Instrumentalizing Coevolution as Design Technique

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THE PAPER INTRODUCES THE CONCEPTS OF SYSTEM, MILIEU, AND COEVOLUTION AND ILLUSTRATES HOW THE TERMS ARE MANIFESTED IN PROJECTS FROM AN URBAN RESEARCH AND DESIGN STUDIO.
1 Systems, Milieus, Coevolution

In his chapter “Coevolution” from Out of Control, Kevin Kelly proposes the coupling of a chameleon with a mirror as a metaphor for informational circuits. He posits the question regarding the dual-sided interaction, “what if one side is a responsive mirror, just as the chameleon is, in part reflecting, in part generating?” (Kelly 1994). He collects multiple responses that try to elicit what would happen when the lizard “bellies up to the mirror” (Kelly 1994). Does the chameleon remain the same color as when it entered? Does the response time of the color-changing cells cause the creature to oscillate from one color to another? Would a color that entered from outside the system telegraph into the relationship? Ultimately the real condition may be less interesting than some of the questions it raises:

- What constitutes a system?
- To what degree is it bounded?
- To what degree is it open?

There are (at least) four systems at work in the interaction. The first two include the intrinsic properties of the two entities: 1. the system that comprises the mirror (reflection, angle of orientation, and speed of light), and 2. the system that comprises the chameleon (ability to mimic color, color change as a response mechanism, and lag time of the color change). The third system emerges when the first two interact with one another, and produces the emergent pattern of color oscillation induced by the “recursive reflection” of the lag time of the color change coupled with the chameleon responding to the current color being projected back from the mirror. The fourth, and potentially most destabilizing system, arises when one considers if the chameleon-mirror assemblage can be affected by an outside input. This proposes that the interaction itself happens within a larger context.

These relationships draw parallels to the design disciplines:

- Intrinsically-generated systems.
- How these systems interact with one another.
- How these interacting systems interact with their surroundings.

However, a discrepancy arises while comparing the examples of chameleon-mirror with design: the chameleon-mirror only works with two systems while designers typically work with multiple ones. The notion of working multiple systems together raises the question of how open a particular one is; in other words, its capacity to be ordered by other logics that do not alter the qualities of the system itself. In “The Open Work”, Umberto Eco talks about qualities of works that are constructed as a field of possibilities:

...the author offers the interpreter, the performer, the addressee a work to be completed. He does not know the exact fashion in which his work will be concluded, but he is aware that once completed the work in question will still be his own. It will not be a different work, and, at the end of the interpretive dialogue, a form which is his form will have been organized, even though it may have been assembled by an outside party in a particular way that he could not have foreseen. The author is the one who proposed a number of possibilities which had already been rationally organized, oriented, and endowed with specifications for proper development.

Eco 1989.

This quality of openness is where designers have potential for exploitation and tactical maneuvering in the design process. What is potentially missing from the quote by Eco is the context in which the interaction is taking place. Typically referred to as site, I will use the term milieu. In his essay “The Living and its Milieu”, Georges Canguilhem traces a history of the concept and the term from Newton through Lamarck to biology. Ultimately he arrives at this conception:

From the biological point of view, one must understand that between organism and environment there is the same relationship that exists between the parts and the whole within the organism itself. The individuality of the living does not come to an end at its ectodermal boundaries, no more than it begins at the level...
of the cell. The biological relationship between the being and its milieu is a functional one, and as a result it changes as the variables successively exchange roles. The cell is a milieu for intracellular elements: it lives in an interior milieu that is either on the scale of the organ or the organism, which organism itself lives in a milieu that is for it, in a sense, what the organism is for its component parts.

Canguilhem 2001

What is conveyed here is the inseparability of organism from milieu. Although entities may be formally distinct, functionally they are wed to one another in time. So now that we have three working ideas: system(s), coevolution, and milieu, we will see how these concepts get deployed in terms of structuring frameworks for an urban research and design studio.

2 Design From Research

The past few years we have focused on Galveston Island, a barrier island on the Gulf Coast of Texas. Developers are exerting pressures on the island as it represents the last reasonably-priced and underdeveloped coastline in North America. The island was leveled by a devastating hurricane at the beginning of the 20th century and in response the city constructed a massive seawall and raised the elevation of the island up to fifteen feet to ensure its protection from further catastrophic storms. The erection of the seawall ultimately served to catalyze the destruction of many of the beaches as it sped up the erosion process. Added to this, the Gulf Coast, being supplied by sediment from the Mississippi River, does not have a continual feed of sand to replenish its beaches, which tend to be a major draw for tourism. The recession of the beaches, wetland encroachment on the bay side, and natural and human-induced subsidence are simultaneously causing the island to shrink while development on the island is tending to accelerate. These issues present material for interrogation as they raise questions about the line between nature and culture, the desire for permanence in a constantly shifting environment, and the necessity to provide more and varied ways in which to occupy the water’s edge ecologically, urbanistically, architecturally, and socially.

Within the studio we examine relationships between architecture, landscape, ecology, urbanism, and infrastructure. Each of these has an associated scale, mode(s) of organization, and material practice. Architecture tends to operate at the scale of a building, infrastructure at the scale of a region, and urbanism at the scale of the city with ecology operating across all of these to construct and organize an integrative milieu. Therefore the interesting question becomes: how might one instrumentalize milieu and coevolution as a generative design strategy to work with these modes and scales? First, I propose a couple preconditions:

• The necessity of multitudes
• The necessity of scales

Working with multitudes implies the organization of a large number of entities. Architecturally, these entities may take the form of components within a material system, or urbanistically as a number of buildings that create a landscape-urbanism interface. Further, multitudes enable a designer to produce a manifold of formal and dimensional permutations that do not significantly alter the generic and intrinsic qualities of systems themselves. Therefore, multitudes allow one to produce many organizational relationships across multiple scales. This both suggests the second condition (multiple scales) as well as affirms it. Multiscalarity is analogous to the relationship of what Gilles Deleuze and Felix Guattari term the molar and the molecular. In discussing this relationship within geology in A Thousand Plateaus, they elaborate:

There may be a greater or lesser number of intermediate states between the molecular and the molar; there may be a greater or lesser number of exterior forces or organizing centers participating in the molar form. Doubtless, these two factors are in an inverse relation to each other and indicate limit-cases. For example, the molar form
of expression may be of the “mold” type, mobilizing a maximum of exterior forces; or it may be of the “modulation” type, bringing into play only a minimum number of them. Even in the case of the mold, however, there are nearly instantaneous, interior intermediate states between the molecular content that assumes its own specific forms and the determinate molar expression of the outside by the form of the mold. 

DELEUZE AND GUATTARI 1987

In terms of design, molecular interactions determine molar form, and molar inflections telegraph into the form of each individual molecule. A molecular field in this way possesses the quality of openness that allows a negotiation between two or more scales. Openness suggests transformability and adaptability as any modifications or inputs act upon each molecule systematically in the field to produce molar-level inflections.

These ideas get deployed within the studio in both a research phase (analysis) and a projective design phase (synthesis). In the context of urban research, we utilize mapping in the research phase as an analytical technique of information design. Within both the mapping and design phases, the aforementioned conditions (multitudes and scales) get deployed. We can construct maps out of a large number of entities (what are termed extracts, the symbols used for constructing the map that register information), as well as construct maps at multiple scales, both spatially and temporally. Examples of extracts can include points, lines, and areas, each able to be modulated by assignable properties. Points, as pixels, can be subject to size and color modifications and also be brought into three dimensions to add another level of information. Lines can be subjected to weight, color and type variance, and area to color and boundary relation. Each of these utilizes multitudes in the process of information design to construct a particular subjective view of an objective condition. Using these representational devices one can map and parameterize social, geometric, material, ecological, political, and economic systems. These systems tend to fall roughly within three categories of biotic, abiotic, and social-technical. Each of these can be understood to exist, abstractly, in a state separate from the others, and each constitutes its own system of internal and cohesive relationships (its intrinsic form). When two or more of these systems come together and modulate one another through a process of cross-mapping, a second-order map gets produced. At this point mapping goes from being simply representational to being analytical; a designer is forced to determine how to combine two different sets of information to produce a synthetic picture of their mutual effects upon one another. It is also critical to decide what is relevant to the mapping and what is not; one
has to determine what systems to foreground and how to represent and combine them. This process of deterritorialization and reterritorialization manifests through what Deleuze and Guattari term the abstract machine, which they define as

the aspect or moment at which nothing but functions and matters remain. A diagram has neither substance nor form, neither content nor expression... The diagrammatic or abstract machine does not function to represent, even something real, but rather constructs a real that is yet to come, a new type of reality.
DELEUZE AND GUATTARI 1987

An abstract machine, here deployed as a pedagogical device, works as an ordering agent that functions to map and modulate intrinsically-generated systems within and between one another in feedback with an exterior milieu.

3 Concepts Into Practice

Now let’s examine some projects taken from the studio that illustrate these concepts. The first project, Migratory Landscape by John Carr and Paul Morel, produces an inter-species modulation between two mobile populations: RV-er’s (recreational vehicles) and migratory birds. Galveston Island is a major stopping point for a wide array of birds migrating between North and South America, and it so happens that bird watching accounts for a large portion of leisure activity in the region. Also, the Galveston Island State Park tends to attract a mobile RV-going public. The project, sited in the 2000-acre state park, and only one foot above sea level, seeks to produce a resonance between these two populations by controlling their respective access to one another.

The project investigates the use of differentially inflatable cells placed beneath the surface of the soil to allow a soft modulation of the surface (Figure 1), and thus grant control of water retention. As little as one inch of difference in the depth of a pool of water can alter the species of birds that will be attracted to use it. This difference also affects vegetation that will grow in these pools (and hence other forms of wildlife), and so the team sought to gain control over these variables to produce peaks of touristic interest throughout the year. By appropriating multitudes of these cells in various configurations and inflation schemes (Figure 2), multiple performative configurations (Figure 3) may be created that can tune the site to attract greater or lesser numbers of a particular migratory bird each season. Larger configurations of these cells also act to articulate proprioceptive human-use (both RV-and human-scaled) paths through the park (Figure 4), so access to various species can be managed; species that dislike disruption can be placed farther from trails and species that are more oblivious to human activity can be placed closer to RV sites. The final distribution and patterning of the inflatables was guided by the negotiation of local site conditions relative to desired landscape effects and bird species. Cross-mapping existing site conditions of soil stability against landscape materiality (Figure 5) with programmatic demands produces a finely tunable landscape (Figure 6) that modulates the social world of RV-er’s with the life worlds of the migratory birds.

The second project, Creeping Park by Tess Hilgefort and Megan Sprenger, anticipates the destruction wrought by a catastrophic hurricane while simultaneously strengthening the social networks that exist on the island. The material proposition developed by the team strategizes a series of concrete jetties embedded in the landscape (Figure 7) that, through their geometric and tectonic design (Figure 8), allow them to integrate with other systems (Figure 9) and engender multiple programmatic conditions (Figure 10) while also being able to reinforce the island at critical points in the event of a washover brought on by a major storm event. This team, also utilizing the state park as their site, used the mapping phase to generate several possible sites of intervention (Figure 11). Areas of susceptibility to damage were found by mapping structural weaknesses in the island against possible storm conditions (location of hurricane strike, direction and speed of wind, amount of rainfall). These were then cross mapped against social networks that exist on the island to produce a range of conditions differing in degree from one another. This generated a
range of strategies of structural reinforcement with social occupation that can be deployed at multiple sites on the island. The park was chosen as the exemplary location to test the relationship of program to infrastructure (social system + material system) deployed within the existing site boundaries (Figure 12). The final site proposal synthesizes structural reinforcement of the island at a critical point, programmatic amenities (bird watching, fishing, housing, etc.), and integration of the park into social and material networks to either side of it (Figures 13 and 14).

The third project, Galveston REstore by Cary d’Alo Place and Marissa Spears, integrates wetland performance with communal occupation. Analytical mapping revealed relationships between soil type, stability, and permeability relative to its ability to support ecological diversity or development (Figure 15). The team utilized three dimensional pixel mapping to visualize the entire island as these criteria then selected a site that presented ambiguous conditions for negotiating natural states with desire for building. They generated two milieu modules that integrate wetland restoration, water filtration, infrastructural access, and housing unit typologies (Figure 16). Because these were conceived of as topological relationships with points of connectivity, multiplication and deformation to site conditions (Figures 17 and 18) allows the modules to maintain their intrinsic qualities while adapting to the local demands of wetland performance, flooding (Figure 19), and habitat formation (Figure 20). The final plan integrates an elevated housing development as a series of reinforced infrastructural ridges with floodable wetland plateaus that provide for and engender local flora and fauna (Figure 21).

The fourth project, Energe(ne)tic Fields by Nkiru Mokwe and Viktor Ramos, utilizes a buoyant structural module (Figure 22) to create a floating offshore community (Figure 23). Multiplication and differentiation of the module allows the system to interface between the motion of the water and the programmatic demands at particular locations within the structure (Figure 24). These include enclosed space for housing, roads for access, and beaches and pools for leisure activities (Figure 25). In addition to these modes of occupation, the structure integrates technology that allows it to transform energy from waves into electricity for itself. Through research and mapping, the team drew the island as a progression from static forms to dynamic forces (Figure 26) and used this conception to drive their criteria for site location. In contrast from the other projects, this one is sited in open water as opposed to on land (Figure 27); here site is constructed as a nexus of forces (tides, currents, winds) as opposed to a physical location. This also provokes the notion of the boundary or edge of the system as there are no physical or legal constraints confining the molar extent of the form. Therefore the molar form results from the intrinsic growth properties embodied within the system (Figure 28) and its ability to support infrastructures and programs that must commingle upon and within it.

These samples illustrate a working back and forth between scales, systems, and logics of representation and combination. The diagrams and projects that get produced within the studio coevolve into self-consistent feedback loops between research, mapping and design.

Consider now that a milieu might constitute the interactive field of architectural representations (diagrams, renderings, models, plans, sections). At this point in the design process the categories of biotic, abiotic, and social-technical become thoroughly destabilized by working together the various logics through these modes. It is through the establishment of categories, creating common representational and design languages, and then assimilating them that we blur the initial categories.

A final clarification we can make is between that of using ecology within a project and that of using the idea of ecology to structure relationships within a project. Projects produced in the studio attempt to do both. The idea of ecology gets deployed to structure and coevolve relations between maps, forms, categories, and design. For example, one may utilize a formal experimentation to study a suggested ordering of a map because the open logic of the map itself might produce hundreds of variations, and pairing it with a different mode and scale of operation allows one to narrow the search space for an optimized form. Ecology itself gets utilized to test relations between humans, animals, forces, envi-
ronments, and forms. It is by utilizing the ideas of ecology and coevolution and engaging with them directly does the studio produce such varied and differentiated projects.

4 References

5 Credits
Environmental Design Research Laboratory
Rice School of Architecture; Lars Lerup, Dean; John Casbarian, Associate Dean.
Student Projects:
2007: Galveston REstore. Cary d’Alu Place and Marissa Spears.
2008: Creeping Park. Tess Hilgefort and Megan Sprenger.
Figure 17. Module deployment, multiplication, and deformation to site conditions.

Figure 18. Arranged diagrammatic modules.

Figure 19. Accommodation of flooding in wetland plateaus.

Figure 20. Perspective of infrastructural-housing ridge flanking wetland.

Figure 21. Final site plan of Galveston Restore.

Figure 22. Bouyant structural module.

Figure 23. Perspective view of energegetic fields.

Figure 24. Integration of structure, surface, enclosure, and access.

Figure 25. Perspective rendering of enclosure.

Figure 26. Mapping of Galveston as static and dynamic forces.

Figure 27. Global plan of energegetic fields.

Figure 28. Close-up of plan.