

Primitive Parametrics

An Exhibition on the Humanist Potentials of 'Architectural Biology' Christopher Beorkrem

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INTRODUCTION

Contemporary research on the human genome has directly influenced new biological metaphors for architectural design. The architectural historian Martin Bressani has summarized this tendency as a new form of "Architectural Biology," which the critics Reinhold Martin and Manuel Delanda have related to historical paradigms of architectural organicism.¹ The intent of this paper is to discuss the biological metaphors that translate the generative principles of genomics into new strategies for architectural design. Spurred in part by the digital revolutions that occurred in architectural studios in the late 1990s, these rubrics metaphorically interpreted computer scripts as "genetic" algorithms for "breeding" architectural forms in digital space.² Following Deleuzian models of scientific materialism, the architects Greg Lynn and Karl Chu have pioneered computational strategies for generating complex geometries. Their efforts have prompted a new string of biomorphic architectures and updated historiographies that link contemporary form-finding philosophies with previous functionalist tendencies and biological metaphors in midcentury modernism.³ Despite nearly two decades of sustained interest in the formal complexities of Architectural Biology, very little research has been completed on the humanist dimensions of this new paradigm. This is a curious oversight considering how fundamental human diversity and identity was implicated in the research completed by the Human Genome project – the most expansive research project on genomics completed in the last two decades.

One of the most important accomplishments of the Human Genome Project was its reconceptualization of the material basis of human diversity. In contrast to Neo-Darwinian models of heredity that consider the transmission of information between DNA and organic tissue to be unidirectional, the discovery of an epigenetic layer above the genome has led to speculations of the potential influence of cultural practices on the transmission of genetic material.⁴ Even before the Human Genome project was completed in 2003, press coverage emphasized the radical potential of this project for reshaping the human body at its most fundamental levels.⁵ These expectations extended from directly eliminating genetic defects, to improve the body's inherent resistance to aging, to aesthetically breeding offspring or shaping one's appearance with greater control. In a strict material sense, genomics forced scientists to

reconsider the role of biology in the constitution of individual identity; it not only increased their understanding of the mechanics of inheritance, but it offered greater agency in deciding what to do with these traits once they exist. It is no coincidence that the term 'diversity' was originally included in the title of the Human Genome Project. According to the DNA Nano-technician Paul Rothmund, understanding the genetic code of the human body is more than a physical map of long strands of information; it provides a base set of instructions to "program" human life.⁶ The term that has become most influential in architectural discourses, however, has been 'complexity'. This term was most often used by scientists to describe the computational modeling tools that were required to calculate the placement of all three billion links in the DNA chain. Regardless of one's preference for either term, it is apparent that our ability to rethink identity is explicitly connected with our ability to visualize the interior structure of organic life.

ARCHITECTURAL BIOLOGY

The current challenges proponents of Architectural Biology face today no longer seems to be the visual production of geometrical complexity. In its place has arisen a battle over the potential semantic meaning of such geometries. The transition in architectural discourses from debates on form finding to discussions on the merits of digital ornament bears this out. What has been overlooked in these discussions is the potential danger that a reductive interpretation of biology presents to the public reception of complexity in architecture. This reception is inherently complicated by the cultural contexts that condition the architect's work, including the racial ideologies and colonial histories that cast biology in a negative light. The conflict between essentialist and non-essentialist interpretations of biology creates situations where the disciplinary sources of Architectural Biology are misinterpreted as a substantive endorsement of biological essentialism, or the attending social hierarchies that were supported by this historical philosophy. Reinhold Martin noted the political function of biological metaphors in 2003 when he was asked to comment on the studio culture that was then dominant at Columbia University:

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 behavior in accessible visual form. It is another version of the 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.⁷

According to Martin, biological metaphors that are not associated with an explicit social referent have a social function of naturalizing existing cultural practices. If the status quo of globalization

is to support the economic exploitation of world markets, then the current separation between First World and Third World architectures reinforces the same divisions that were legitimized by biological essentialism on new economic grounds. However, this danger can be faced directly by those expressing an interest in borrowing the disciplinary tools and frameworks of contemporary biology. Balancing the dictates of 'complexity' with 'diversity' are precisely what is required in our globalized world.

PRIMITIVE PARAMETRICS

This paper summarizes the work that was completed for a recent exhibition entitled "Primitive Parametrics: Biology as Architectural Catalyst." The intent of the exhibit is to reconstruct the long history of biological metaphors in architecture in order to reconfigure the boundaries of contemporary practice.⁸ A primary goal of this show is the construction of an extended historical timeline for biological metaphors in architecture that spans from the second half of the nineteenth century to the present. However, in contrast to previous efforts to historicize the modern architect's exclusive interests in the formal principles of biology, this show examines the integration of formal and cultural prerogatives in modern architectures of the past. Reconstructing the 'long history' of architectural biology has enabled us to establish an intellectual frame for reconsidering the cultural potential of biological metaphors in contemporary architecture. This historicist methodology encourages the cultural critique of architectural autonomy by reasserting the importance of semantic (if not directly representational) readings of architectural form. Our aim was to combine the themes of 'complexity' and 'diversity' to recuperate the inclusive anthropological frameworks of the nineteenth century. However, we sought to explicitly challenge the biological essentialisms of the past with the new model of nature outlined by the Human Genome Project. In this sense, our exhibition synthesizes the particularity of social critiques in architecture with the projective paradigms of recent years.

An important element of the show "Primitive Parametrics" is the heuristic function of architectural history for establishing a design philosophy. Our show employs architectural historiography to analyze the social and political implications of contemporary claims, which challenges the ahistorical bias of the post-critical debates that emerged at the beginning of the millennium. While contemporary architects have successfully translated the 'complexity' of biological mapping into new techniques for generating architectural forms, these techniques have not yet been comprehensively related to the 'diversity' that is present in contemporary society. Widening one's gaze to examine the anthropological implications of biological metaphors in architecture enables us to recuperate the cultural significance that biology has

accrued within the discipline of architecture. This disciplinary history repairs the historical amnesia that has beset contemporary architects who limit their cultural references to the functionalist precedents of mid-century modernism.

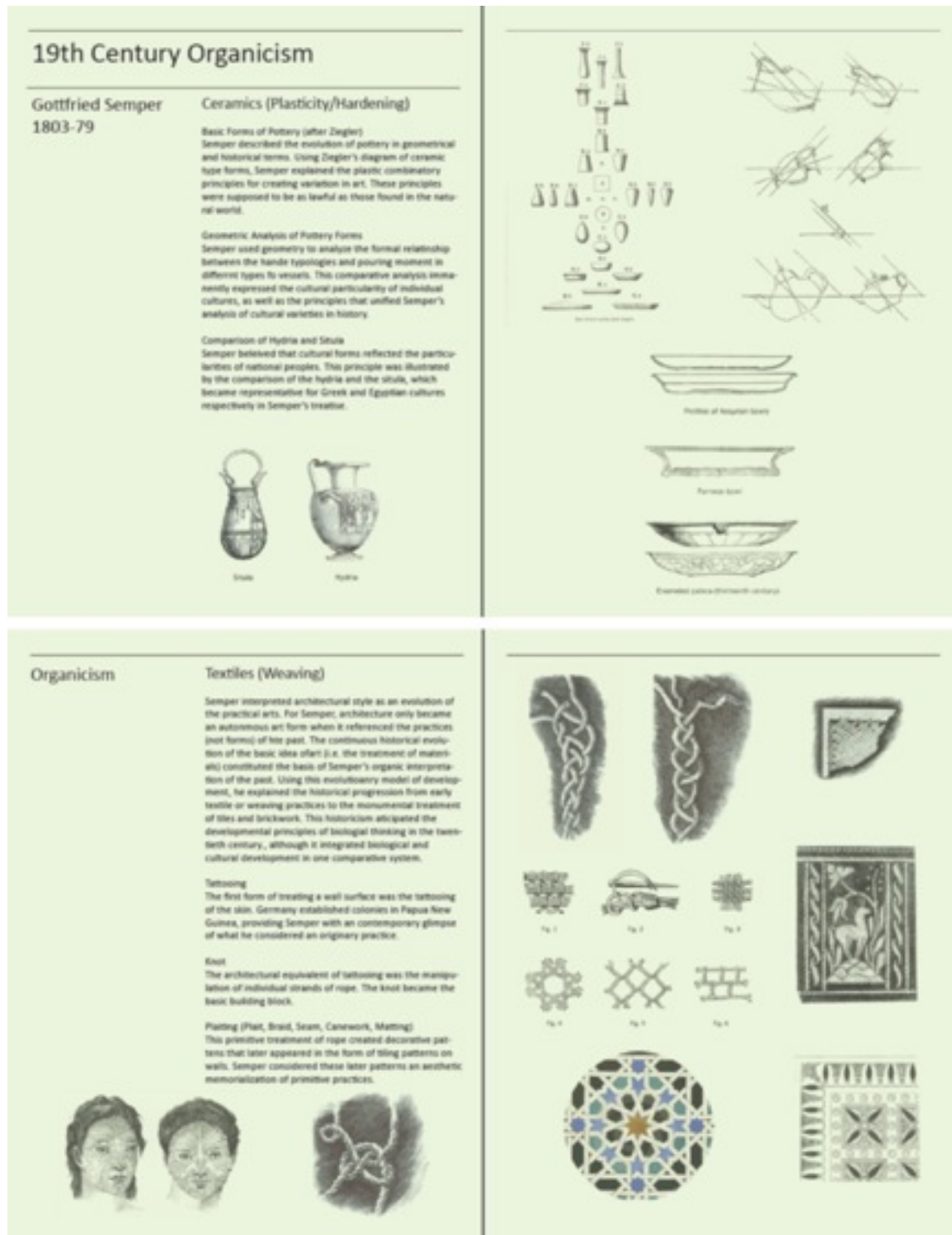


FIGURE 1: Pages from exhibition catalogue illustrating components of Semper's evolutionary history of style. These pages deal with the theme of 'ceramics' and 'textiles' as outlined in *Der Stil* (1864).

THE FRAME OF SEMPER

European critics reinterpreted architectural style as an analogical form of ‘organic’ development that emulated nature’s processes for generating formal variety. Proceeding as empiricists, the French architect Viollet-le-Duc and the German architect Gottfried Semper used the scientific method to uncover the historical and morphological principles behind architectural evolution. This post-Enlightenment interpretation of architectural style resulted in a new form of structural realism that employed architectural ornamentation as surface embellishments of the structural forces responsible for a building’s performance. Yet, this form of architectural materialism did not result in the complete closure of representational meaning. In addition to establishing the corporeal transparency of architecture as the imminent product of “technostatic” forces, nineteenth century architects continued to think of ornament as visual tools for expressing cultural particularity. Both Viollet-le-Duc and Semper characterized architecture as the product of mankind’s “second nature,” which that 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 the formal and cultural content of architecture.

Viollet-le-Duc’s *Dictionnaire* was an astounding estimation of French medieval development and Semper’s *Der Stil* was a comparative analysis of human cultural development. However, Semper in particular interpreted architectural style as an evolution of the practical arts. For Semper, architecture only became an autonomous art form when it referenced the practices (not forms) of the past. 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 development, he explained the historical progression from early textile or weaving practices to the monumental treatment of tiles and brickwork. This historicism anticipated the developmental principles of biological thinking in the twentieth century, although it integrated biological and cultural development in one comparative system. It is through this frame that we wanted to evaluate the clear repetitive arc of the biological metaphor in architectural design.

OVERVIEW OF THE EXHIBITION

For the exhibit we chose to create a series of analytical diagrams, which first deconstructed Semper’s four elements (enclosure, hearth, roof, and mound) of the primitive (Caraib) hut to relate to four contemporary categories: textiles, ceramics, carpentry and stereotomy. Each of these elements was cross-referenced against case study examinations of contemporary works. Through these case studies we identified both explicit and implicit relationships between the

contemporary designer's work and Semper's categories. We used these relationships to craft a diagram noting physical as well as process-based evidence from each designer.

Once a set of correlations between the products and processes of our contemporary designers were established with Semper's categories, we used these maps to craft a series of interpretative two and three-dimensional collages. The intent for these collages was to both demonstrate the significant evidence we found to support our claim, but also to create new correlations between designer's of each generation. The intent of the collages was to serve as an example of other correlations that visitors to the exhibit might make on their own.

Semper Maps:

The exhibit is introduced with a series of five maps, the first is a parent to the rest, discussing the Primitive (Caraib) Hut and Semper's method for breaking its construction down into four elements. Each of these four elements (enclosure, hearth, roof, and mound) is the topic for the other four maps textiles, ceramics, carpentry and stereotomy, respectively. Each map has a cultural history which Semper mapped in detail, and for which we have created a phylum like organizational structure, attempting to map the cultural parent/child relationships across time. Each map traces the lineage of the cultural products which Semper identified as leading up to the creation of that component of the hut. For example; tattooing, to knots and binding, to lacing and weaving, to binding tools, to mat weaving, to headdresses, to surface textiles, to surface banding as ornament on columns. Each cultural component is an evolution upon a previous technology (See FIGURE 2).

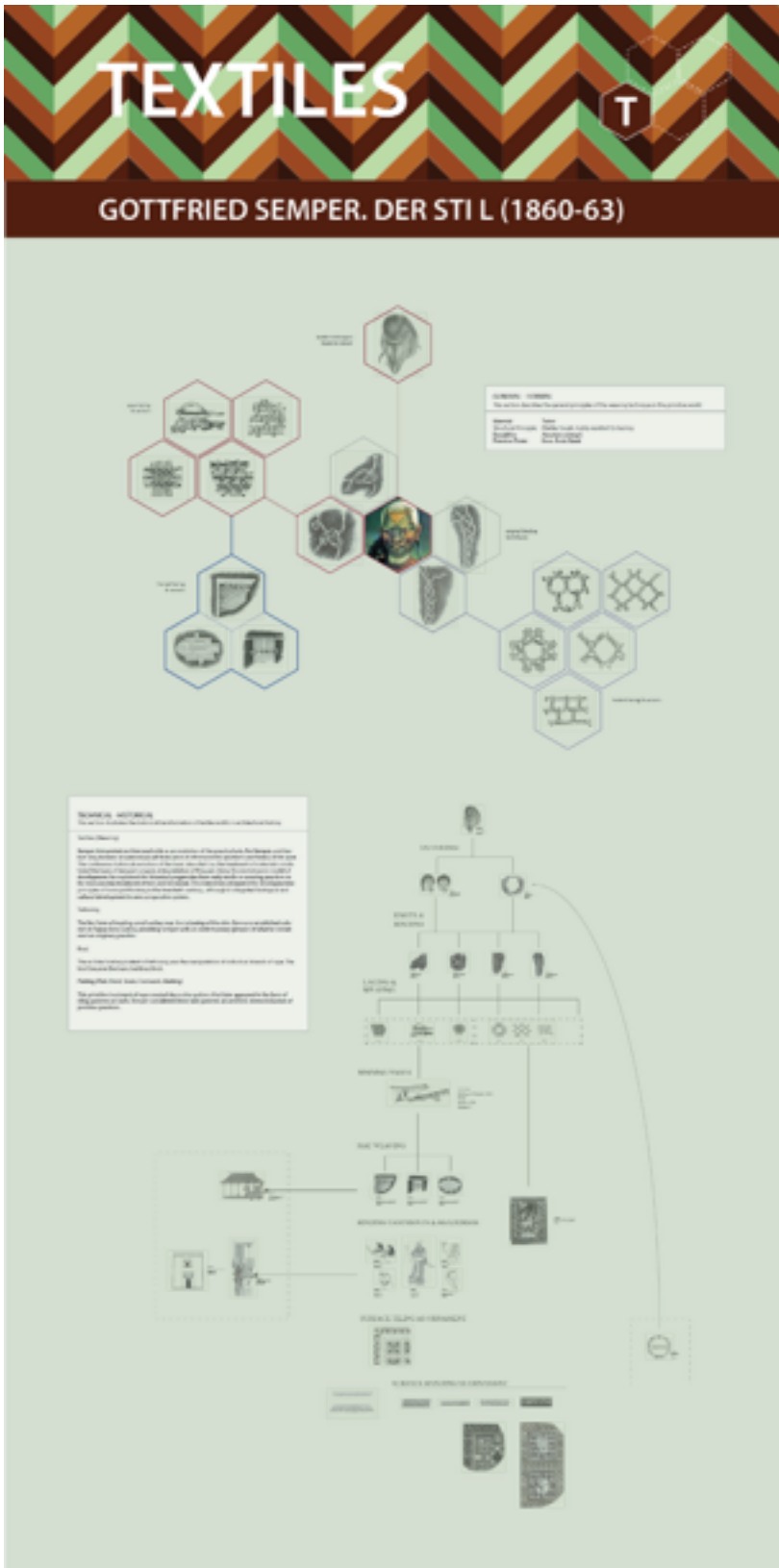


FIGURE 2: Example Semper Map, four of these maps explain the cultural anthropology of Semper's four elements in the exhibit.

CONTEMPORARY CHARACTERS

We chose to examine a number of “characters” from each era who used parametric/biological principles in their design methodology. They are as follows:

Nineteenth Century Organicism

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

Twentieth Century Functionalism

- Frei Otto
- Japanese Metabolists
- Charles and Ray Eames

Twenty-First Century Architectural Biology

- Lars Spuybroek
- Evan Douglass
- SHoP
- Achim Menges

We sorted through a wide range of contemporary designers who would be included in the range of those who define their work as biological in nature. Of those we chose a range of contemporary characters whom explicitly or implicitly reference Semper but also others who did not reference the biological at all. Of those who immediately identify Semper as a key reference point in their semantic descriptions we would include Spuybroek and Menges, while others only reference the biological or organic including Otto, Eames’ and Douglass, further some don’t mention the biological at all, but whose work has clear references to the biological, or to biological processes, including SHoP.

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.⁹

While the immediate references, with Spuybroek and Menges are easy to note, most other contemporary designers ascribe little relationship between their designs or design process and the biological metaphor. Further we could find very little reference to the cultural impact of their logic and forms.

While there are many varied nuances, with which designers have used to ascribed their relationships to the biological, few if any reference the cultural impacts of the biological metaphor on the broader culture. Instead of searching for these implications we chose to create a frame inside of which the visitor is able to create their own cultural references and bias. Project maps developed for each contemporary project serve as the primary vehicle for the delivery of this information.

PROJECT MAPS

Using the architectural identities of each of the Semper maps, we broke out the characteristics of each, which could be identified in the contemporary designers rhetoric. We created a graph of specific analogies between Semper's characteristics and those of the contemporary design. Semper's four elements, hearth, roof, and mound, respectively were broken into design components that could be more readily identified for each contemporary design. For example, the hearth was divided into three further categories Life Source, gathering space, spatial anchor, ceramics/ practical arts.

On each map a vertical axis was used to identify the scale of the relationship between Semper's definitions and our interpretation of the contemporary project. Those scales include; the biological inspiration, small scale modules, connection type, sectional quality, and form/ composition. Each of those scales were used to identify the many varied ways in which we found the project to align with Semper's definitions (See FIGURE 3).

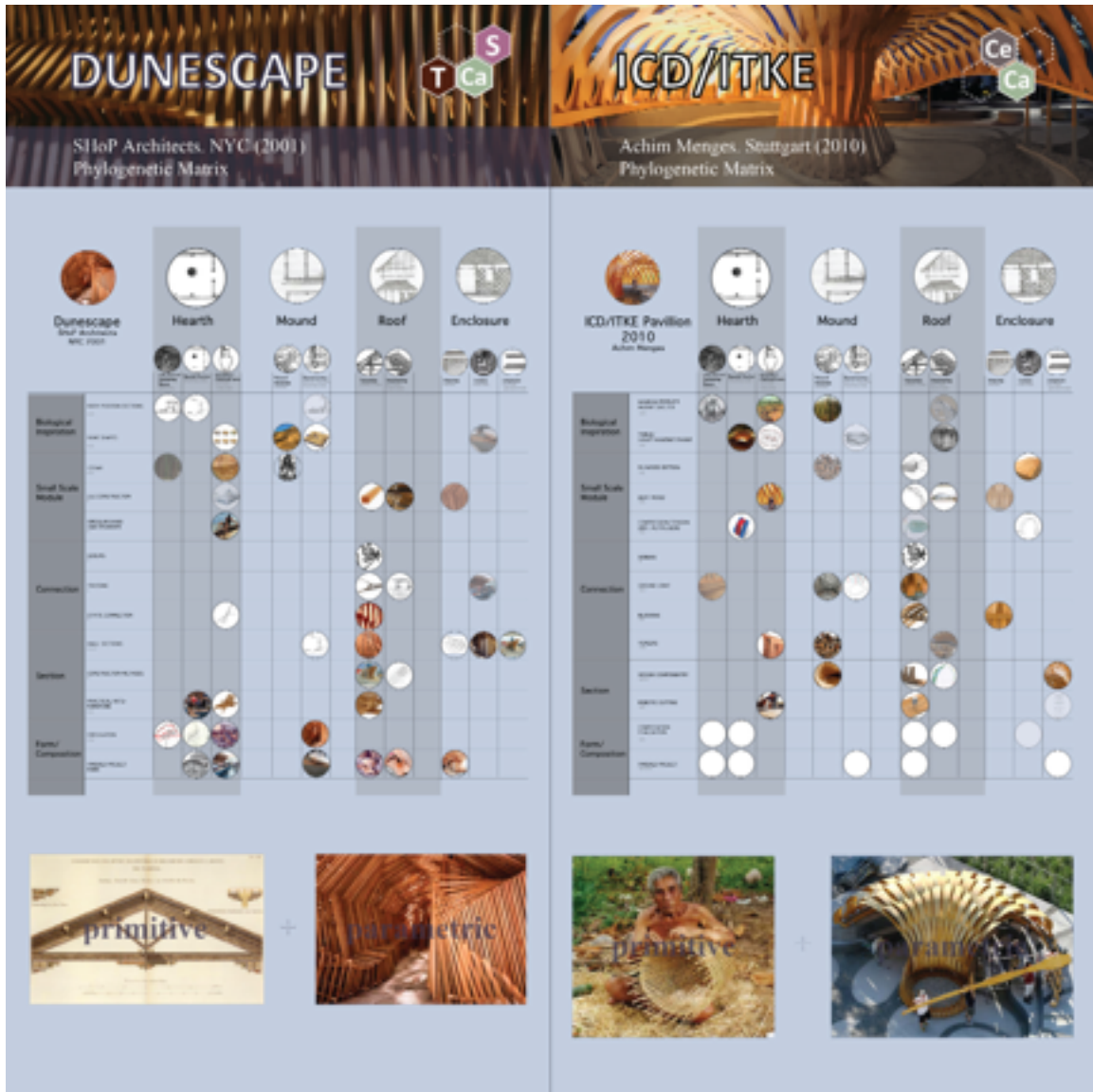


FIGURE 3: Two example project maps, which articulate the overlaps we recognized between the Semper's four elements and the elements of each contemporary project. (SHoP's Dunescape and Menges, 2010 ICD/ITKE Pavilion)

THE TIMELINE:

The timeline is a Fifty-five foot long document we produced which attempts to create a broad historiography of the biological metaphor in architecture and culture since the publication of Semper's *Der Stil*. The timeline includes the work of both architects and designers alongside biologists and scholars who have commented on the cultural importance of biological imagery. We indicated the names and dates of evolutionary diagrams created by biologists who helped to clarify the identity of evolution to our culture. Each designer who was highlighted in the show became a datum on the timeline, helping to indicate the cyclical nature of these references.

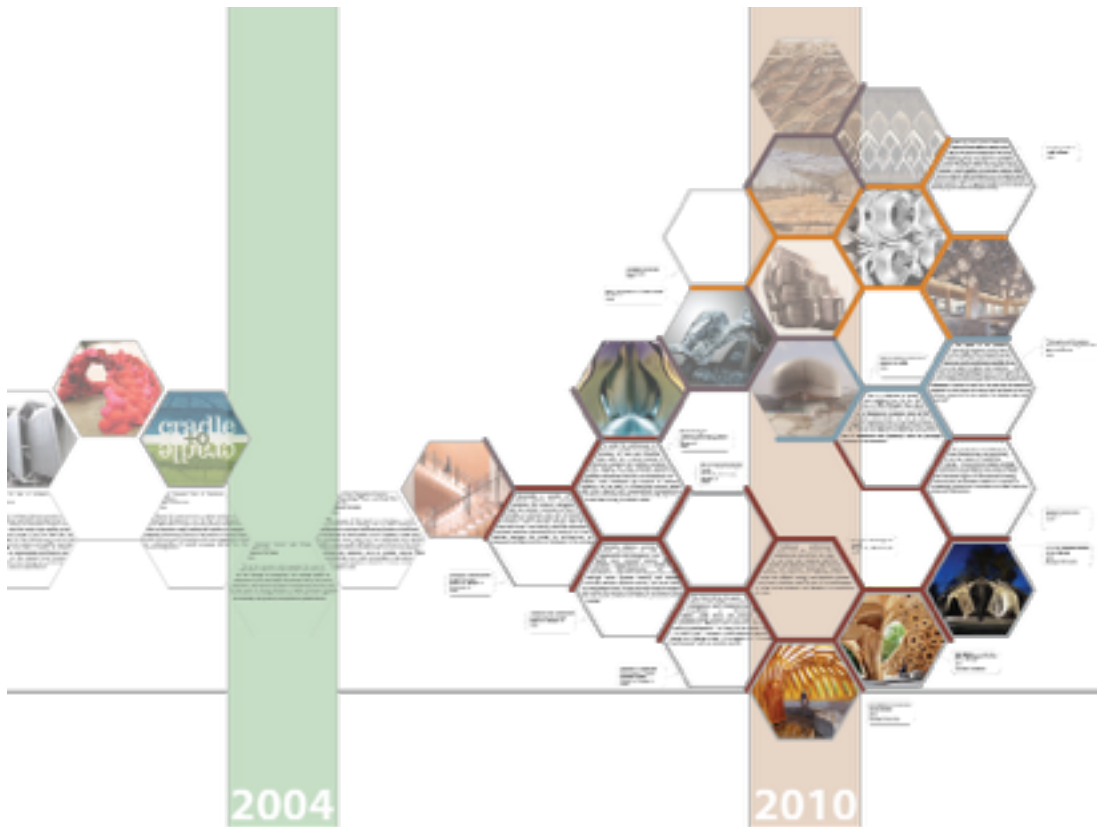


FIGURE 4: Last six feet of timeline mockup, showing designers whom were used as a focal point for the exhibit.

Collages:

Despite the depth and complexity of these maps, they did not begin to demonstrate the compelling formal relationships that we began to recognize between each of the designer's we were considering. As the products were primarily analytical, we wanted to explore ways in which we might begin to cull these characteristics out of the images and form of each set of projects. This part of the exhibit resulted in a series of two and three- dimensional collages (see FIGURE 5), 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 the portion of the investigation included collages between hand drawn works, photographs and three- dimensional computer models. They include laser cut and 3D printed components as well as hand-sketches. We identified a small series of collages which best described the correlations we recognized across generations, and exhibited them near large 3D prints which were intended to meld the 3D forms of each project together into one new object. Our hope is that this procedure will literally draw attention to the limited cultural connection contemporary methods create. The exhibit will include these analytic models and drawings, which operate as critiques of the apparently "novel" methods from each era. These models will demonstrate the overlays each map has created between materiality, formal expression, and methodology.

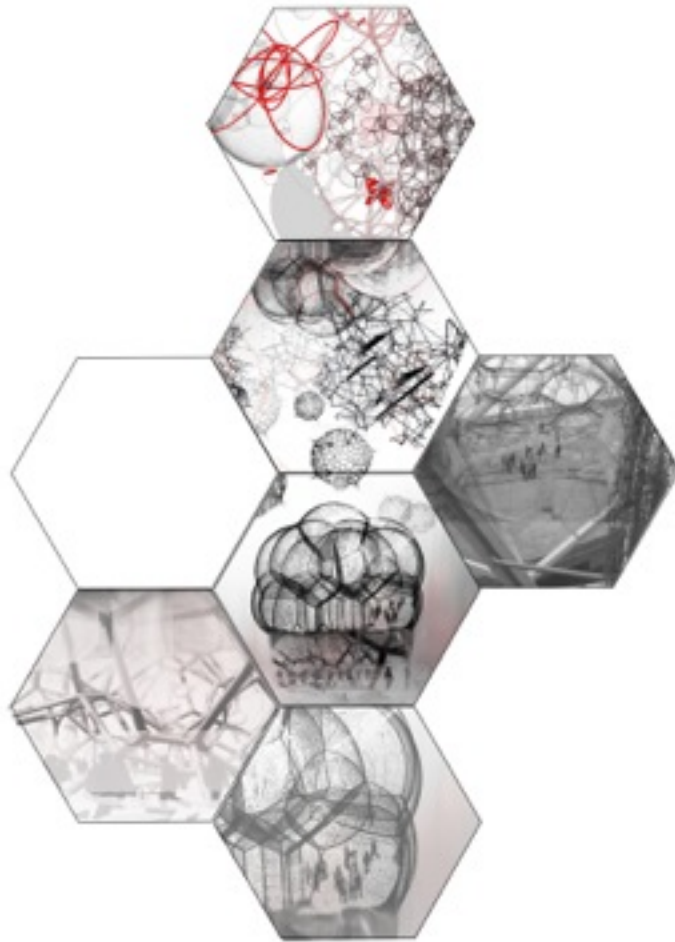
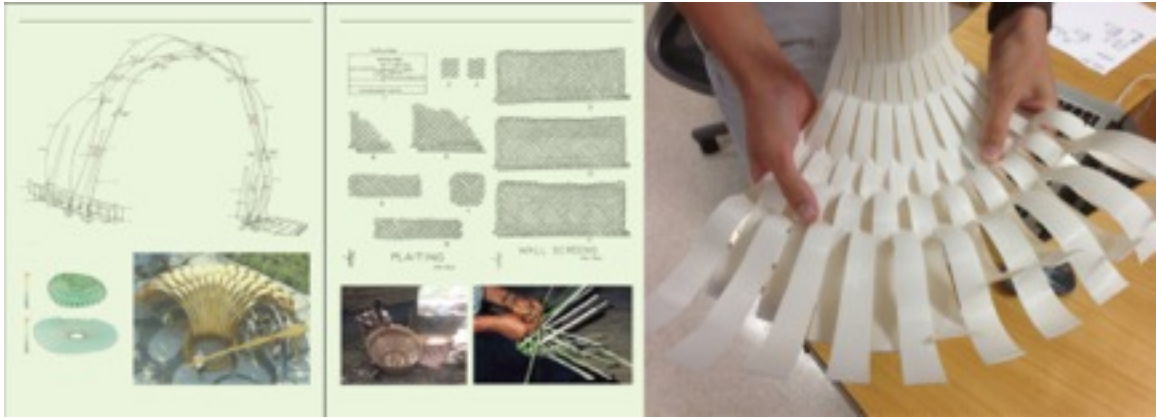


FIGURE 5: Example collages exploring the overlaps between the primitive and the parametric that we recognized (Menges' 2010 ICD/ITKE Pavilion as an unraveled basket and Frei Otto's Floriade and radiolarian).

CONCLUSIONS

Cultural Humanism-

Not a style or aesthetic, but an idea- tried to abstract them so much that we can see both the parametric and primitive are located- space and program- dress biology into, not just consumerist an globalist- create a provocation for people... Still have to contend with this older model of culture and race...

A. The intent of the exhibition/booklet is to open a way for reintegrating form and culture in architecture. In this sense, expanding the architect's historical horizons may be the best tool for challenging an overly reductive conception of form finding today.

B. Suggest possible readings of the digital prints

1. Each object manifests 'primitive' and 'parametric' criteria
2. Multiplicity of readings exposes latent potential of cultural signification in digital designs

Check for anonymity

¹ See Martin Bressani's "Observations on Architectural Biology: the Gen(H)ome Project," *Log*, vol. 9 (winter/spring 2007): 119-127.

² Manuel Delanda. "Deleuze and the Use of the Genetic Algorithm in Architecture," Center for New Media, Teaching and Learning, Columbia University, April 9, 2009.

³ See Detlef Mertins. "Bioconstructivisms," *NOX: Machining Architecture*, edited by Lars Spuybroek (Thames & Hudson, 2004), pp.360-369.

⁴ [Locate reference here – NOVA video]

⁵ Nicholas Wade. "Scientists Complete Rough Draft of Human Genome," *New York Times*, June 26, 2000.

⁶ Paul Rothemund. "DNA Origami," TED Talks (Monterey, CA: March 2007); According to Rothemund, "There are many ways of casting molecular spells using DNA. What we really want to do in the end is learn how to program self-assembly so that we can build anything."

⁷ Reinhold Martin, "Organic/Organicism," in *Index Architecture: a Columbia Architecture Book* (MIT Press, 2003), p.148

⁸ Lars Spuybroek. "Experience, Tectonics and Continuity," *The Architecture of Continuity* (NAi Publishers, 2008), p.20