

## A PRIMITIVE PARAMETRIC

### *An Exhibition on the Humanist Potentials of ‘Architectural Biology’*

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**Abstract.** This paper describes the products of an exhibition organized by the authors that speculatively reconstructed the ‘long history’ of Architectural Biology to recover the cultural potential of biological metaphors in contemporary architecture. The extended historical timeline of the show spanned from the second half of the nineteenth century to the present. However, in contrast to previous shows that have isolated modern architects’ interests in the formalist principles of biology, this show examined the formal and cultural prerogatives of modern architects in tandem with one another. This historical framework encouraged the speculative analysis of the social and political relevance of contemporary claims, which inherently challenges the ahistorical bias of the postcritical debates that emerged in the new millennium. Widening our gaze to examine the ‘long history’ of biological metaphors in architecture enabled us to recuperate the cultural significance that biological references have accrued within the discipline of architecture. This disciplinary history promises to repair the historical amnesia that has beset contemporary architects who limit their analysis of biology to formalist principles of design. A key component of the exhibit was the conceptual pairing of the ‘primitive’ (cultural) concerns of nineteenth-century figures with the ‘parametric’ (formal) concerns of postwar and contemporary architects. Using Gottfried Semper as a representative figure for the former position, we reinterpreted the inherent cultural meaning of postwar and contemporary architectural works, including those completed by Frei Otto, Achim Menges, Lars Spuybroek, SHoP, and Evan Douglass. The material potential of this approach was expressed in the making of analytical

maps, digital models, and conceptual drawings that explored the latent 'primitive' themes of contemporary 'parametric' designs.

The horizon that lies before us is one that science cannot approach alone. It is the horizon that represents the ethical, moral and spiritual dimension of the power we now possess. We must not shrink from exploring that far frontier of science. But as we consider how to use [this] new discovery, we must also not retreat from our oldest and most cherished human values. We must ensure that new genome science and its benefits will be directed toward making life better for all citizens of the world, never just a privileged few.

- President Bill Clinton on the cultural politics of the Human Genome Project (June 26, 2000)

The scientific principles of genomic research has inspired a new strain of biological metaphors in contemporary architecture. Spurred in part by the digital revolutions occurring in architectural studios of the 1990s, a biological reading of digital space has strategically interpreted computer script as 'genetic algorithms' capable of 'breeding' complex architectural forms. In response to Gilles Deleuze's immanent model of scientific materialism, the architects Greg Lynn and Karl Chu pioneered computational techniques that emulated the self-organizing capacity of the human genome. Their efforts prompted a series of historiographies that have attempted to trace contemporary tendencies back to the functionalist and biological rhetoric of architectural modernism.<sup>1</sup> The historian Martin Bressani has used the label "Architectural Biology" to refer to the collective return of biological models in contemporary practice, and Harry Francis Mallgrave, Caroline van Eck, and Reinhold Martin have traced such thinking back to architectural organicisms of the nineteenth century.<sup>2</sup> With all that has happened recently, the surprising aspect of Architectural Biology has not been the amount of ground covered by contemporary research, but the ground that remains fallow. Despite two decades of sustained interest in the formal complexities of Architectural Biology, very little has been done to construct a cultural project outside of the creation of novel forms. This lack of a clear semantic trajectory is curious considering the fundamental reconceptualization of human identity that was undertaken in response to the completion of the Human Genome Project.

One of the most important findings of the Human Genome Project is an entirely new understanding of the material basis of human diversity. In contrast to neo-Darwinian models of evolution that considered the transmission of information between DNA and surrounding proteins to be unidirectional, the discovery of an epigenetic layer above the genome has led to the theory that genetic development actually consists of a multidirectional relationship

between genetic material and external cultural factors such as diet and stress. In this new conception of biological evolution, the flexible structure of the epigenome regulates the genetic expression of the genome by coiling up to prevent interaction with surrounding proteins, or uncoiling to permit interactions. Not only is this movement triggered by cultural events, but the epigenome seemingly retains a memory of the changes that have occurred within the genome - achieving a form of cultural memory as it were. Even before the epigenome was discovered, however, press coverage of the Human Genome Project emphasized the radical potential of genomics for reshaping the human body.<sup>3</sup> These expectations included direct manipulation of the genome to eliminate genetic defects, improve the body's inherent resistance to aging, or to aesthetically shape the breeding of offspring or one's personal appearance. In a strict material sense, genomics (and epigenesis) has forced scientists to reconsider the role of biology in the constitution of individual identity. In light of this shift, it is no coincidence that 'diversity' was originally included in the title of the Human Genome Project.

In contrast to the explicit consideration of diversity in scientific debates, the term that has been most influential in architectural discourses is the more abstract label of 'complexity'. This term has mostly been used to describe the computational modeling tools that were required to calculate the placement of all three billion chemical links in the DNA chain. Yet the selective references of architectural theorists cannot change the fact that the conceptualization of human identity is explicitly connected to our ability to visualize the fundamental structure of organic life. This exhibit uses the cultural implications of genomics as a prompt to recover the humanist dimensions of Architectural Biology, especially as these reveal a new conception on human identity in contemporary society.

### **PROBLEMATIZING ARCHITECTURAL BIOLOGY**

The challenges that proponents of Architectural Biology face today are no longer limited to the visual production of geometrical complexity. A battle over the semantic dimension of these geometries has taken on greater prominence. This transition is manifest in new architectural debates over the purpose of digital ornament, which have been spearheaded by critics such as Antoine Picone, Lars Spuybroek, and Ali Rahim, among others.<sup>4</sup> The primary danger that emerges as a result of not establishing a meaningful cultural program for digital ornament is the unintentional repetition of biological essentialisms of the past. The public's reception of architecture is inherently complicated by the cultural contexts that condition architectural production,

including the racial ideologies and cultural politics that are a part of historical memory. The unresolved conflict between an essentialist and non-essentialist model of scientific materialism makes the disciplinary sources of contemporary architecture a substantive concern for designers. Reinhold Martin has noted the political and cultural effects of autonomous readings of architecture that currently dominate Architectural Biology:

The subject of biology is recurring at a time when we are still saddled with the term 'organicism,' which has come up around computing [...] Digital technologies give us ways to model complex behaviorism of the 1960s projected onto an economic rather than a social referent. Its function is to naturalize what we call globalization now. And when something is naturalized it's as if there is no alternative. It's like nature. You can't argue with nature. It's just there. It's just truth.<sup>5</sup>

The social consequence of not establishing an explicit cultural program for Architectural Biology is the naturalization of existing cultural politics. In the case of globalization, this means privileging the economic exploitations that perpetuate inequality in world markets, and the aesthetic distinctions that maintain the social distinctions created by biological essentialism (i.e. First and Third World civilizations) on new economic grounds. Under these conditions, the architect must remain cognizant of the fact that borrowing the disciplinary tools and conceptual models of biology comes with historical baggage. In lieu of merely translating the visual complexities of biological science, the architect can intentionally engage with the semantic role of architecture by managing the visual interpretation of biology at a cultural level. This aesthetic responsibility can even be considered a unique opportunity, as new models of nature now make it possible to directly problematize the biological essentialisms of the past. We propose that this aesthetic project should become one of the explicit cultural programs of Architectural Biology, which would inevitably build upon cultural critiques that have exposed the political functions of biological essentialism in the past.

This aesthetic program is the theme of "Primitive Parametrics: Biology as an Architectural Catalyst." Our exhibit attempts to recover the humanist potential of contemporary digital architectures by bringing the formal and cultural components of Architectural Biology together. The relationship between these complimentary elements of architectural production are revealed through an extended historical timeline of modern architecture that spans from the second half of the nineteenth century to the present. In contrast to historiographies that have concentrated on the architect's exclusive formal interests in biological principles, this show examines the integration of for-

mal and cultural prerogatives in historical modern architectures. Reconstructing this 'long history' establishes a conceptual field that strategically reconfigures the ethos of contemporary practice. Our historical methodology is an explicit critique of architectural formalism, which reasserts the fundamental importance of a semantic (if not directly representational) reading of biological paradigms. This interpretation recombines the themes of 'complexity' and 'diversity' that were implicated by the Human Genome Project to recuperate the ground that was lost in the architectural translations of the 1990s. In addition, an explicit reference to the scientific materialism of genomics presents a unique opportunity to challenge the biological essentialisms that underwrote nineteenth-century modern architectures. In this sense, the exhibition synthesizes postwar social critiques of modern architecture with the projective paradigms of recent years. Widening one's gaze to examine the cultural implications of biological metaphors in architecture reengages the historical significance that 'biology' has accrued within the discipline of architecture. This disciplinary history also repairs the historical amnesia that has beset contemporary architects that refuse to acknowledge the humanist implications of evolutionary biology.

#### **THE SEMPERIAN FRAME OF THE EXHIBIT**

The historical journey outlined by this exhibit begins with nineteenth-century explorations of nationalist architectural styles. During this time, European critics reinterpreted architectural style as an analogical form of artistic evolution that emulated nature's processes for generating formal variety. Proceeding as empiricists, architects such as Eugene Emmanuel Viollet-le-Duc (1814-1879) and Gottfried Semper (1803-1879) characterized architecture as the imminent product of mankind's 'second nature', which extended the logic of organic life toward material constructions that expressed the progressive arc of human development. In this way, nineteenth-century Architectural Biology mandated an integration of a formal and cultural content for architecture. Viollet-le-Duc's *Dictionnaire Raisonne* (1856-64) was an astounding demonstration of an ethnographic explanation of French medieval development, and Semper's *Der Stil* (1860-63) became the model of comparative analysis of human cultural development in architecture.

Semper in particular interpreted architectural style as an evolution of the practical arts that began with the innate drive of primitive race groups to create artistic form. According to the timeline outlined in *Der Stil*, monumental architecture only became a distinct realm of art when it advanced far enough in human civilization that an immediate understanding of past practices (not forms) was completely lost. Reviving the continuous historical evolution of the basic idea of art (i.e. the treatment of materials) constituted the basis of Semper's organic interpretation of the past. Using this evolutionary model of historical development, he explained the temporal progression from early textile or weaving practices to the ornamental treatment of tiles and brickwork. This historicist model of cultural progress anticipated the developmental principles of biological thinking in the twentieth century, although it integrated biological and cultural developments in one comprehensive system. It is for these reasons that we selected to use Semper's style theory as a baseline for our comparison with contemporary architecture. Although his model was flawed by its references to biological essentialism, Semper's attempts to integrate the formal and cultural dimensions of historical forms was a crucial corrective to the formalism of contemporary designs.



*FIGURE 1: Panoramic photograph of the exhibit.*

## OVERVIEW OF THE EXHIBITION

For the exhibit, we chose to create a series of analytical diagrams that explained the formal and cultural content of the biological metaphor in architectural history. The first series of maps serves as a 'parent' diagram for the contemporary architects displayed in the show. These diagrams visualize Semper's typological explanation of the architectural components of the Primitive (Carib) hut, which broke down into what he termed the "four elements of architecture". Our maps of these four elements (enclosure, hearth, roof, and mound) visualized the cultural history Semper explained in his text, which are represented by a phylum-like organizational structure in the show. These tree diagrams map the cultural parent/child relationships that propa-

gated across time. Each Semper map traces the lineage of cultural products he identified as leading up to the creation of a central component of the primitive hut. For example, the primordial method for finishing textiles began with tattooing, then moved to knots and binding lacing and weaving, to the binding of tools, mat weaving and headdresses, until the appearance of surface textiles and banding ornament gave birth to monumental architectures. Each cultural component in this string of development was considered an evolutionary adaptation of a previous technology.

In the context of the exhibit, Semper's evolutionary history of style establishes a conceptual datum against which we compared the formal and cultural implications of biological metaphors in contemporary case studies. We tended toward selecting pavilion and demonstration projects to emulate the scale of the primitive huts Semper used to model his original theory. The overlay of nineteenth, twentieth and twenty-first century case studies revealed both explicit and implicit conceptual relationships between the critical functions of biological metaphors in architectural discourse. Once a stable set of comparisons were established between the products and processes of our historical examples, we crafted a series of interpretive two and three-dimensional collages that overlaid the qualities of each example onto one another. The intent of these collaged forms was to both communicate the correlations we found within the historical record to support our claims, as well as to allow these correlations to resonate with one another between designs of each generation. Each collage serves as a subset of the correlations that are possible within the broader framework of the exhibit. Visitors are encouraged to extend these first steps to create their own sets of correlations. In the end, we chose to examine a fixed set of historical figures from each era that used parametric and biological principles in their design methodology. These figures included:

**NINETEENTH-CENTURY ORGANICISM:**

Gottfried Semper, Eugene Emmanuel Viollet-le-Duc, Louis Sullivan

**TWENTIETH-CENTURY FUNCTIONALISM:**

Frei Otto, Japanese Metabolists, Charles & Ray Eames

**TWENTY-FIRST CENTURY ARCH. BIOLOGY:**

Lars Spuybroek, SHoP Architects, Achim Menges

We sorted through a wide range of contemporary designers whose work could be defined as biological in one way or another. These included figures who explicitly referenced Semper's organic theory of style, as well those whose work was implicitly biological in aesthetic or argumentation. We

would include Spuybroek and Menges in the category of those who immediately identified Semper as a key reference point in their semantic descriptions of architecture, while Otto, Eames and Douglas limit their references to the organic or biology directly.

A quote from Spuybroek's writings demonstrates his reliance on Semper's style theory:

I have tried to rethink Semper's materialism in a more processual, active form [...] I call this the "Semperian reversal": the reversal of the order of the four elements. Instead of starting with earth and a wooden frame to support the weaker textile fibers, I reason the other way around: weak threads move, find each other, and lock into each other, building structure and rigidity. So, instead of adding the soft to the rigid, as Semper did, we see a transformation of soft into rigid.

In addition, some architects did not mention biology at all, their work contained clear visual references to biological imagery or processes, such as the work of the architectural firm SHoP. While the immediate references made by Spuybroek and Menges were easy to note, many contemporary designers ascribed little direct relationship between their design process and the biological metaphor. Further, we found very few direct references to the intended cultural impact of their architectural forms. To address this wide range of possibilities, we chose to create an intellectual and historical framework within which the visitor can examine the latent cultural and humanist potential of contemporary design. Project maps developed for each contemporary project serve as the primary vehicle for revealing the potential parallels that have existed in modern architectural history.

## PROJECT MAPS

Using the information outlined in each Semper map, we created a graph of specific analogies between Semper's four elements of architecture and the biological rhetoric or imagery found in contemporary designs. A major aspect of this analysis was relating the principles of Semperian construction to design components that would more readily be identified by contemporary design students. For example, the hearth was divided into three quasi-cultural categories (Life Source, Gathering Space, Spatial Anchor) that opened up a materialist reading of Semper. On each map, a vertical axis was used to identify the scale of the relationship between Semper's definitions and our interpretation of contemporary projects. These scales included the biological inspiration, small-scale modules, connection type, the sectional quality of a project, and formal composition. Each scale captures the varied

ways in which we found contemporary projects to (implicitly) align with Semperian categories.

### THE TIMELINE

The timeline is a fifty-five foot long visual document that attempts to create a broad historiography of the biological metaphor in architecture and culture since the late eighteenth century. This timeline is inclusive insofar as it accumulates the work of architects, biologists and humanist scholars who have commented on the cultural importance of biology. We have indicated the names and dates of evolutionary diagrams created by biologists who speculated on the cultural meaning or significance of biological imagery.



This intellectual field is offered as a starting point for visitors to the exhibit, which is visually indicated by the empty hexagons in each time period that can be filled in at a later date.

*FIGURE 2: Last six feet of timeline mockup, showing designers who were used as a focal point for the exhibit.*

### COLLAGES

Despite the depth and complexity of these maps, they do not fully demonstrate the compelling formal relationships that we began to recognize between each of the designers we were considering. As these products were primarily analytical, we needed a way to explore the visual principles these characters brought out of the images and forms of each set of projects. This visual and formal goal resulted in a series of two and three-dimensional collages in a wide variety of media, which were intended to create a more sinuous linkage between each of the projects we considered. The products of this portion of the investigation included collages between hand drawn works, photographs and three-dimensional computer models. They included laser cut and 3-D printed components as well as hand sketches. We included a small series of collages which best described the correlations we recognized across generations, and exhibited them near large 3-D prints which were intended to meld the 3-D forms of each project together into one synthetic object. Our hope is that this procedure will literally draw attention to the limited cultural connection contemporary methods create by infusing contemporary projects with Semperian cultural references. These analytical models and drawings demonstrate the overlays illustrated in each of the

maps created by drawing physical connections between materiality, formal expression and methodology. These collages are the material means we have used to critique the limited cultural work that is currently being performed in architecture today.

The final product of the show is not a style or aesthetic, but an ethos for recovering the cultural significance of the biological metaphor in architecture. The abstract character of each 3-D model allows the viewer to relate the formal and cultural referents included in each collage, which conflates the 'primitive' and 'parametric' qualities of each historical case study into one synthetic image. For example, one of the collages that we chose to use in the exhibit combines the formal and cultural attributes of three separate projects: SHoP's *Dunescape* of 2000, NOX's *Sun-O-House* of 2006, and the Tirolean truss system illustrated in Gottfried Semper's *Der Stil* (1860-63). The sectional character of this model conceptually weaves the fundamental aspects of these three forms together into one form. The individual trusses of SHoP's *Dunescape* are juxtaposed with one another, creating the flowing geometries present in NOX's water pavilion. Nested within the exterior shell is a traditional trabeated structural system, which connotes the so-called primitive origins of traditional architectures to these parametric forms. The new synthetic form that is created proposes a semiotic integration of the primitive hut of the past with the parametric pavilions of the present. The timeline and the booklet included in the show included additional references that extend beyond the three collages case studies we ultimately decided to use, which invites further speculation. We hope this intellectual framework provokes greater discussion and material speculation in the future.

### Endnotes

1. Manuel Delanda. "Deleuze and the Use of the Genetic Algorithm in Architecture," Center for New Media, Teaching and Learning, Columbia University, April 9, 2009.
2. See Detlef Mertins. "Bioconstructivisms," NOX: Machining Architecture, edited by Lars Spuybroek (Thames & Hudson, 2004), pp.360-369.
3. See Martin Bressani's "Observations on Architectural Biology: the Gen(H)ome Project," *Log*, vol.9 (winter/spring 2007): 119-127.
4. Nicholas Wade. "Scientists Complete Rough Draft of Human Genome," *New York Times*, June 26, 2000.
5. Reinhold Martin, "Organic/Organicism," in *Index Architecture: a Columbia Architecture Book* (MIT Press, 2003), p.148
6. Lars Spuybroek. "Experience, Tectonics and Continuity," *The Architecture of Continuity* (NAi Publishers, 2008), p.20