EcoArchitectural Machines

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Reviewing the embodied energy of materials used in a project has become an essential part of the design process. This, however, is only one way in which matter and energy are co-dependent in what regards the work of architecture.

These concluding remarks from the ACSA session description "Emerging Ecological Materials and Environments" create an opening to extend discussion beyond "selection of a project's palette" to more encompassing concerns as to the nature of ecologically responsive architectures. To be sure, ecological imperatives provide impetus to develop new materials, ones that are efficient, adapt to environmental stimuli, minimize negative impacts on human and ecosystem health, etc. Yet it is not simply a matter of what assemblies we might devise and evaluate: a deeply ecological architecture calls for new forms of 'accountability,' new modes of describing materials, assemblies and their co-dependencies. Such an approach would emphasize projects as open experiments in the 'arrangements' of the living and nonliving.

This essay considers how conceptual predispositions affect our ability to describe ecological materials and environments. It provides a speculative basis for aligning heterogeneous, event-laden ecologies and dynamic architectures of the city. It lastly asks how urban interventions as hybrids of architectural fabrication and ecological regeneration might support a trajectory of enhanced human and biological diversity.

TRANSITIONS AND INHERITENCES

At the heart of all ecological praxes there is an a-signifying rupture, in which the catalysts of existential change are close at hand, but lack expressive support from the assemblages of enunciation. –Felix Guattari, *The Three Ecologies* [1]

Guattari describes three ecological *registers* that deserve aggressive and concerted response: the environment, social relations and human subjectivity. As befits an ecological perspective, changes in the condition of one register impact the status of others. New 'assemblages of enunciation' can motivate more environmentally beneficial design practices, breaking through the inertia of sedimented signification. What inheritances of articulation, unexamined modes for describing the organization of matter and energy, thwart or abet conceptual and practical innovation? What emerging assemblages of enunciation pertaining to the making of architecture reflect an effort to address accelerating environmental degradation?

We continue to feel the effects of – and offer views of the world in terms of -metaphors and ideas of order and structure that dominated thinking centuries ago. We remain subject to the sway of taxonomies of the discrete, descriptions of materials and entities as stable and enduring, and a view of phenomenon operating within bounded systems. During the Renaissance, the properties of the human body, the closest earthly facsimile to God's ordered perfection, offered an ideal from which to design building facades and other architectural compositions. The neoplatonist Renaissance philosopher Marsilio Ficino saw humans as intermediaries binding the worldly to the heavenly. Ficino envisioned a *pyramidal* structure, establishing, as Alberto Perez-Gomez describes, "a hierarchy of being that emanates from God (unity) and extends down to the

physical world (multiplicity)." [2] The uniqueness of human beings corresponds to their privileged location between the apex of God and the plurality of nature. Works of architecture as embodiments of humankind strive to lift the worldly toward God's oneness. Perez-Gomez articulates, "Through them the splendour of beauty contributes to reconcile multiplicity into unity." [3]

Significantly, Ficino's pyramidal hierarchy relies on an understanding of *species as discrete entities* (something Perez-Gomez overlooks in his writings). As the scholar of Renaissance humanism Paul Kristeller contends in discussing this system, "The whole sphere of being…is constructed out of substantial entities that coexist in a definite order." [4] For Ficino,

> The importance of species rests essentially upon the fact that each species is distinguished from the others through its ranking, but does not admit further graded differences within itself, in other words, between its individual members. [5]

Ultimately, Kristeller concludes, "The single species, therefore, constitutes the different degrees of being, and the whole universe, as a unique hierarchy, is constructed upon the different species." [6] Only through the singular, in particular this divinely ordered singularity of worldly beings, can one comprehend overarching unity. [7] 'Man,' although elevated above the multiplicity, would, like other beings of divine creation, nevertheless appear to have a clear, fixed identity. Individual works of architecture as singular acts of aesthetic and technical rigor affirm and figure in – as in helping to discern a figure – a system of clear, stable relations. Architectural orders validate a metanarrative that builds from and outlines a position on the nature of living beings. As befits this manner of thinking, we highlight the immutability of non-human life forms, humans and other beings, and distinguish between organic entities and those that are 'inert' (non-living).

I use Ficino's system as an episode in a vast tradition of seeking enduring correspondences between architectural order and the nature of nature. Although we no longer carry visions of pyramids in our heads, we nevertheless proceed with the belief that we grasp things in their proper proportions and parse categories in ways that correspond neatly to predictable worldly reality. For instance, as one contemporary manifestation, our prevailing metaphors for advancement of knowledge in 'green' architecture such

as the development of 'toolkits' of energy saving design strategies and a desire to 'unlock' new manners of working presume great precision of understanding of the 'problem' designers are called upon to respond to. The implicit conviction is that designers can apply the correct tools that adjust to and match up optimally with finite and fixed questions of design. Piece by piece, with our well-honed tools, we continue to erect an edifice of knowledge that further discloses the dynamic forms of nature.

Missing from this manner of discussion is an acknowledgment of 'outlier' events that insinuate themselves and require our response, of unforeseen interventions that modify the character and trajectory of built and ecological systems, and the ongoing interplay of the organic and inorganic. Further, they suggest a stable environmental context as the backdrop to inquiry, versus a circumstance of dramatic environmental degradation. Related to this is insufficient capacity to discuss the ways new depths of uncertainty accompany new forms of knowledge. According to the environmental sociologist Matthias Gross,

> The contemporary explosion of knowledge or the observation that our current age is the beginning of a knowledge society thus has a little remarked on corollary: new knowledge also means more ignorance. [8]

Even some of our most 'green' conceptual constructs in architecture today, for example the notion of 'living buildings' as promoted by the United States Green Building Council, perpetuates emphasis on the building proper, its carapace-like skin, and thin layers of ambient and luminous tension surrounding it. We are less compelled to describe projects as participants in open ecologies of transaction. A former student Leonard Yui wrote his thesis, "Ecological Aesthetics in Architecture: A Deadwood Metaphor," as largely a critique of the ostensibly beneficial and yet primarily emulative notion of living buildings. [9] For Yui this emphasis represents a one-way movement, a furtherance of modernist forms of elaboration, where the designer appropriates qualities of living beings (organisms such as flowers with petals) in order to 'animate' architecture. While perhaps resulting in projects that achieve aggressive levels of building performance, overlooked in this process are opportunities to participate in more encompassing acts of regeneration, where works of architecture contribute to broader scale landscape ecologies (by serving

as stepping stones for nonhuman species to reach fragmented habitat patches, by aggressively treating stormwater so as to support watershed health, overall by acting as 'beneficial disturbances' that help stabilize biologically compromised urban sites). With conscious irony, Yui counters 'living buildings' with the notion of 'dead buildings' as in 'deadwood,' where architectural material assemblies form a nutritive purchase for life to flourish. Interestingly, in this instance, although the metaphor focuses on the building/built entity, it prompts a manner of thinking as far as the interface of building skin and form and dynamics of the surrounding landscape.

TRAJECTORIES

Contemporary ecologists and environmental philosophers favor increasingly a view of (eco)systems as dynamic, open and characterized by continual disturbance and change. Disruption generates stability. Species in such systems are, according to evolutionary biologist Richard Dawkins, 'fuzzy assemblages,' and individuals "temporary meeting points on the crisscrossing routes that take genes through history." [10] Perhaps most critically for the purposes of this essay, organism and environment are forever engaged in a process of co-creation that some characterize as a *refrain*. An organism has inward structural disposition at the same time it assumes, through the constitution of its membrane-like skin and 'triggered' cues from its environment, a selective set of rhythmic links to its outerworld. As the philosopher Mark Johnson maintains,

> As Levins and Lewontin have argued, natural selection is not a consequence of how well the organism solves a set of problems posed by the environment; on the contrary, the environment and the organism actively codetermine each other. The internal and external factors, genes and the environment, act upon each other through the medium of the organism. [11]

The phenomenologist Maurice Merleau-Ponty's philosophical project supported a conceptual reconstitution of the intertwining of body and *umwelt.* He drew heavily from the German biologist Jacob von Uexkuell to explicate his views, as did other philosophers such as Giorgio Agamben attracted to this conception:

> Everything happens as if the external carrier of significance (marks in the umwelt or environment-world perceived by the organism) and its receiver in the animal's body constituted two elements in a single musical score. [12]

This actively relational orientation, focusing on melodic exchange at the porous boundaries of beings and environments, influences certain contemporary readings of architecture. According to Marie-Ange Bryer:

> The frame, the frontier, the wall, the barrier – all giving way to the passage, the membrane, the network and all the other mediators between the body and its environment, between architecture and the dynamic processes that structure it. [13]

Marsilio Ficino offers a clear figure of the pyramid to describe relations between species, humans and the heavenly, and where architecture serves as an explicit harmonization of these. Today, hierarchical stratification emanating from above and based on sharp distinctions of value seems at odds with understandings of organic/inorganic co-formations and ecosystem theory. In considering 'emerging ecological materials and environments' and contemporary beliefs about organisms and ecosystems, we are led to speculate anew as to notions of architectural order. To what extent does clarity of figure and unity of expression (continue to) hold sway, in which elements stitch together within a more encompassing armature? How do we acknowledge the dizzyingly intricate nature of ecosystems as described by the ecologist Henry Gleason, where "graded differences" exist and characterize assemblages of living systems? [14] How can a contemporary work of architecture express evolving notions of the order of ecosystems and the entities that comprise them, and at the same time provide functional support for those very systems and entities?

Dramatic environmental transformation calls upon designers to move beyond a view of nature as a stable backdrop to human affairs and to recalibrate their own roles in refashioning the city. Architectural interventions as 'new urban natures' reestablish pre-development biological processes while supporting the needs and aspirations of growing human populations. Works of architecture that involve the input of urban ecologists, natural scientists, and citizen stewards, among others, become a form of participatory aesthetics facilitating ongoing experimentation. Conceptualizing projects as speculative narratives implicated in evolutionary processes resonates with the environmental writer Michael Cohen's belief that "the resolution of these stories, as in any good tale, is deferred." [15]

Rather than reconciling multiplicity into unity (Ficino), one postmodern emphasis for designers concerned with relational eco-architectural expression might be that of multiplying unions, that is, *establishing open systems for open ecological operations* (openness is very different from being vague). Such attention to multiplicity suggests that we not abandon one metaphorical construct altogether such as the machine – the paradigmatic architectural qualifier of the twentieth century – as we embrace the ecological ("living buildings"). Certainly there is a measure of 'rightness' to a machine-like characterization of architecture given the manner in which architectures are produced, the efficiencies and levels of performance expected, and the technologies buildings consist of and house. Architectures will always be machines, bodies and landscapes. Of concern is how the emphases that inhere in our characterizations motivate design inquiry and to what ends, and how these descriptions impact the conditions of humans and other beings. The machine in the zenith of Le Corbusian influence would seem an all embracing, totalizing phenomenon. A contemporary striving might be to enlist machine as a prosthetic in the service of life.

In exploring hybrid descriptions that associate life, the body and the machine, ones that are nuanced and diverse in their accommodation, designers and their collaborators might take a cue from a notion of organic-inorganic 'arrangements' that the philosophers Deleuze and Guattari develop in their work. They eschew any idea of the body as a singularity of identity, and rather conceive it as a constellation of multiplicities that are socially, environmentally and technologically influenced, with any one singular identity capable of establishing 'blocks of becoming' with entities that lie beyond, including the formation of 'becomings' with entities with machine-like, or otherwise inorganic qualities. As indicated, species are fuzzy associations of organisms with like patterns and intensities; these habits of association can break loose and new formations and communities can coalesce. Deleuze and Guattari would argue "It is no longer even appropriate to group biological, physiochemical, and energetic intensities on the one hand, and mathematical, aesthetic, linguistic, informational, semiotic intensities, etc., on the other." [16] Instead they speak of event laden active processes and the sensations thus generated: "vibrating sensation – coupling sensation - opening or splitting, hollowing out sensation." [17] Perhaps articulations of such sensations as formative 'moves,' as prompts that challenge and motivate design inquiry, offer a more promising path for creating architectures sophisticated in their behavior, supportive of life, and expressive of their technical and biological constitution.

ECO ARCHITECTURAL MACHINES

In their 'Center for the Life of Urban Waters' studio project, Andi Solk and Jeff Vincent proposed a poetic bio-hydrological 'machine' for a piazza in the densely settled historical center of Rome (see figure next page). Upon entering the piazza from any one of the adjacent alleys, one is channeled to a broad, gentle ramp that descends to a subterranean space organized around a pool of clear still water (the journey of the people and the water are reversed, and one is first greeted with water that has already percolated through the eco-architectural machine). One then ascends a stair through a vertical slot of space shaped by tall stacks of block-like concrete forms that hold sand and that filter and cleanse water from nearby rooftops during rain events. One arrives at a horizontal plane of roofs, and is greeted by numerous gardens in the foreground, the ubiquitous green roofscapes of Rome, as well as views of aqueducts and 'head' fountains in the distance (head fountains serve as the termini of aqueducts and present a 'face' to the water as it is introduced into the city). Finally, one descends a filigree stair through a matrix-like screen of living 'trays' of aromatic plants that filter greywater from nearby apartments and sunlight from above. A modest proposal, one that could be replicated throughout public spaces in the city, collapses architecture and ecology and establishes correspondences at vastly different scales, linking the immediacy of tactile experience (the coolth of the stairwell between water-saturated blocks of sand), the pulse of a neighborhood, and visual ties to a regional hydrological context. 'Stacking value' involves aligning heightened multi-sensory awareness, sociability and dramatically enhanced performance. In this dense urban setting, an ecological architecture acts as a 'block of becoming' that binds the elegant, urbane and classically proportioned, notions of the garden, textural richness, neighboring buildings, exhibitory of living matter, ongoing educational demonstration and sensations of purification, cooling moisture, green shadows and gossamer light.

Figure 1. *'Center for the Life of Urban Waters' in Piazza della Quercia, Rome, a studio proposal for an 'eco-architectural machine' (Andi Solk and Jeff Vincent, 2009)*

In an effort to augment ecological 'participation,' the designer might build from this approach and establish as a physical presence numerous routes for water to flow from a project to urban landscape to stream, with severity of rain event dictating the course. A multiplicity of temporary watercourses, an eventful aqueous urbanism, might invigorate our everyday experience, linking built form to the temperament and power of the indeterminate, flux-like hydrological landscapes in which we are immersed. At the same time, these braid-like forms would behave in a manner akin to pre-development hydrology, slowing, cleansing and cooling water prior to entering urban streams, helping improve aquatic habitat in the process.

Addressing the ecological designer Paul Kephart's concern for "how to show ecological vernacular," we invite a more lateralized aesthetic transpiration. [18] *Architectures become frames and filters of aesthetic and ecological value.* In an approach that might be described as *rhythmic interspersing and nesting*, a designer seeks to extend and entangle built and natural systems so as to soften sharp distinctions, encourage layering, and lead to the generation of a vastly greater number of junctions where pooling and recombination can occur. Such integrated ecological architectures do not suggest centers, and instead precipitate de-centers that emphasize mobility, 'passing through,' and terrestrial, aquatic and avian connectivity. This 'breakdown' precipitates less constricted architectural orderings, commensurate with notions of ecosystems as fundamentally open systems.

Shannon McGinley recognizes, "architects deal with the same basic elements as ecologists: composition, structure and function." [19] Presumably, given these parallels, the designer may reconstitute architectural and ecological identities, and anticipate that byproducts of any one system will continue to transform others over time. The environmental philosopher Bryan Norton suggests, "From quantum physics to ecological theory the epistemological lesson is the same: each action, even if it is a measuring action, changes the system in which it intervenes." [20] The art historian Henri Focillon revels in a simultaneous reversal and preservation of identity: "this delightful emulation and this interest in transpositions – which seeks the artificial at the heart of nature and the secret labor of nature at the heart of human invention." [21]

Architectural ecologies become pixellations, pockets and knots of alternating, interchanging systems. Matrices of biological communities expand upon buildings as trellises. Fields of light filtering rooftop hedgerows hover above columnar grafts. Path streams provide walking surfaces while acting as micro-hydrological channels and cleansers. Colored surfaces attract pollinators – and people - to adjacent, interstitial gardens such that architectures become explicit components in the melodic refrains and couplings of the organic and inorganic. A work of architecture functions as a scaffold for living systems. Over time, living systems reconstitute the scaffold. Johnson and Hill suggest,

> A second generative metaphor we consider useful in linking design and ecology is that of a scaffold as a structure that allows new forms to be constructed but does not determine those forms completely. [22]

A project as a purchase ("deadwood") and an open experiment in adaptive ecosystem management invites the possibility of unanticipated future arrangements, territorial realignments, biological formations.

ENUNCIATIONS AND ACCOUNTABILITY

The architect's search for stability of meaning helps explain current, widespread interest in ecology. There is a reining sense in certain contemporary design circles that ecological parameters and insights from the natural sciences promise reliable, true design guidance. And yet, the more closely we look, the less stability we find. Ecologists work

from multiple paradigms of how ecosystems work, and operate at a great range of spatial and temporal scales. Despite prevailing tendencies, no one model dominates to the exclusion of others; therefore, ecology as source domain for architectural meaning is fundamentally contingent. As Haila and Levins claim, "principles derived from ecology are likely to prove transitory." [23] Here, models of ecology parallel loosely the multiplicity of options in architectural design in the wake of the postmodern suspension of 'rules.' If anything, investigations of ecosystem and ecological theory serve to accentuate the transitory nature of our grounding and call upon architects to embrace uncertainty and paradox in the design process more explicitly, especially in an era of rapid environmental transformation.

Works of architecture as life enhancing (and in some measure living), resourcefully abundant systems embedded in others of greater magnitude do not confirm so many 'givens.' Instead, eco-architectural machines as open experiments may help us, as Latour suggests, "associate the notion of external reality with surprises and events rather than with simply 'being-there.'" [24] Ecological complexity and unpredictability combine with the messy civility of urban life to form the very gap within which creative speculation resides. As the environmental philosopher Kerry Whiteside maintains, "Civility designates our ability to invoke nature freely and unpredictably, by moving among the symbolic registers of identity, convention, and science." [25] While acknowledging convention, such civility defies conformity, celebrating instead a polyphony, a chorus of voices, some appealing, others harmonizing, indifferent, impassioned, dissenting, fleeting, some on the wing, others on foot, still others immobile and resolute.

Architects are called upon to participate in a diversity of explorations in linking urban sites, new material assemblages and biophysical processes. Looseness and inventiveness of description might parallel and productively challenge the precision of our simulations (and our wall sections). As the linguist George Steiner argues:

> It is the great untidiness that makes human speech innovative and expressive of personal intent. It is the anomaly, as it feeds back into the general history of usage, as it enriches and complicates the general standard of definition, which gives coherence to the system. A coherence, if such a description is allowed, in constant motion. [26]

Let us summon and put in constant motion new conceptual constructs that may help us align the highly efficient and the fantastically earthbound, the fragile and the enduring. In order to advance ecological architectures, we must first play at what it means to speak ecologically.

Endnotes

1   Guattari 2000, 45
2   Perez-Gomez 2006, 75
3   Perez-Gomez 2006, 75
4   Kristeller 1943, 74
5   Kristeller 1943, 81
6   Kristeller 1943, 82
7   Interestingly, centuries later, anthropologist and ethnologist Levi-Strauss would look to species diversity as a basis for a fragmented versus a unified view of the world and our experience of it: "The diversity of species furnishes man with the most intuitive picture at his disposal and constitutes the most direct manifestation he can produce of the ultimate discontinuity of reality." (See Levi Srauss 1966, 137)
8   Gross 2010, 1
9   See Yui 2010
10 Dawkins 2004, 61
11 Johnson 1987, 207
12 Agamben 2004, 41
13 Brayer 2003, 18
14 See Barbour 1996
15 Cohen, 1998, 5
16 Deleuze and Guattari 1987, 109
17 Deleuze and Guattari 1994, 168
18 Personal correspondence with Paul Kephart, January 2008. For information on the work of his firm, see: http://www.ranacreek.com/services/
19 See McGinley 2008
20 Norton 1987, 205
21 Focillon 1992, 98
22 Johnson and Hill 2002, 15
23 Haila and Levins 1992, 7
24 Latour 2004, 79
25 Whiteside 2002, 181
26 Steiner 1998, 213

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