems

In my future, humans will have harnessed the power of plant (mycelium, bacteria) intelligence. With acknowledgement of our own neurological (brain) prejudices, biomimicry will have become standard practice. Thus, we will model our social and technological systems on the superior flora-intelligence. Today, scientists are only beginning to understand the complex nature of plant communication, their sensory systems and biochemical mechanisms. In an article published in the New Yorker last year, scientists revealed that "plants hold the key to a future that will be organized around systems and technologies that are networked, decentralized, modular, reiterated, redundant—and green, able to nourish themselves on light."[21] Designers are using biomimicry as a method to explore the relationship between human and biological organization. An official selection of the Venice Biennial, *Bio City Map of 11 Billion,*[22] by the design firm Terreform, uses biosynthetic matter (bacteria) to model world population density and growth (see Figure 6). "[T]he bacterial shapes grow to reveal variant patterns of biological transformation in urban regions" (Joachim, et al). Using the E. Coli bacteria served as a method of "analog computation using synthetic biology."[23] This example of biomimicry ultimately helped to "narrow the gap between idealized mathematical interpretations and observable events in nature" (Joachim, et al). Understanding the ecologically synergistic, systems-organization of plants (mycelium, bacteria) will help future humans better understand their own complex connections to each other, to nature, and even to the cosmos.

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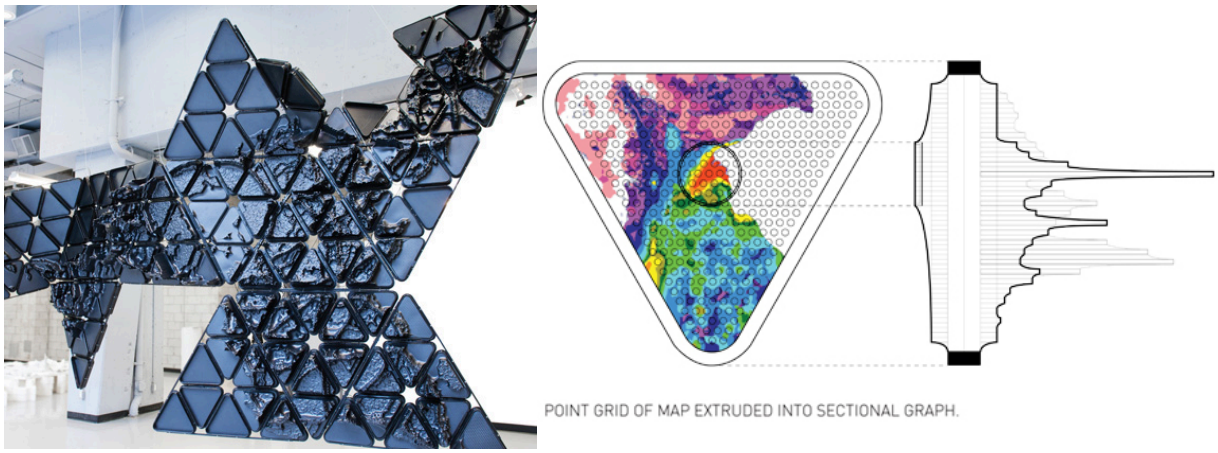
[21] Pollan, Michael. "The Intelligent Plant: Scientists Debate a New Way of Understandign Flora". *The New Yorker.* December 23, 2013. Web. < http://www.newyorker.com/magazine/2013/12/23/the-intelligent-plant>
[22] Joachim, Mitchell. Et al. *Bio City Map Of 11 Billion: World Population in 2110.* Official Selection of the Venice Biennale. 2014. <http://www.terreform.org/projects_urbanity_bio_city_map.html>
[23] *Magdaleno*, Johnny. "World Map Installation uses E. Coli and Jellyfish Proteins to illuminate our population in 2100". *The Creators Project*. October 22, 2013. Web. < http://thecreatorsproject.vice.com/blog/world-map-installation-uses-e-coli-and-jellyfish-proteins-to-illuminate-our-population-in-2100>

Figure 6: (Left) *BIO CITY MAP OF 11 BILLION: World Population in 2110* installation piece. (Right) Example of bacteria colony growth graphed as population density.



4. The Future of our Consciousness

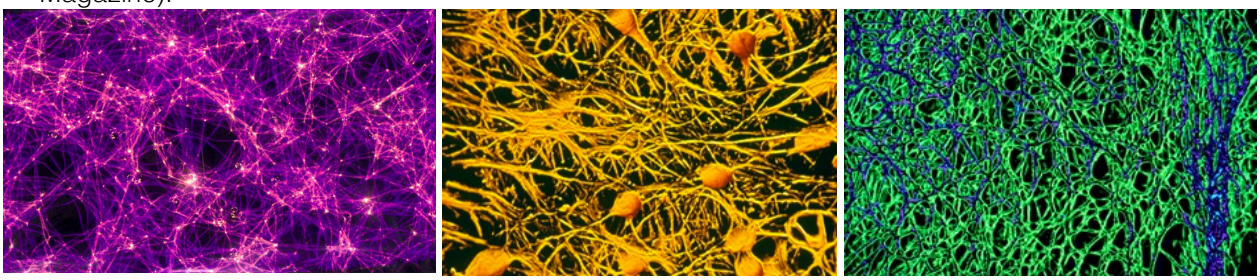
In my future, the concept of *Astrophysics as Aesthetic* will have become commonplace. The *Theory of Everything*[24] will be understood, and astrophysics will have become the human language. Floridi writes that "[we are] in the process of dislocation and reassessment of humanity's fundamental nature and role in the universe. We do not know whether we may be the only intelligent form of life" (Floridi, pg 10). In my future, humans finally do know that we are *not* the only intelligent life form. As we continue to evolve, not just in our biological and emotional understanding of ourselves, but in our understanding of our universe, we will recognize that we are "cosmonauts" on "Spaceship Earth," but one ship in a cosmic sea teeming with life and possibility. In his 1969 manifesto, Buckminster Fuller warned us that humanity is

> …faced with an entirely new relationship to the universe. We are going to have to spread our wings of intellect and fly, or perish; that is, we must dare immediately and fly by the generalized principles governing [the] universe and not by the ground rules of yesterday's superstitious and erroneously conditioned reflexes. (Fuller, pg 66)

[24] Wikipedia Definition: A theory of everything (ToE) or final theory, ultimate theory, or master theory refers to the hypothetical presence of a single, all-encompassing, coherent theoretical framework of physics that fully explains and links together all physical aspects of the universe.

Because of the ecological synergy in my future, humanity will finally be operating by the "general principles governing the universe" (quantum theory and beyond). Humans will have become highly evolved; to be *conscious* will have become synonymous with the understanding that we are all fundamentally connected—to each other, to our planet, and to the cosmos—physically, energetically, and spiritually. We will recognize that the symmetry found in nature is the key to unlock the mysteries of our own place in the universe. We will see that the planetary flora web, the "mycelium-like patterns in the information architecture of the Internet, in the matrices of string theory, in computer models of the web of dark matter suffusing the cosmos… [is evidence of an] evolutionary intelligence governing reality itself[25]" (see Figure 7). In my future, we will see that we *are* nature. We will see that we *are* dark matter, neurons, and mycelium. Our emotional make-up will be fundamentally altered by this realization. We will understand that we are but a node in the vast planetary, universal, mesh-network that makes up our synergetic ecology.

Figure 7: Rendering of dark matter in space; matter pulls together into a web-like structure along a scaffolding of dark matter (left)[26]. Scanning electron microscope images of human brain cells (middle) and (right) scanning electron microscope images of mushroom mycelium (Discover Magazine).



[25] 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>
[26] Hammond, Richard. "Building a Universe". *BBC One.* Web. <http://www.bbc.co.uk/programmes/galleries/p01kw0mt>

Conclusion: Toward a Whole Universe Catalog

In 1968 the first Whole Earth Catalog was published. In 2014 we need to begin publishing the Whole *Universe* Catalog. During a time of tremendous social and political change in the world the Whole Earth Catalog provided a "variety of tools accessible to newly dispersed counterculture communities, back-to-the-land households, and innovators in the fields of technology, design, and architecture, and to create a community meeting-place in print."[27] The catalog became symbolic of a social movement predicated on ecological ideals similar to those that I have outlined in this paper. Unfortunately, humanity today faces far greater problems than socio-political concerns. Today we face global, ecological catastrophe and the potential extinction of the human race. We need to eradicate *our way of life* and change how we *think of acting in the world* and how we *deal with objects* by shifting our perception to "matters of concern." We need a revolution. We need a philosophical "reboot" that will fundamentally alter our emotional connection to each other, to the planet, and to the cosmos. Perhaps such a cultural symbol—a Whole *Universe* Catalog—will help shepherd us into a new age (see Figure 8). Our only hope of survival is through ecological synergy and the realization of how utterly interconnected we all are.

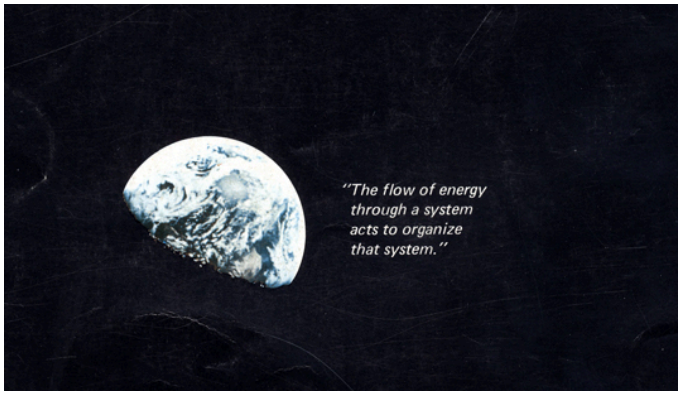


Figure 8: Imagery from *Whole Earth Catalog*, spring 1969, is still relevant 45 years later as the *Whole Universe Catalog*. "The of energy through a system acts to organize that system." -- Harold J. Morowitz, Biophysicist (Photo courtesy of MoMA website)

[27] Web resource: <http://www.moma.org/interactives/exhibitions/2011/AccesstoTools/>